

Transgrid

People. Power. Possibilities.

HumeLink

Environmental Impact Statement

EIS declaration

Project details
Project name: HumeLink
Application number: SSI-9717, EPBC 2018/836
Address of the land on which the infrastructure is to be carried out: Generally the land comprises 360 kilometres of new transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle in NSW and as described within the Environmental Impact Statement. The project would be located across five Local Government Areas including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley.
Project details
Proponent name: NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid)
Proponent address: 180 Thomas St, Haymarket, 2000, NSW, Australia
Proponent ABN: 70 250 995 390
Details of person by whom this EIS was prepared
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Declaration by registered environmental assessment practitioner
Name: Todd Robinson on behalf of Aurecon Australasia Pty Ltd
Registration number: 11215
Organisation registered with: Aurecon Australasia Pty Ltd
Declaration: The undersigned declares that this EIS: • Has been prepared in accordance with Schedule 2 and Part 10 of the Environmental Planning and Assessment Regulation 2021; • Contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which this EIS relates; • Does not contain information that is false or misleading; • Addresses the Planning Secretary's environmental assessment (SEARs) for the project; • Identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments; • has been prepared having regard to the *Department's State Significant Infrastructure Guidelines – Preparing an Environmental Impact Statement*; • Contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development; • Contains a consolidated description of the project in the EIS; • Contains an accurate summary of the findings of any community engagement; and • Contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.
Signature: T Robinson
Date: 25/08/23

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Abbreviations

Abbreviation	Description
ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACM	asbestos containing materials
ACT	Australian Capital Territory
AECs	areas of environmental concern
AEP	annual exceedance probability
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AGL	above ground level
AHIMS	Aboriginal Heritage Information Management System
ALA	aircraft landing area
ALUM	Australian Land Use and Management
ANEF	Aircraft Noise Exposure Forecasts
ANZECC	Australian and New Zealand Environmental Conservation Council
APZ	Asset Protection Zone
AQMS	Air Quality Monitoring Station
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARR	Australian Rainfall and Runoff
ARTC	Australian Rail Track Corporation
ATC	air traffic control
ATSHIP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016*
BCD	Biodiversity and Conservation Division
BDAR	Biodiversity Development Assessment Report
BFEMEP	Bush Fire Emergency Management and Evacuation Plan
BFPL	Bush Fire Prone Land
BMP	Biodiversity Management Plan
BoM	Bureau of Meteorology
BOS	Biodiversity Offsets Scheme
BSAL	biophysical strategic agricultural land
CASA	Civil Aviation Safety Authority
CEMP	Construction Environmental Management Plan
CCG	Community Consultative Group
CIS	Community Information Sessions
CLM Act	*Contaminated Land Management Act 1997*

Abbreviation	Description
CNVG	*Construction Noise and Vibration Guideline* (TfNSW, 2019)
CO	carbon monoxide
CO_2-e	carbon dioxide equivalent
CSEMP	Community and Stakeholder Engagement Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSSI	Critical State Significant Infrastructure
dB	decibel
dBA	decibel A-weighted
DC	direct current
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water (formerly the Commonwealth Department of Agriculture, Water and the Environment – DAWE)
DECC	former Department of Environment and Climate Change
DECCW	former NSW Department of Environment, Climate Change and Water
DEWHA	Department of the Environment, Water, Heritage and the Arts
DIN	Deutsches Institute fur Normung
DISER	Department of Industry, Science, Energy and Resources
DLWC	Department of Land and Water Conservation
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	former Department of Planning, Industry, and the Environment
EdM	Electronic direct mail
ECZ	easement clearing zone
EHNV	Epizootic Haematopoietic Necrosis Virus
EIS	Environmental Impact Statement
ELF	extremely low frequency
EMF	electric and magnetic fields
EMS	Environmental Management System
ENA	Energy Networks Associations
ENM	excavated natural material
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation 2021
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESB	Energy Security Board
ESD	Ecologically Sustainable Development
ESCP	Erosion and Sediment Control Plan
ESG	Environmental, Social and Governance
FCNSW	Forestry Corporation of NSW
FM Act	*Fisheries Management Act 1994*
FTE	Full-time equivalent

Abbreviation	Description
GDE	groundwater dependent ecosystem
GDP	gross domestic product
GHG	greenhouse gas
GIS	Geographical Information System
GPS	global positioning system
GRP	gross regional product
GVA	Gross Value Added
ha	hectares
Heritage Act	*Heritage Act 1977*
HLS	helicopter landing site
HMP	Heritage Management Plan
HNA	highly noise affected
HSU	Hydrostratigraphic unit
HTZ	hazard tree zone
HV	heavy vehicles
Hz	Hertz
IAP2	International Association of Public Participation
IAQM	Institute of Air Quality Management
IBRA	Interim Biogeographical Regionalisation of Australia
ICNG	*Interim Construction Noise Guideline* (DECC, 2009)
ICNIRP	International Commission on Non-Ionising Radiation Protection
ILUA	Indigenous Land Use Agreement
I-O	input-output
IPCC	Intergovernmental Panel on Climate Change
IS	Infrastructure Sustainability
ISC	Infrastructure Sustainability Council
ISO	International Organization for Standardization
ISP	Integrated system plan
KFH	key fish habitat
km	kilometres
kV	kilovolt
LA_{eq}	The average noise level during a measurement period, such as the day-time or night-time
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LiDAR	light detection and ranging
LLS	Local Land Services
LoS	Level of Service
LSALT	lowest safe altitude

Abbreviation	Description
LSC Assessment Scheme	*The Land and soil capability assessment scheme – a General Land Evaluation System for New South Wales* (OEH, 2012)
LSPS	Local Strategic Planning Statements
LV	light vehicles
m	metres
m^3	cubic metres
mAHD	metres above the Australian Height Datum
MDBA	Murray Darling Basin Authority
ML	megalitres
MNES	Matters of national environmental significance
MOU	Memorandum of Understanding
Mt CO_2-e	million tonnes carbon dioxide equivalent
µS/cm	microsiemens per centimetre
NEM	National Electricity Market
NEPC	National Environment Protection Council
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NGERS	National Greenhouse and Energy Reporting Scheme
NHL	National Heritage List
NM	nautical mile/s
NML	noise management level
NOA	naturally occurring asbestos
NOHC	Navin Officer Heritage Consultants
NorBE	Neutral or Beneficial Effect
NO_x	oxides of nitrogen
NPfI	*Noise Policy for Industry* (NSW EPA, 2017a)
NPS	National Policy Statement
NP&W Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales
NSW EPA	New South Wales Environment Protection Authority
NVMP	Noise and Vibration Management Plan
OEH	former NSW Office of Environment and Heritage (now the Environment, Energy and Science Group of DPIE)
OHEW	overhead earth wire
OJD	ovine Johnes disease
OLS	Obstacle Limitation Surface
OPGW	optical fibre ground wire
OSOM	oversize and/or over mass
PACR	Project Assessment Conclusion Report
PADR	Project Assessment Draft Report

Abbreviation	Description
PAD	potential archaeological deposit
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
PBP	*Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (NSW RFS, 2019)
PCB	polychlorinated biphenyls
PCT	plant community type
PFAS	per- and poly-fluoroalkyl substances
PIAC	Public Interest Advocacy Centre
Planning Systems SEPP	State Environmental Planning Policy (Planning Systems) 2021
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
PMF	probable maximum flood
PMP	Property Management Plan
PNTL	Project Noise Trigger Level
POEO Act	*Protection of the Environment Operations Act 1997*
PSCR	Project Specification Consultation Report
QLD	Queensland
RAAF	Royal Australian Air Force
RACH	Remote Access Community Hub
RAP	registered Aboriginal parties
RBL	rating background level
RCP	representative concentration pathway
REZ	Renewable Energy Zone
RFS	Rural Fire Service
RIT-T	Regulatory Investment Test For Transmission
RNE	Register of the National Estate
RNP	*NSW Road Noise Policy* (DECCW, 2011)
SA	South Australia
SAII	serious and irreversible impact
SEARs	Planning Secretary's Environmental Assessment Requirements
SFPP	Special Fire Protection Purpose
SHR	State Heritage Register
SIA	Social Impact Assessment
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SSAL	State significant agricultural land
SSI	State Significant Infrastructure
SWMP	Soil and Water Management Plan

Abbreviation	Description
TAC	Transgrid Advisory Council
TAS	Tasmania
TCZ	total clearing zone
TEC	threatened ecological community
TfNSW	Transport for New South Wales
TN	Total Nitrogen
TP	Total Phosphorus
TSR	travelling stock reserve
TTMP	Traffic and Transport Management Plan
UXO	Unexploded Ordnance
VFR	visual flight rules
VIC	Victoria
VENM	virgin excavated natural material
VNI West	Victoria to NSW Interconnector West
VOC	volatile organic compound
WAL	Water Access Licence
WARR Act	*Waste Avoidance and Resource Recovery Act 2007*
Waste Regulation	Protection of the Environment Operations (Waste) Regulation 2014
Water Act	*Water Act 1912*
WBCSD	World Business Council for Sustainable Development
WM Act	*Water Management Act 2000*
WQMP	Water Quality Monitoring Plan
WRI	World Resources Institute
WRP	Water Resource Plan
WSP	Water Sharing Plan

Glossary of terms

Term	Description
access routes	Roads providing the access to and from the project footprint.
aerodrome	Areas that are suitable for the arrival, departure and surface movement of aircraft.
afflux	Change in flood level between two scenarios.
air quality study area	All land within the 350 metre and 500 metre buffer around the project footprint.
amenity	'The pleasantness of a place as conveyed by desirable attributes including visual, noise, odour etc' (Australian Institute of Landscape Architects QLD, 2018).
annual exceedance probability	The annual exceedance probability (AEP) is the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.
areas of environmental concern	Potential contamination sources are referred to as areas of environmental concern.
annual exceedance probability	The probability of an event occurring in any given year, ie a one per cent (1%) AEP means there is a 1% chance in any given year of the event occurring.
asbestos containing material	Any, material, object, product or debris that contains asbestos.
Asset Protection Zone	A bushfire protection measure, providing a buffer around assets. APZs are designed and maintained to reduce fuel near assets, and to reduce the potential for damage from direct flame contact, smoke, radiant heat, and ember attack. The dimensions for APZs are designed in line with *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (NSW RFS, 2019), and are determined by surrounding vegetation type, slope, and the type of asset/development.
beneficial reuse	Reusing a waste material that would otherwise be discarded.
brake and winch site	A brake and winch site is a temporarily cleared area where plant and equipment are located to spool and winch conductors into place on transmission line structures. The locations of the brake and winch sites may or may not be within the nominated transmission line easement. These sites are only required for construction of the project and do not need to be maintained during operation.
busbar	A busbar is a metallic strip or bar made from copper, brass, or aluminium that grounds and conducts electricity. Within substations they are used to connect high voltage equipment within the switchyard.
Bushfire Attack Level	A way of measuring the severity of potential ember attack, radiant heat, and direct flame contact, to a building. The BAL is used to specify the construction requirements necessary to protect buildings from bushfire in accordance with AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* and the *National Construction Code* (Australian Building Codes Board, 2019).
capacity	The volume a road is designed to accommodate.
Class G airspace	A category of airspace in which an air traffic control separation service is not provided ie uncontrolled airspace.
climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed, largely, to the increased levels of atmospheric greenhouse gases.
combined cumulative impact assessment	Combined cumulative impact assessment approach involves considering the combined effect of the different cumulative impacts of the project with other relevant future projects on key matters in an identified area (DPE, 2022a).
compost	Decaying organic matter used as fertiliser for vegetation.
consecutive noise impacts	Consecutive noise impacts are cumulative noise impacts experienced by receivers for an extended period of time in a particular area where there is little to no break between the activities of one project and an adjacent project(s).

Term	Description
construction compounds	Construction compounds proposed for construction of the project. Each construction compound would accommodate a range of facilities which may include (but not limited to): • laydown areas • site offices • amenities • construction support facilities such as vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas • parking.
Construction Environmental Management Plan	A Construction Environmental Management Plan (CEMP) describes how activities undertaken during the construction phase of development would be managed to avoid or mitigate impacts, and how those environmental management requirements would be implemented.
construction fatigue	Construction fatigue is when combined impacts from multiple adjacent projects are experienced by receivers. This can occur due to concurrent or consecutive construction activities of multiple adjacent projects where the activities overlap or have little or no break between the activities.
consumption induced impacts	Consumption induced impacts in the locality or region refer to the additional economic activity generated from increased demand for goods and services from the project workers earning wages. These workers would generate demand in the region for accommodation, food, commercial and personal services, transport, etc.
Critical State Significant Infrastructure	Critical State Significant Infrastructure (CSSI) projects are high priority infrastructure projects that are essential to the State for economic, social or environmental reasons.
direct GHG emissions	GHG emissions produced from sources as a result of a project's activities.
easement	A legal property right attached to a parcel of land that enables the use of an identified part of the land by a third party other than the owner. For transmission lines, an easement defines the corridor area where the lines are located and that allows access, construction and maintenance work to take place. The easements for the 500 kV transmission lines would typically be 70 metres wide. However, a few locations would require wider easements up to 110 metres wide at transposition locations and up to 130 metres wide where the new transmission line would parallel the relocated section of Line 51. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets.
easement clearing zone	The vegetation zones along the transmission line easements which would require the clearing and ongoing maintenance of tall growing vegetation that may intrude on the vegetation clearance requirements at maximum line operating conditions (maximum conductor sag and maximum conductor blowout) at that location at the time of construction of the project, or at any time in the future. To minimise impacts on biodiversity and ground stability within this zone, ground cover vegetation would be retained, with partial mid-storey removal required along with complete removal of the canopy layer.
electric and magnetic fields	Electric and magnetic fields (EMF) are part of the natural environment and are present in the earth's core and the atmosphere. These fields are also produced wherever electricity or electrical equipment is used.
excavated natural material	Excavated natural material is defined by the NSW EPA as naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has: a) been excavated from the ground, and b) contains at least 98% (by weight) natural material, and c) does not meet the definition of Virgin Excavated Natural Material in the POEO Act. Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils, Potential Acid Sulfate soils or sulfidic ores.

Term	Description
flood immunity	Not affected by flooding for a specified flood event.
floodplain	Land that is subject to flooding up to the Probable Maximum Flood (PMF), which is the maximum possible flood that would reasonably be expected to ever occur.
future Maragle 500 kV substation	The future Maragle 500/330 kV substation that would be built under the approved Snowy 2.0 Transmission Connection Project, which is subject to a separate planning approval (reference SS1-9717, EPBC 2018/836).
greenhouse gas	A gas that absorbs and emits radiant energy within the thermal infrared range.
green waste	Any organic waste or material that can be composted. Green waste includes garden and grass clippings or leaves, shrubs, branches, woodchips, bark, wood, palm trees and branches and weeds.
Grid LSALT	Lowest safe altitude provided for instrument flight rules aircraft that are not flying along a published air route. The grid is a one degree by one degree within the whole number latitude and longitude.
gross regional product	A measure of size or net wealth generated by the local economy.
hazard tree	A hazard tree is defined as a tree or part of tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines.
historic item	An item that is of historic heritage significance. Historic heritage is non-Aboriginal heritage.
hot work	Any work that requires the application of heat or generates extreme heat, either directly or indirectly, such as from an open flame, sparks, or high temperatures.
hydraulics	The science of water movement along channels, floodplains, pipes and other structures that convey water.
hydrology	Assessment of rainfall and runoff processors in a catchment area.
hydrology and flooding study area	The hydrology and flooding study area encompasses the project footprint and the three main hydrological catchments intersected by the project footprint. These are the Murrumbidgee River, Lachlan River and the Wollondilly River catchments and all waterways within these catchments.
hydrostatigraphy	Hydrostatigraphy is the structure of subsurface porous materials in reference to the flow of groundwater, often relating to geological units.
in situ	Situated in the original, natural, or existing place or position.
indicative disturbance area	The area of land that would be temporarily or permanently cleared for the project including: • construction and operation of all proposed infrastructure elements (including the proposed transmission line and structures, substation site work, telecommunications hut and other ancillary work) • construction elements such as construction compounds and worker accommodation facility, access tracks and brake/winch sites. The area is identified based on realistic project component locations and areas however it is indicative at this stage. The final disturbance area would be confirmed during finalisation of the design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation. This indicative disturbance area includes areas required for operation and maintenance.
indirect GHG emissions	GHG emissions generated in the wider economy as a consequence of an organisation's activities but are physically produced by the activities of another organisation.
instrument flight rules	A set of regulations that govern how to fly an aircraft when using visual reference is not safe.
issue-specific cumulative impact assessment	Issue-specific cumulative impact assessment approach involves considering the impacts of the project together with the impacts of other relevant future projects on specific issues (key matters) within an identified area (DPE, 2022a).

Term	Description
job years	A job year is one full-time equivalent job over one year. This is used to measure jobs generated and supported in design and construction. This unit of measure is better than jobs because construction has a short life and hence the jobs are not permanent. Dividing the number of job years by the number of years of construction gives the average number of jobs during construction.
karst environments	An area of land made up of limestone.
key communities	The key communities include the towns and urban centres within the social locality which are most likely to experience direct impacts relating to the accommodation of non-resident workers – including availability of housing, impacts to the economy and access to social infrastructure and services.
Key Fish Habitat	Key Fish Habitat (KFH) is aquatic habitat that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally, and the survival and recovery of threatened aquatic species.
landscape	'*All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure*.' (TfNSW, 2020)
landscape and visual study area	This study considers a study area which extends to approximately five kilometres from the project footprint for landscape character and to about two kilometres from the project footprint for visual impacts.
landscape assessment area	The project footprint and adjacent lands (ie land within 500 metres of the project footprint). The landscape assessment area has been used to establish the site context in accordance with *Biodiversity Assessment Method* (Department of Planning, Industry and Environment, 2020a).
landscape character	The '*combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place'*. (TfNSW, 2020)
landscape character zone	*'An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby*.' (TfNSW, 2020)
landscape values	*'Any aspect of landscape or views people consider to be important. Landscape and visual values may be reflected in local, state or federal planning regulations, other published documents or be established through community consultation and engagement, or as professionally assessed.'* (Australian Institute of Landscape Architects QLD, 2018)
level of Service	A measure of the performance of a road network which typically considers an assessment of various factors including speed, volume of traffic, geometric features, traffic interruptions, delays, and freedom to manoeuvre.
locality	The project footprint and surrounds, nominally a 10 kilometre buffer from the edge of the project footprint. The locality is predominantly used in reviewing available data, existing reports, and database searches for the biodiversity assessment.
lux	A unit of illumination (ie brightness) measuring luminous flux per unit area. It is equal to one lumen per square metre.
non-Aboriginal heritage study area	The non-Aboriginal heritage study area for this report was defined by applying a 1 km wide buffer to either side of the project footprint.
metres above Australian Height Datum	A common reference level used in Australia which is approximately equivalent to the height above sea level in meters.
mulch	Material such as decaying leaves, bark and compost that is typically spread around a plant or tree to enrich or insulate the soil.
near neighbours	Landowners who are not easement affected and outside of the project footprint who might experience construction or operation impacts as a result of the project.

Term	Description
NSW EPA Resource Recovery Order	Resource recovery orders are made by the NSW EPA under the POEO Regulation to allow certain waste to be beneficially reused. Generators and processors of waste to which a resource recovery order applies must meet all the conditions of an order to supply a resource recovery waste to a consumer (refer to clauses 91, 92 and 93 of the POEO Regulation).
OLS	Defines the airspace surrounding an airport that must be protected from obstacles to ensure aircraft flying in good weather during the initial stages and final stages of a flight, or in the vicinity of the airport, can do so safely.
oversized and/or over mass	A heavy vehicle carrying, or designed for the purpose of carrying, a large item that cannot be divided without extreme effort, expense or risk of damage to it, or cannot be carried on any heavy vehicle without contravening a mass requirement or dimension requirement.
PANS-OPS	A traffic control acronym which stands for Procedures for Air Navigation Services – Aircraft Operations.
particulate matter	A category of airborne particles which is classified in relation to its size as either: • PM_{10} particles which are sufficiently small enough to penetrate the large airways of the lungs • $PM_{2.5}$ particles which are generally small enough to be drawn in and deposited into the deepest portions of the lungs.
peak hourly traffic	Maximum of average recorded morning peak (recorded between 6am and 10am) and evening peak (recorded between 3pm and 7pm) volume.
perched aquifers	Perched aquifers are aquifers which occur above the regional water table.
project	The CSSI project “HumeLink”, which is the subject of this EIS. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.
project footprint	The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
proponent	The entity seeking approval for the CSSI application, which for the HumeLink project is NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid).
Ramsar wetland	Wetlands designated under the Convention on Wetlands of International Importance which are representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.
restricted access vehicle	Any vehicle which exceeds the overall dimensions of vehicles as defined in the Heavy Vehicle National Law (NSW).
Scope 1 emissions	Direct GHG emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level.
Scope 2 emissions	Indirect GHG emissions released to the atmosphere from the indirect consumption of an energy commodity.
Scope 3 emissions	Indirect GHG emissions other than Scope 2 emissions that are generated in the wider economy that occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business.
secondary containment dam	A secondary containment dam is a part of a substation oil containment system that captures any oil or oil contaminated water that is not captured by the primary spill oil containment tank.
sediment containment dam	A sediment containment dam is a purpose-built dam designed to collect and settle sediment from stormwater runoff. A sediment containment dam may not always be required and is dependent on a number of requirements such as the catchment area and expected soil loss rate.

Term	Description
sensitivity (of a landscape or view)	'*Susceptibility of a landscape or receptor to accommodate change without losing valued attributes*.' (Australian Institute of Landscape Architects QLD, 2018) The sensitivity of a landscape character zone or view is '*its capacity to absorb change*'. (TfNSW, 2020)
sensitive receptor	A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area.
sky glow	*'The brightening of the night sky that results from radiation (visible and non-visible), scattered from the constituents of the atmosphere (gaseous, molecules, aerosols and particulate matter), in the direction of observation.*' It comprises natural sky glow and artificial sky glow. (AS4282:2019)
spoil	Excavated soil and rock
social baseline	Forms the basis from which, potential impacts may be reasonably perceived or experienced by different people within the social locality.
social impacts	The consequences experienced by individuals, households, groups, communities, or organisations as a result of the project.
social infrastructure	Community facilities and services which meet social needs and community wellbeing.
social locality	A social study area has been defined based on the scale and nature of the predicted social impacts of the project and the considerations in the SIA Guideline. The social study area may also be referred to as the 'social locality' as indicated in the SIA Guideline.
Strahler stream order	Strahler stream order classification is a 'top down' system in which streams of the first order have no upgradient streams flowing into them (DPI 2018). If two streams of the same order merge, the resulting stream is given a number that is one higher. If two rivers with different stream orders merge, the resulting stream is given the higher of the two numbers. Under the Strahler stream order classification, 1st to 3rd order streams are called headwater streams. Streams classified as 4th through 6th order are medium streams and streams that are 7th order or larger are a river.
substation bench	The switchyard within a substation needs to be accessible under most circumstances to allow fault response and access for operational and maintenance reasons. To assist with this requirement, the switchyard is located on a bench to provide a stable, dry weather trafficable and free-draining structure and provide a safe platform for workers, vehicles, cranes and trucks in order to facilitate the maintenance and operation of the switchyard for the duration of its operational life.
surface water and groundwater study area	The study area for the surface water and groundwater assessment includes the project footprint with a one-kilometre buffer.
the Approved Methods	*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2022)
the Guidelines	*State significant infrastructure guidelines – preparing an environmental impact statement* (DPE, 2022)
telecommunications hut	The proposed optical repeater telecommunications hut as part of HumeLink, which is required to boost the signal in the optical fibre ground wire.
Transgrid	The project is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the ACT, and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
transmission line route	The location of the transmission line structures along the middle of the transmission line easement.
transmission line structure	Proposed free standing structures to support the transmission lines.

Term	Description
transposition	Transposition is the periodic swapping of positions of conductors on a transmission line in order to improve transmission reliability.
TUFLOW	One and two dimensional hydrodynamic modelling software
unconfined aquifers	Unconfined aquifers are aquifers that do not have a confining layer like a clay layer or solid rock which restricts flow from one aquifer to another.
unserved energy	A measure of the amount of customer demand that cannot be supplied within a region due to a shortage of generation, demand-side participation or interconnector capacity (AEMO, 2019).
view	'Any sight, prospect or field of vision as seen from a place, and may be wide or narrow, partial or full, pleasant or unattractive, distinctive or nondescript, and may include background, mid ground and/or foreground elements or features.' (Australian Institute of Landscape Architects QLD, 2018)
viewpoint	'The specific location of a view, typically used for assessment purposes.' (Australian Institute of Landscape Architects QLD, 2018)
virgin excavated natural material (VENM)	Natural material such as clay, gravel, sand, soil or rock fines that: • has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities • does not contain sulfidic ores or soils, or any other waste • and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved pursuant to an EPA Gazettal notice.
visual flight rules	A set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.
voluntary load curtailment	The voluntary specific removal or reduction of electrical loads for a limited period of time from a utility grid system in response to a request from the utility or electrical grid system operator.
water quality objectives	Water quality objectives are long-term goals for water quality management. They are measures, levels or narrative statements of indicators of water quality that protect environmental values. They define what the water quality should be to protect the environmental values - after consideration of the socio-economic assessment of protecting the water quality.
work site	A general word to describe a defined construction location.

Part A – Project information and background

1. Introduction

This chapter provides an overview of HumeLink (the project) as proposed by Transgrid, including its key features, objectives and benefits. This chapter also outlines the statutory purpose and structure of this Environmental Impact Statement (EIS).

1.1. Overview of HumeLink

1.1.1. Project background

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres (km) of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley. The location of the project is shown in Figure 1-1.

HumeLink would involve construction of a new substation east of Wagga Wagga as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

HumeLink is a priority project for the Australian Energy Market Operator (AEMO) and the Commonwealth and NSW governments and has been declared as Critical State Significant Infrastructure (CSSI). The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the declared South West Renewable Energy Zone (REZ) and candidate Wagga Wagga and Tumut REZs. The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

Refer to Chapter 2 (Strategic context and project need) for more information on the background to the project and its relationship to other critical energy projects.

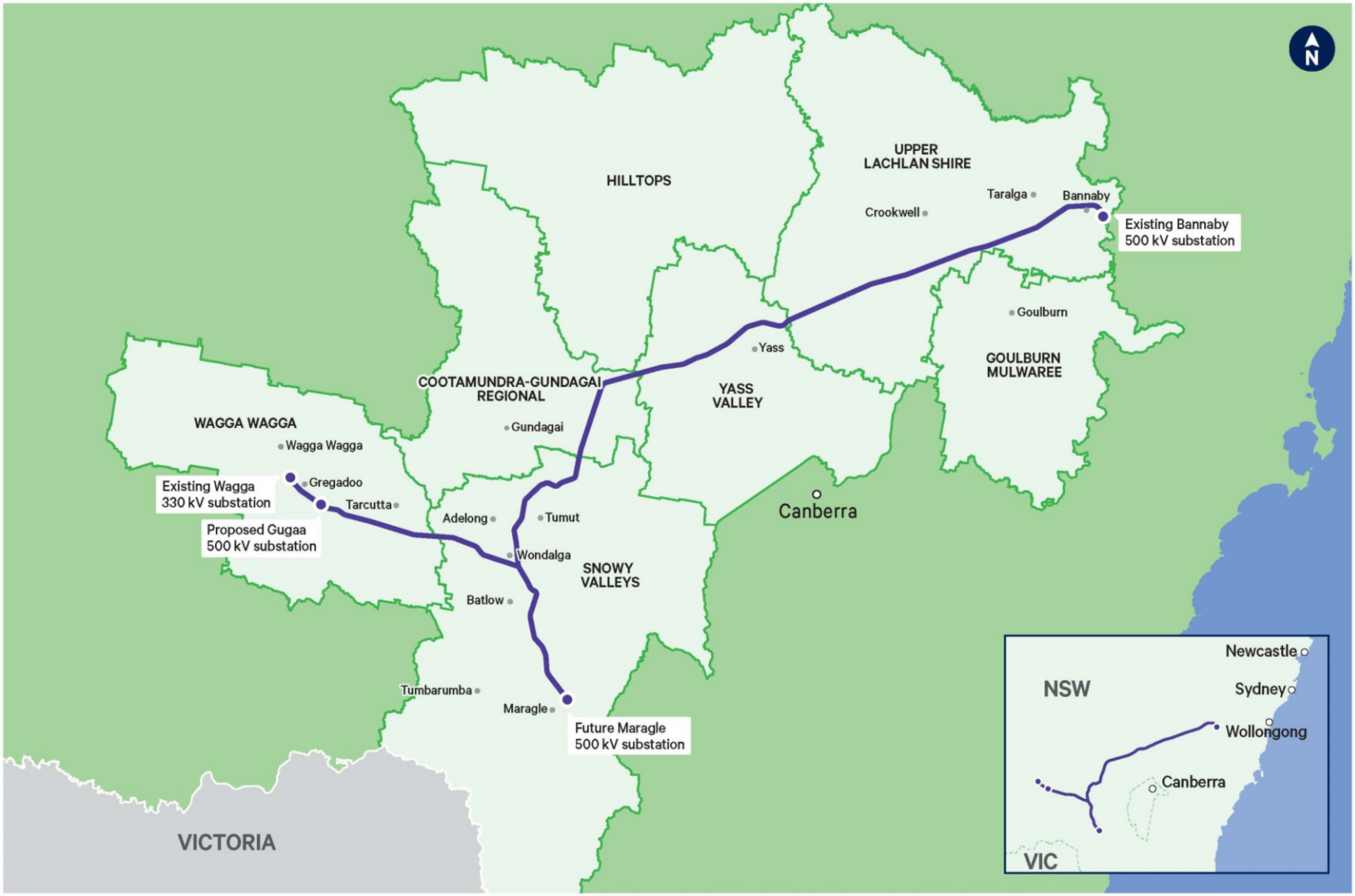


Figure 1-1 Location of the project

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. Once construction has commenced, the project is estimated to take approximately 2.5 years to build and would become operational by the end of 2026.

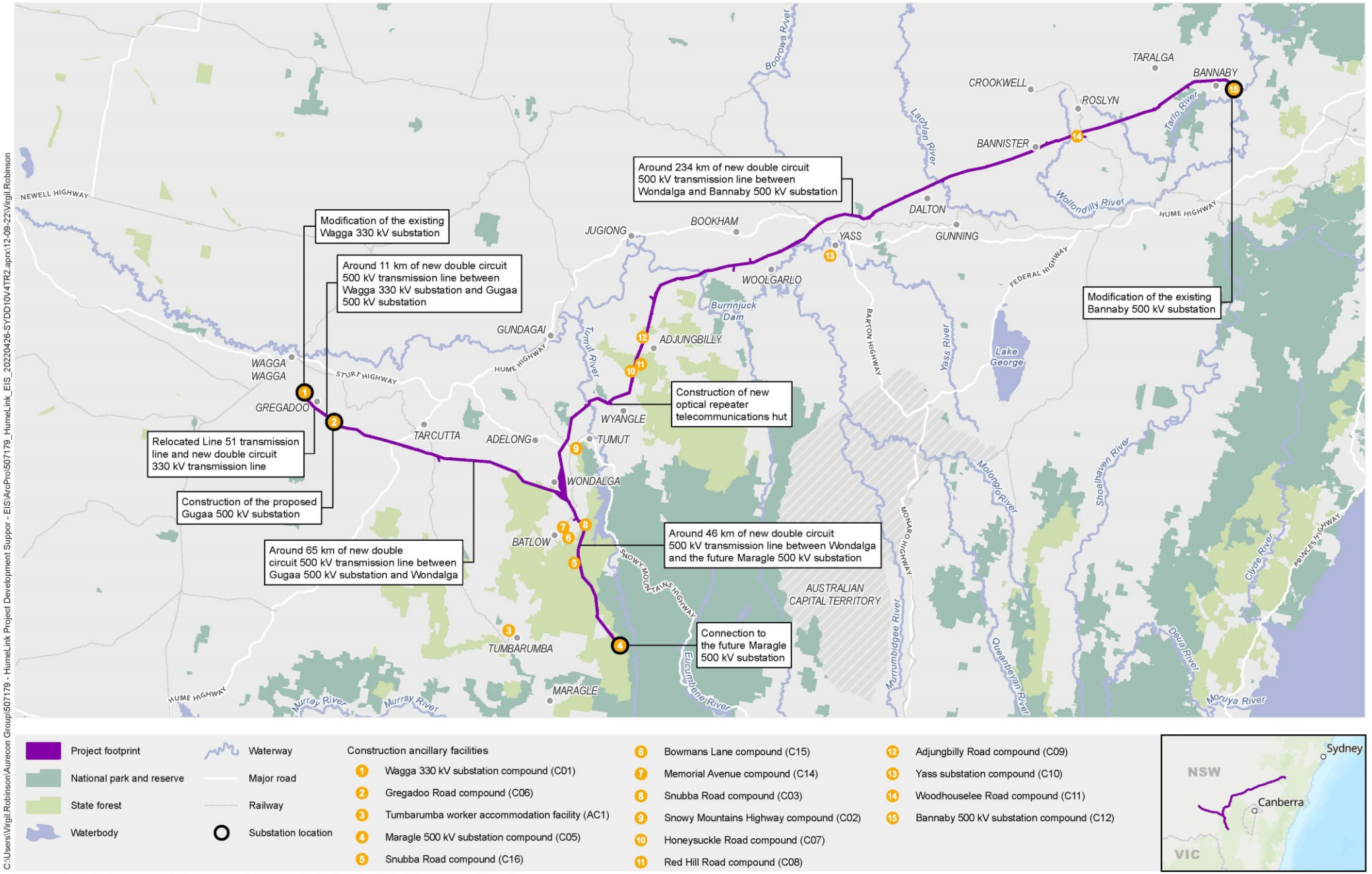
1.1.2. Key features of the project

The project includes the following key components (refer to Figure 1-2):

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

Further detail on the key infrastructure components and construction activities is provided in Chapter 3 (Project description – infrastructure and operation) and Chapter 4 (Project description – construction) respectively.

The key components of the project would be located within the project footprint (refer to Figure 1-2), which is the area that has been assessed for the purpose of this EIS to be directly affected by the construction and operation of the project. The project footprint is a conservative area. For example, during operation of the project the new transmission line easement would generally be 70 metres wide, which is almost three times smaller than the 200 metre width used for the majority of the project footprint assessed in this EIS. The project footprint has been developed to achieve a level of flexibility for future design refinement that allows for further avoidance and minimisation of impacts while allowing for a rigorous level of impact assessment to be carried out. Chapter 7 (Approach to assessment of impacts) provides further detail on the use of the project footprint for the environmental assessment carried out in this EIS. The process for avoidance and minimisation of impacts and management of any residual impacts or uncertainties are described for each environmental issue in Chapters 8 to 23 and Chapter 25.



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Source: *Base data (aerial imagery, transport, water, and cadastral themes); NSW Foundation Spatial Data Framework; Transgrid*

1:925,000
0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 1-2: Key components of the project

1.1.3. Project objectives

When completed, HumeLink aims to:

- increase the transfer capacity between southern NSW and major load centres within NSW (Sydney, Newcastle and Wollongong)
- reinforce stability and reliability in the network
- facilitate transition of the network to new generation sources.

1.1.4. Key benefits of the project

The anticipated benefits of the project include:

- Reliable power: NSW households would have greater access to reliable and affordable electricity.
- Economic growth: HumeLink would unlock the full capacity of the expanded Snowy Hydro Scheme and enable greater sharing of energy across the eastern states.
- Cleaner, sustainable future: HumeLink would enable more renewable energy generation to enter the market, supporting Australia's emissions reduction targets.
- Jobs and opportunities: HumeLink would create more than 1,000 construction jobs.
- Economic growth: HumeLink would contribute to economic activity in regional NSW, generating major benefits for local communities along the route.

1.2. The proponent

The proponent is NSW Electricity Networks Operations Pty Ltd[1] (referred to as Transgrid). Transgrid operates and manages the main high voltage transmission network in NSW and the ACT and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.

Transgrid's network enables more than three million homes and businesses to access a safe, reliable and affordable supply of electricity. It is made up of more than 100 substations and more than 13,000 kilometres of high-voltage transmission lines and underground cables. Interconnections with QLD and VIC allow energy to be transmitted between states. The network is instrumental to the electricity system and, therefore, the economy and facilitates energy trading across the NEM. Further information on Transgrid can be found at www.transgrid.com.au.

1.3. Summary of planning and statutory requirements

The NSW Minister for Planning has declared HumeLink to be Critical State Significant Infrastructure (CSSI) as part of the 'Snowy 2.0 and Transmission Project' defined under Schedule 5, clause 9 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). As CSSI, the project requires approval from the NSW Minister for Planning under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

[1] NSW Electricity Networks Operations Pty Ltd ACN: 609169959
Proponent address: 180 Thomas St, Haymarket, 2000, NSW, Australia

The Planning Secretary's Environmental Assessment Requirements (SEARs) for the project were issued on 14 March 2022 (refer to Appendix A). This EIS has been prepared to address the SEARs and the requirements of the (NSW) Environmental Planning and Assessment Regulation 2021 (EP&A Regulation), in particular, the requirements for the form of EIS as outlined in Schedule 8 of the EP&A Regulation that commenced on 1 July 2022.

A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted in March 2022. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined the project to be a controlled action under section 75 of the EPBC Act on 13 April 2022. The project will be assessed under the Bilateral Agreement made under section 45 of the EPBC Act. In May 2022, Supplementary SEARs were issued to provide additional requirements from DCCEEW.

Therefore, this EIS has been prepared to satisfy both the NSW Government requirements in accordance with the EP&A Act and the Commonwealth requirements in accordance with the EPBC Act. Appendices A and B of this EIS provide further detail on how this EIS is compliant with the SEARs and other statutory requirements.

Should the project be approved to proceed, the project would be constructed and operated in accordance with the mitigation measures proposed in this EIS, any subsequent commitments outlined in the submissions report as well as the conditions of approval.

The applicable planning approvals process for the project is summarised in Figure 1-3. Other regulatory approval processes for the project are described in Chapter 5 (Statutory context).

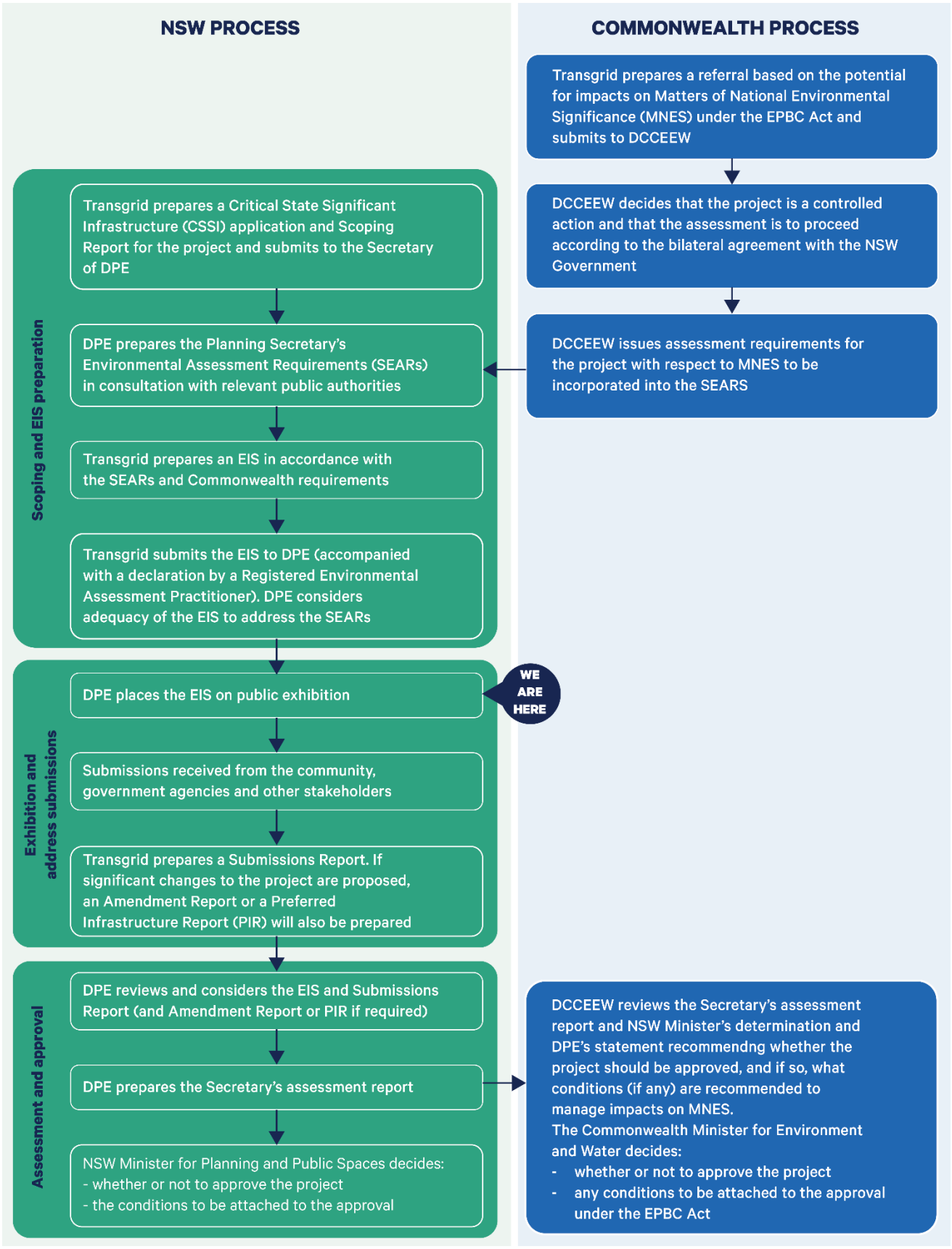


Figure 1-3 Planning approvals process for the project

1.4. Structure of this EIS

The EIS comprises several parts and associated technical reports as follows:

- EIS Summary Report
- Part A Project information and background:
  - Chapter 1 – Introduction
  - Chapter 2 – Strategic context and project need
  - Chapter 3 – Project description – infrastructure and operation
  - Chapter 4 – Project description – construction
  - Chapter 5 – Statutory context
  - Chapter 6 – Engagement
  - Chapter 7 – Approach to assessment of impacts
- Part B Environmental assessment:
  - Chapter 8 to 25 – the results of the assessment of the potential impacts of the project
- Part C Environmental management and conclusion:
  - Chapter 26 – Environmental management
  - Chapter 27 – Project justification and evaluation
  - Chapter 28 – References
- Part D Appendices:
  - Appendix A – SEARs compliance table
  - Appendix B – Statutory compliance table
  - Appendix C – Engagement Outcomes Report
  - Appendix D – Mitigation measures
  - Appendix E – Options Report
- Technical reports supporting the EIS include:
  - Technical Report 1 – Biodiversity Development Assessment Report
  - Technical Report 2 – Aboriginal Cultural Heritage Assessment Report
  - Technical Report 3 – Historic Heritage Impact Assessment
  - Technical Report 4 – Agricultural Impact Assessment
  - Technical Report 5 – Land Use and Property Impact Assessment
  - Technical Report 6 – Economic Impact Assessment
  - Technical Report 7 – Social Impact Assessment
  - Technical Report 8 – Landscape Character and Visual Impact Assessment
  - Technical Report 9 – Noise and Vibration Impact Assessment
  - Technical Report 10 – Phase 1 Contamination Assessment
  - Technical Report 11 – Hydrology and Flooding Impact Assessment
  - Technical Report 12 – Surface Water and Groundwater Impact Assessment
  - Technical Report 13 – Bushfire Risk Assessment
  - Technical Report 14 – Aviation Impact Statement
  - Technical Report 15 – Electric and Magnetic Field Study
  - Technical Report 16 – Traffic and Transport Impact Assessment
  - Technical Report 17 – Air Quality Impact Assessment
  - Technical Report 18 – Greenhouse Gas Assessment.

2. Strategic context and project need

This chapter considers the strategic context of the project with reference to the changing Australian energy environment and the infrastructure required to respond to these changes. The chapter also considers the influence of global changes, the transition to low emissions energy generation, how the project would contribute to this transition and the strategic support of relevant government and other regulatory and industry strategies, policies and plans. In particular, this chapter discusses the need for the project to support the reconfiguration of the transmission network to connect to new renewable energy generation sources in line with the *2022 Integrated System Plan* (Australian Energy Market Operator (AEMO), 2022). This chapter also presents the alternatives and options considered in the development of the project and justification for the project. Appendix E (Options Report) provides a more detailed consideration of alternative options and routes.

2.1. Overview of project need

The Australian energy landscape and its supporting infrastructure requirements is transitioning. In NSW, existing coal-fired generators are being progressively retired and as a result, there is a pressing and urgent need for new sources of supply to meet existing and growing energy demand. New sources of energy generation will largely consist of renewable energy projects.

In response, the transmission infrastructure networks need to be expanded to connect renewable generation. Expansion is required as load centres are primarily located along the eastern, coastal regions of NSW where coal-fired generation has been traditionally located. Areas of greatest potential for new renewables are distant from these existing load centres. Whilst the existing network will continue to play an important role, it only has enough capacity to connect around five per cent of these potential new renewable energy projects according to the *NSW Transmission Infrastructure Strategy* (Department of Planning and Environment (DPE), 2018a).

HumeLink – which would comprise around 360 kilometres of new 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle – would be a key component of the energy transition. It would open up additional capacity for new generation, primarily renewable wind and solar generation in southern NSW, and improve wholesale market competition, thereby lowering electricity costs. It would also help unlock the full potential of the Snowy 2.0 project by increasing transmission capacity and enable greater sharing of energy across the eastern states.

Other key strategic factors driving the need for HumeLink are the need to:

- address climate change, and to meet the Commonwealth and State government commitments to reduce carbon emissions and greenhouse gases (GHGs)
- reinforce stability and reliability in the network
- facilitate development of new renewable energy generation in the Wagga Wagga and Tumut renewable energy zones (REZs), which are candidate REZs, and the South West REZ, which is a declared REZ.

Further details on the strategic drivers for HumeLink are discussed below.

2.2. International and Australian context

2.2.1. Global need for emissions reduction

Climate change, which is linked to an increased level of GHG emissions in the atmosphere, is having worldwide impacts on society, the economy and the environment. To try and minimise the future impacts of climate change, 195 countries, including Australia, agreed on the United Nations Paris Agreement on climate change in December 2015 (the Paris Agreement). This includes a global commitment to achieve net-zero GHG emissions by the second half of this century.

On 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol (Department of Foreign Affairs and Trade, 2016), representing the Commonwealth Government commitment to action on climate change. In 2017, the Government reviewed its climate change policies to ensure they remain effective in achieving Australia's 2030 target and Paris Agreement commitments. A final report was released on 19 December 2017, which generally indicated the Government's policies were on course to meet Australia's international climate change commitments.

In June 2022, the Prime Minister, Anthony Albanese, and the Minister for Climate Change and Energy, Chris Bowen conveyed Australia's updated Nationally Determined Contribution under the Paris Agreement to the United Nations, stating that Australia will reduce its net GHG emissions to 43 per cent below 2005 levels by 2030 and to zero by 2050 (Department of Industry, Science, Energy and Resources, 2022a). These reduction targets have now been put into legislation in the *Climate Change Act 2022* (Commonwealth). HumeLink is consistent with the Commonwealth Government's climate change initiatives and would be an enabler for the continued expansion of renewable energy generation by facilitating the longer-term transition of the energy sector to low-emission energy sources.

2.2.2. The shift towards renewable energy and the challenges of the National Electricity Market

The National Electricity Market (NEM) incorporates around 40,000 kilometres of transmission lines across QLD, NSW, ACT, VIC, SA and TAS. However, areas with greater renewable energy potential are often remote from the existing transmission network. Therefore, as NSW transitions to low-emission energy generation sources, the transmission network within the NEM also needs to be reconfigured to connect to the new sources of renewable energy generation.

The NEM is currently transitioning from a system dominated by coal-fired generation to one of diverse renewable and distributed energy generation, supported by energy storage and network solutions. The existing network is estimated to have a connection capacity of 13 gigawatts in areas with favourable renewable resources, which is significantly less than the 26 gigawatts (or more) of new grid-scale renewables required by 2040 (AEMO, 2020).

In response, several REZs have been identified across the National Electricity Market (NEM). These are areas of high energy resource potential where strategic transmission infrastructure upgrades can connect multiple projects at lower cost (AEMO, 2020). To balance resources and connect REZs in new regions, the transmission grid needs targeted augmentation, including strategically placed large-scale transmission lines.

Of particular relevance to HumeLink are the Wagga Wagga (N6) and Tumut (N7) REZs, which are candidate REZs in the 2022 *Integrated System Plan* (ISP) (refer to Figure 2-1 and Figure 2-2). HumeLink would also indirectly support electricity transfer and development within the declared South West NSW (N5) REZ through its connection to EnergyConnect (NSW – Eastern Section) (refer to Figure 2-1, Section 2.3.3 and Section 2.5).

HumeLink would be crucial to connect the identified REZs to the network and would provide a key electricity connection to encourage future renewable energy providers to invest in lower emission electrical generation alternatives.

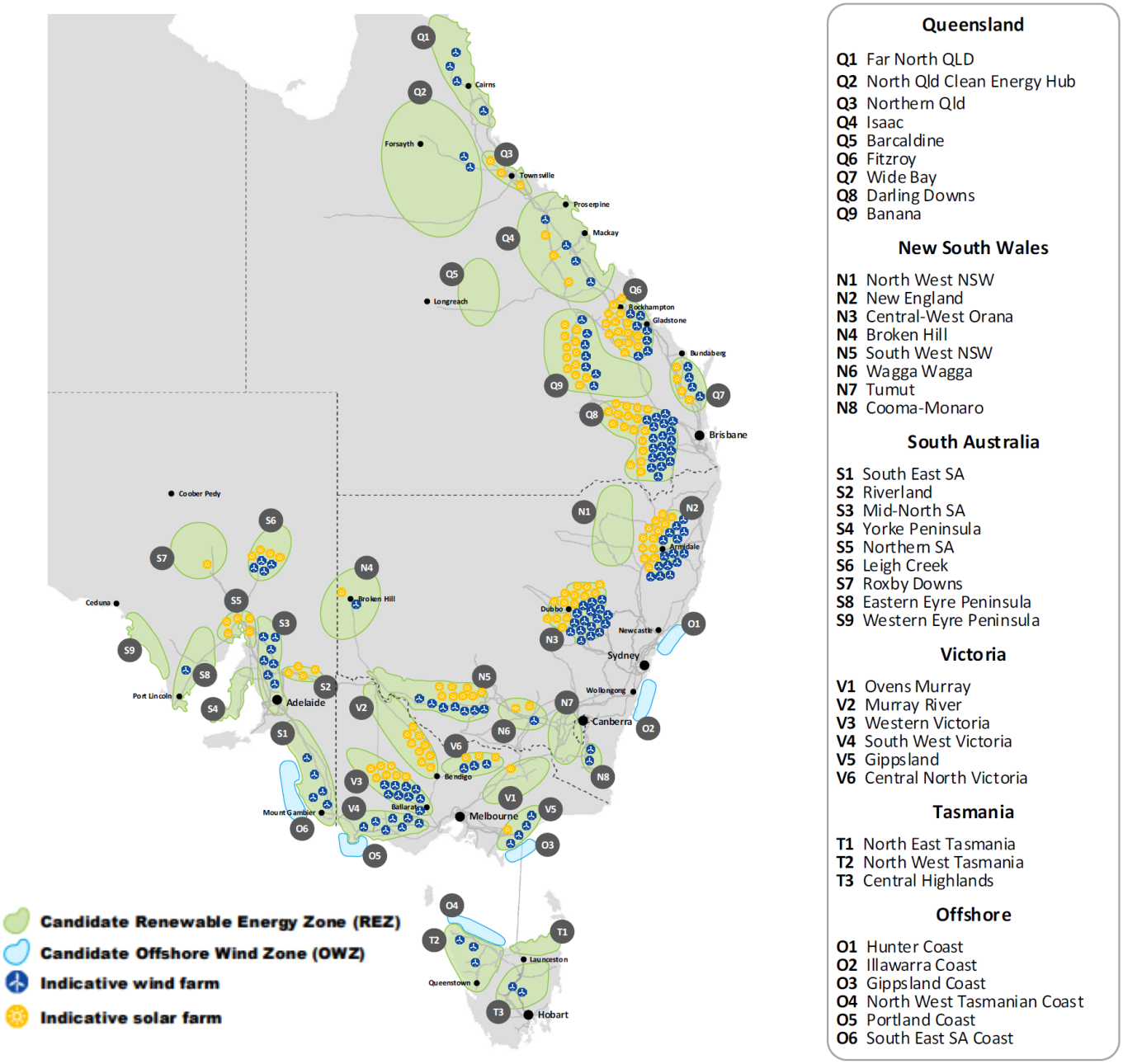


Figure 2-1 Identified candidate Renewable Energy Zones development across the National Energy Market - 2049-50 (AEMO, 2022)

2.2.3. Integrated System Plan

Responding to a recommendation in the *2018 Independent Review into the Future Security of the NEM* (Commonwealth of Australia, 2017), the AEMO released the first Integrated System Plan (ISP) in July 2018. The purpose of the ISP is to deliver a strategic infrastructure development plan, based on sound engineering and economics, which can facilitate an orderly energy system transition under a range of scenarios (AEMO 2018). The ISP is updated and released by the AEMO every two years.

The most recent 2022 ISP identifies HumeLink as a key "actionable" project, to be "progressed urgently" with the latest delivery date of July 2026 (AEMO, 2022). The Australian Energy Regulator (AER) estimates that HumeLink would deliver around five per cent of the net market benefits of the ISP (AEMO, 2022).

The 2022 ISP also indicates that HumeLink is the only actionable ISP project that could be delivered in the critical period that directly addresses the risk of not enough dispatchable capacity available if there are early coal-fired generator closures in the period 2026 to 2028. If HumeLink is not delivered on time, the 2022 ISP indicates that more long-duration storage than otherwise anticipated under the *NSW Electricity Infrastructure Roadmap 2020* (refer to Section 2.3.3) and/or additional gas-fired generation would be needed to maintain the reliability of the power system in NSW (AEMO, 2022).

2.2.4. Priority transmission projects

The Commonwealth Government has supported reforms that would ensure timely delivery of the transmission projects recommended in the 2022 Integrated system plan (ISP). The reforms aim to bring forward necessary transmission investment at least cost to energy consumers.

The Commonwealth Government has provided support, including funding of transmission infrastructure, through the Grid Reliability Fund announced in October 2019. On 31 January 2020, a Memorandum of Understanding (MOU) was signed by the NSW and Commonwealth governments to jointly fund energy and emissions reduction initiatives, and ensure NSW has a reliable and affordable energy system (Commonwealth of Australia and State of NSW, 2020). The MOU will help NSW to meet its target of net zero emissions by 2050. Key initiatives in the MOU include improving transmission connections and network access, including accelerating and delivering key transmission infrastructure capacity projects; HumeLink is specifically mentioned in Schedule A of the MOU.

The Commonwealth Government has also identified HumeLink in Australia's Long Term Emissions Reduction Plan, which finds that it is needed to strengthen the network in southern NSW and transport renewable energy to consumers from new projects, including Snowy 2.0 (Commonwealth of Australia, 2021).

2.2.5. The post-2025 project

The Energy Security Board (ESB) was tasked by the former Council of Australian Governments Energy Council in March 2019 to advise on a long-term, fit-for-purpose national electricity market design. The ESB published the Post-2025 Market Design Directions Paper in January 2021, bringing together the results of consultation and forming four directions and next steps. One of the four directions is focussed on transmission and access to the transmission grid.

The report highlights that *"while current access arrangements may have been adequate in the past with only incremental investment in renewables occurring, they are not fit for the future transformational change to the system. Without resolving connection issues there will be higher prices for consumers and the grid will be more difficult to operate"* (ESB, 2021).

HumeLink would assist in resolving potential future connection issues associated with the shift towards renewables by providing additional transmission capacity and greater interconnectivity of the grid.

2.2.6. Regulatory investment test for transmission (RIT-T)

The Regulatory Investment Test for Transmission (RIT-T) aims to promote efficient transmission investment in the NEM by promoting greater consistency, transparency and predictability in transmission investment decision-making (AER, 2020). The purpose of the RIT-T is to consider all credible options to address the identified need for the transmission network (including non-network options) and to ensure that the selected option maximises benefits to all those who produce, consume and transport electricity in the market. In many ways the RIT-T process is an independent regulatory review by the AER of the need for HumeLink albeit largely focussed on the economic and financial aspects.

The RIT-T process for HumeLink was carried out between 2019 and 2022 (refer to Section 2.6). The AER approved the requested funding for the first stage of HumeLink in August 2022 (AER, 2022), indicating the confidence and urgency for progressing its development from an economic and financial perspective. In accordance with the Project Assessment Conclusion Report (PACR), prepared as part of the RIT-T process, the project is expected to deliver $491 million in net benefits to electricity customers (Transgrid, 2021b).

2.3. NSW electricity framework

2.3.1. NSW Transmission Infrastructure Strategy

The NSW *Transmission Infrastructure Strategy* (DPE, 2018a) is the NSW Government's plan to unlock private sector investment in priority transmission infrastructure projects that can deliver least-cost energy to customers through to 2050. The NSW *Transmission Infrastructure Strategy* forms part of the government's broader plan to make energy more affordable, secure investment in new generation sources and network infrastructure, and ensure new technologies deliver benefits to consumers.

The NSW *Transmission Infrastructure Strategy* identifies three priority energy zones – the South-West Energy Zone, Central-West Energy Zone and New England Energy Zone (now superseded by the candidate and declared REZs identified in the 2022 ISP). These are areas with high energy-generation potential where planned transmission infrastructure upgrades could allow multiple generation projects to connect to the network with associated cost efficiencies. HumeLink is identified in this strategy, which refers to it as 'SnowyLink North'.

2.3.2. NSW Electricity Strategy

Building on the NSW *Transmission Infrastructure Strategy*, the *NSW Electricity Strategy* (DPIE, 2019) plans for a reliable, affordable and sustainable electricity future that supports a growing economy and sets out actions to support the energy market. The *NSW Electricity Strategy* states that to connect new generation at the scale required to meet NSW's future energy needs, it is critical to develop greater transmission capacity to these new locations.

HumeLink would provide additional transmission capacity focussed on these new generation locations, which would in turn encourage continued investment in new renewable generation sources.

2.3.3. NSW Electricity Infrastructure Roadmap 2020

The *Electricity Infrastructure Roadmap* (DPIE, 2020a) (the Roadmap) builds on the *NSW Electricity Strategy* to provide a framework for developing the electricity system in NSW. The Roadmap is enabled by the *Electricity Infrastructure Investment Act 2020*, which commits the NSW Government to:

- declaring five REZs
- establishing an Electricity Infrastructure Investment Safeguard to deliver new generation, long duration storage and firming capacity
- establishing an Electricity Infrastructure Jobs Advocate and NSW Renewable Energy Sector Board
- establishing a Transmission Development Scheme that will de-risk REZ investment.

The Roadmap aims to coordinate investment in generation and transmission infrastructure so that generators can be sure of a reliable connection to the network, and transmission infrastructure projects can be planned and approved to provide the connection in time.

HumeLink would play a critical part in providing investor confidence in new generation projects by providing additional transmission capacity. In particular, HumeLink would indirectly support electricity transfer from new generation projects within the South West NSW REZ, which is a declared REZ under the *Electricity Infrastructure Investment Act 2020,* through its connection to EnergyConnect (NSW – Eastern Section) (refer to Section 2.5).

2.3.4. NSW Government's Net Zero Plan Stage 1: 2020–2030

The *Net Zero Plan Stage 1: 2020–2030* (DPIE, 2020b) sets the foundation in NSW for action on climate change and the goal to reach net zero emissions by 2050. The Net Zero Plan identifies the economic opportunities presented by solar panels and wind turbines that – in combination with firming technologies, such as gas, batteries and pumped hydro – are now the cheapest forms of new, reliable electricity generation.

The Net Zero Plan explains that delivery of the REZs will involve expanding transmission infrastructure into regions to open new parts of the grid for renewable energy projects. HumeLink is a critical transmission infrastructure project that would support the transfer of energy generated within the declared South West REZ as well as the candidate Wagga Wagga and Tumut REZs as identified in the 2022 ISP.

This would encourage the continued expansion of renewable energy generation within the identified REZs, which would help to facilitate the transition of the NEM to energy sources with lower GHG emissions.

HumeLink would also provide an important connection to the Snowy 2.0 project to support the transfer of energy from the Snowy Mountains Hydro-electric Scheme, which would provide a major source of renewable energy generation and storage. This is aligned with the opportunities identified in the Net Zero Plan to use new, reliable pumped hydro electricity generation to hep NSW reach its goal of net zero emissions by 2050.

2.4. Regional context

The project is located across two planning regions – the Riverina Murray and the South East and Tablelands. The *Riverina Murray Regional Plan 2041* (DPE, 2023) and the *South East and Tablelands Regional Plan 2036* (DPE, 2017a) (including the *Draft South East and Tablelands Regional Plan 2041* (DPE, 2022)) set out the strategic land use planning framework for these two regions. The regional plans recognise the role of the regions in supporting NSW's transition to net zero carbon emissions by 2050 through the prioritisation and support of renewable energy.

Relevant key strategic directions and objectives include:

- *Riverina Murray Regional Plan 2041* – Direction 13: Support the transition to net zero by 2050 (DPE, 2023a)
- *South East and Tablelands Regional Plan 2036* – Direction 6: Position the region as a hub of renewable energy excellence (DPE, 2017a)
- *Draft South East and Tablelands Regional Plan 2041* – Objective 8: Plan for a net zero region by 2050 and Objective 12: Promote a year-round visitor economy (DPE, 2022a).

HumeLink would significantly help to meet these regional planning directions as it would support NSW's transition to net zero carbon emissions by providing additional transmission capacity in the regions to encourage prioritisation of investment in new renewable energy sources.

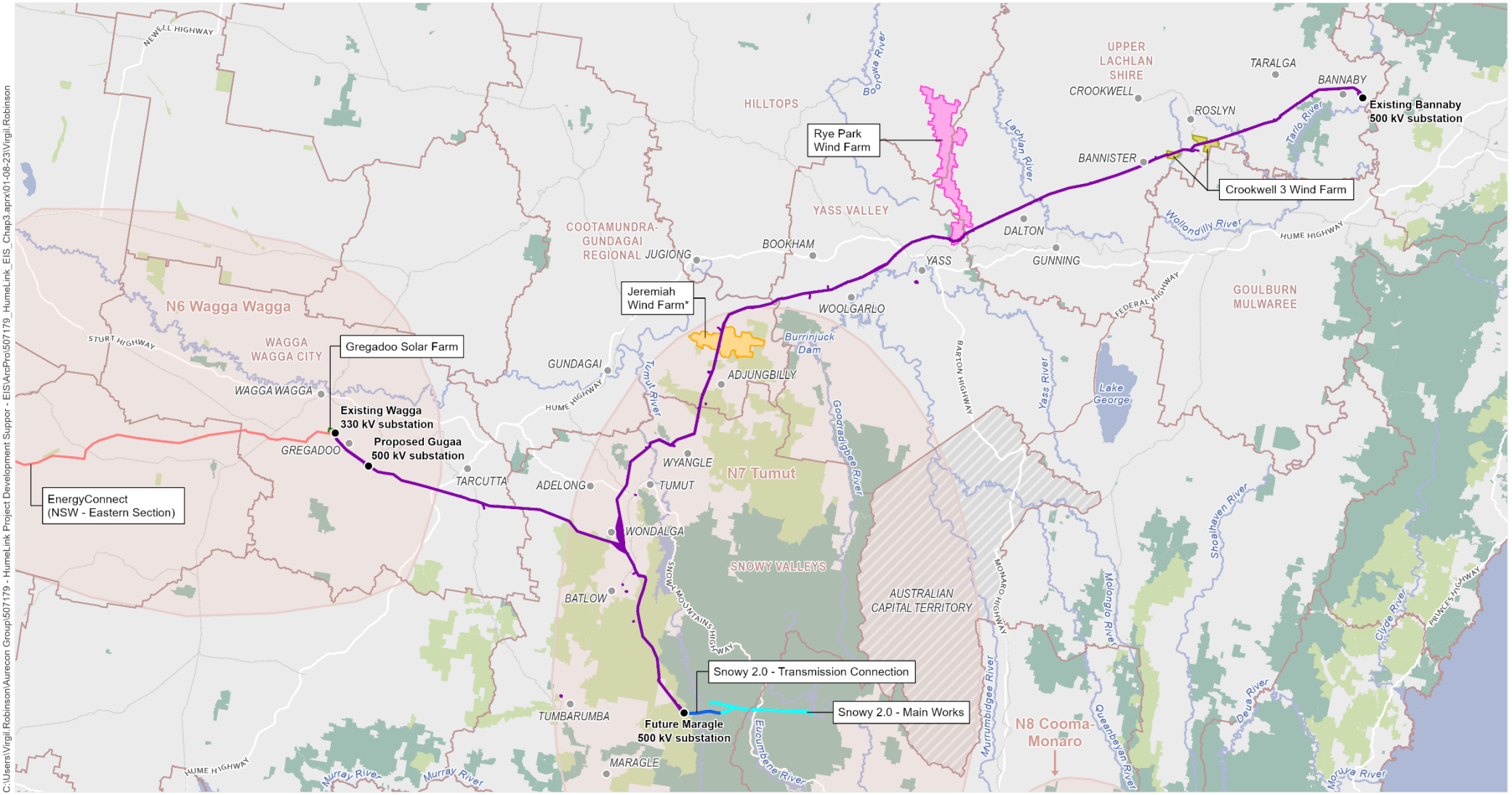
2.5. Relationship to other critical energy projects

HumeLink would support several other critical energy projects identified in the 2022 ISP in the transition of the NEM to lower cost and low-emission renewable energy sources.

In particular, HumeLink would have a direct interface with the Snowy 2.0 – Transmission Connection project at the future Maragle 500 kV substation and with Project EnergyConnect (NSW – Eastern Section) at the Wagga 330 kV substation (refer to Figure 2-2). Both projects have received planning approval by the NSW Government.

As stated in the *2019 Electricity Statement of Opportunities* (AEMO, 2019), the full benefits of new renewable generation, including upgrades to the Snowy Hydro Scheme (Snowy 2.0), cannot be realised without an associated increase in transmission capacity. HumeLink would provide this additional capacity.

Chapter 25 (Cumulative Impacts) provides more detail on these projects as well as other relevant nearby projects that may result in cumulative impacts or benefits with HumeLink during construction and/or operation.



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

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 2-2: Location of the project relevant to candidate REZs as per 2022 ISP

2.6. Alternatives and options considered

A comprehensive assessment of alternatives and options has been carried out for HumeLink. The assessment included consideration of alternatives and options for:

- strategic solutions and technical options to meet the need of the transmission network
- transmission line corridors
- undergrounding of transmission lines
- substation locations
- ancillary facilities including construction compounds and worker accommodation facilities.

The full assessment is provided in Appendix E (Options Report), and summarised below.

2.6.1. Transmission line options development and assessment process

Transgrid, like all other Transmission Network Service Providers, must investigate and identify the most efficient route for transmission that is in the long-term interests of consumers of electricity with respect to price, safety, reliability and security of supply. Transgrid's assessment of options considered the costs and benefits for supply of electricity to consumers (including the construction cost, ongoing operational costs, market benefits, and expected reliability) as well as potential impacts on landowners, the community, and the environment.

The development of the preferred transmission line options involved a robust process ranging from a regulatory test of strategic options (RIT-T process) through to more detailed route identification and corridor refinement processes.

Transgrid identified a broad study area where new transmission lines could be built to connect substations at Wagga Wagga, Bannaby and Maragle. A constraints mapping tool was used to narrow down the broad study area to a one kilometre wide study corridor.

Constraints considered were categorised as Tier 1, which are considered no-go areas, incompatible with new transmission lines. Tier 2 constraints were areas to be avoided or impacts minimised whenever possible. This approach comprehensively considers environment, social, engineering and cost factors.

The study corridor was progressively refined based on technical assessments and feedback gathered during consultation with landowners and project stakeholders.

Landowners and community provided feedback on key route options. Decisions were publicly documented and communicated via information on Transgrid's website, as well as community sessions, mail out of project updates and face-to-face meetings.

A summary of the process including the opportunities for community and stakeholder engagement is shown in Figure 2-3 and Figure 2-4.

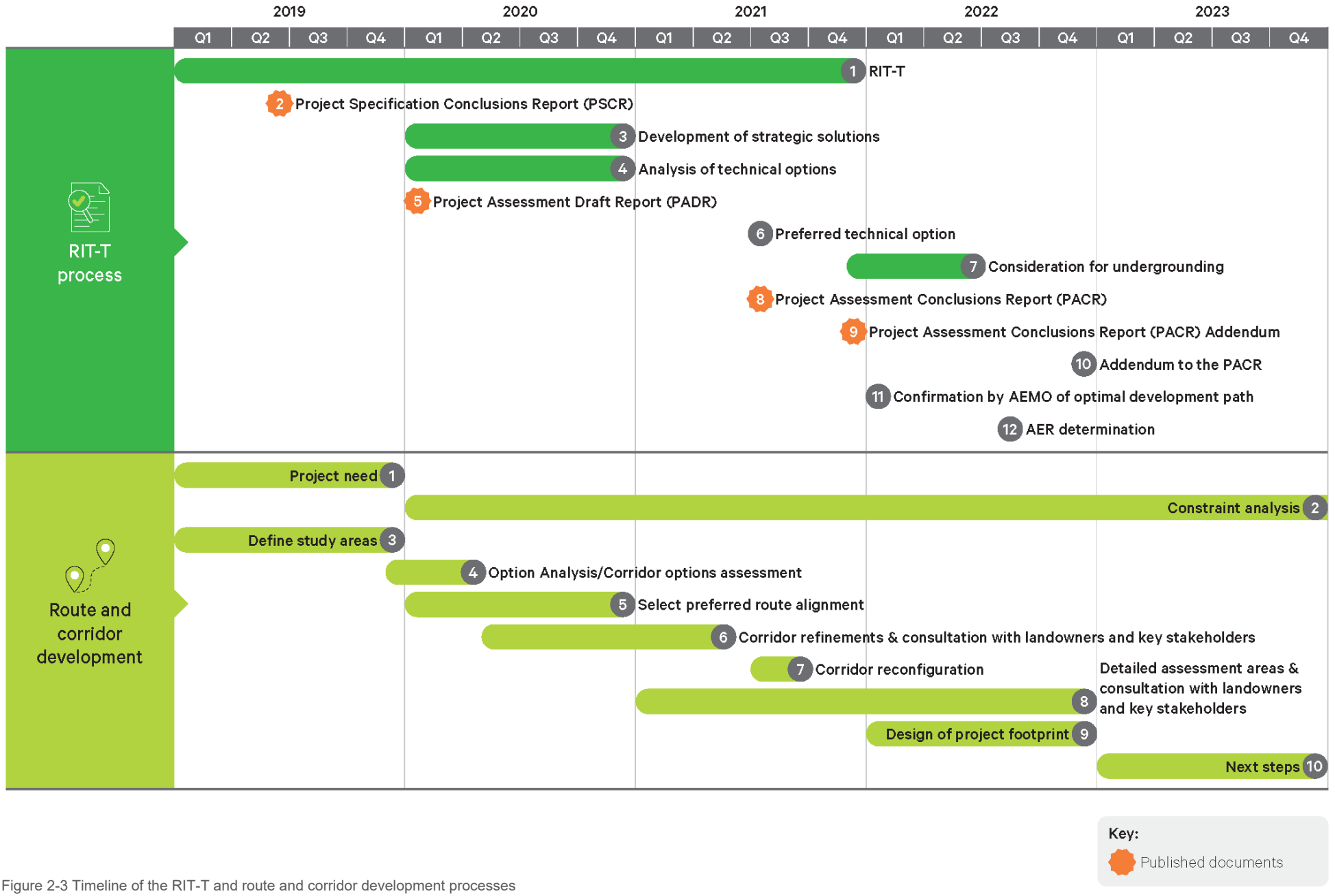


Figure 2-3 Timeline of the RIT-T and route and corridor development processes

RIT-T process

1. **RIT-T (Jan 2019–Dec 2021):**
   Regulatory Investment Test-Transmission demonstrating Humelink's benefits to consumers.
2. **Project Specification Conclusions Report (PSCR) (Jun 2019):**
   Detailed the need to reinforce the transmission network in southern NSW to increase capacity to the state's demand centres and described options to meet the need, including technical characteristics that would be required of a non-network option.
3. **Development of strategic solutions (Jan–Dec 2020):**
   Testing and determining different strategic options.
4. **Analysis of technical options (Jan–Dec 2020):**
   Technical options assessed including optional transmission lines and scenarios for different voltages, to be included in Project Assessment Draft Report (PADR).
5. **Project Assessment Draft Report (PADR) (Jan 2020):**
   Quantitative analysis of the proposed options and expected market benefit across a range of scenarios and sensitivities, published as supporting documents.
6. **Preferred technical option (Jul 2021):**
   Best technical option/project solution published in the Project Assessment Conclusion Report (PACR). Best technical option has been announced as – *new transmission lines in a "loop" between Maragle, Bannaby and Wagga Wagga with construction and operation at 500 kV.*
7. **Consideration for undergrounding (Nov 2021–Jun 2022):**
   Research and analysis on the possibility and benefits of undergrounding.
8. **Project Assessment Conclusions Report (PACR) (Jul 2021):**
   Addressed PADR consultation responses and determined the final preferred option.
9. **Project Assessment Conclusions Report (PACR) Addendum (Dec 2021):**
   This addendum has been prepared in response to the AER's dispute determination and extends the analysis presented in the HumeLink PACR published in July 2021.
10. **Addendum to PACR (Dec 2022):**
    Providing more information on the best technical option/project solution.
11. **Confirmation by AEMO of optional development path (Jan 2022):**
    Confirmed that the proposed option and preferred cost is consistent with the optimal development path.
12. **AER determination (Aug 2022):**
    Confirmed that Transgrid may proceed to the next stage of the HumeLink project and is entitled to recover revenues from energy consumers to deliver the Stage 1 (Early Works).

Route and corridor development

1. **Project need (Jan–Dec 2019):**
   Transmission lines route and area of works.
2. **Constraint analysis (2020–ongoing):**
   Tier 1 – Avoid, Tier 2 – Avoid where possible, minimise impacts to Network requirements.
3. **Define study areas (Jan–Dec 2019):**
   Based on nodes and outcomes of high level constraint analysis.
4. **Option Analysis/Corridor options assessment (Nov 2019–Apr 2020):**
   Identified high level constraints through desktop analysis and community engagement processes. Generated list of route alignment options that connect between nodes and reflect ranking of Tier 1 and 2 constraints. Evaluated list of route alignment options and shortlisted alignment options.
5. **Select preferred route alignment (Jan–Dec 2020):**
   Divided project into sections based on common constraints and opportunities. Compared shortlisted alignment options based on constraints and opportunities. Selected preferred route alignment for each section.
6. **Corridor refinements & consultation with landowners and key stakeholders (May 2020–May 2021):**
   Refine the project footprint with the selected route alignment, prioritising consultation with landowners and key stakeholders through the corridor refinement process.
7. **Corridor reconfiguration (Jul–Sept 2019):**
   Further changes and modifications to the refined project footprint.
8. **Detailed assessment areas & consultation with landowners and key stakeholders (2021–2022):**
   In parallel with RIT-T process, to address strong community interests to potential route options and minimise environmental impacts in particularly sensitive areas, by undertaking consultation with landowners and key stakeholders.
9. **Design of project footprint (Jan–Dec 2022):**
   Design the final project footprint with sufficient flexibility for concept design.
10. **Next steps (Jan–Dec 2023):**
    Community and stakeholder engagement along preferred project footprint, considering alternative alignments and routes suggestions. Refine project footprint and easement alignment. Direct engagement with landowners in the area have resulted in the proposal of alternative route for consideration (Yaven Creek and Green Hills).

Figure 2-4 Overview of the RIT-T and route and corridor development processes

Table 2-1 provides a chronological summary of the key steps and outcomes in the development of the project and preferred transmission line option, including key opportunities for stakeholder and community engagement and publication of information regarding the options process for the project. Appendix E (Options Report) provides further details on the options that were assessed. Chapter 6 (Engagement) provides more information on the engagement carried out during development of the project.

Table 2-1 Key steps and outcomes in the development of the preferred option

Timeframe	Key process	Summary of key processes and outcomes	Key public engagement and information
2018	NSW *Transmission Infrastructure Strategy* 2018	The NSW *Transmission Infrastructure Strategy* (DPE, 2018) identified a new interconnector between Wagga Wagga, Snowy 2.0 and Bannaby north-east of Goulburn. This interconnector was initially referred to as SnowyLink North, now identified as HumeLink.	NSW *Transmission Infrastructure Strategy* made publicly available in 2018.
Strategic option identification and assessment through Regulatory Investment Test for Transmission (RIT-T process)			
2019 to 2020	Project Specification Consultation Report (PSCR)[2]	The PSCR identified five potential strategic solutions: • installing new high voltage direct current lines between Maragle, Bannaby and Sydney • using the existing 330 kV network with minor line upgrades • rebuilding the existing 330 kV lines • building new 330 kV or 500 kV double circuit transmission lines from Maragle to Bannaby • installing new 500 kV transmission lines between Wagga Wagga, Maragle and Bannaby substations. The installation of a new 500 kV transmission line between Wagga Wagga, Maragle and Bannaby was determined as the only feasible strategic solution. It was deemed the most economically beneficial, with lower technical risks than other potential strategic solutions.	PSCR made publicly available in June 2019 (Transgrid, 2019).
2020	Technical Options assessed in Project Assessment Draft Report (PADR)[3]	PADR assessed four Technical Options: • Technical Option 1 – two new transmission lines with a direct path between Maragle and Bannaby • Technical Option 2 – new transmission lines between Maragle and Bannaby via Wagga Wagga • Technical Option 3 – new transmission lines in a 'loop' between Maragle, Bannaby and Wagga Wagga • Technical Option 4 – new transmission lines in a 'loop' between Maragle, Bannaby and Wagga Wagga plus additional capacity between Bannaby and Sydney. Each option considered three different voltage scenarios: • Scenario A – construction and operation at 330 kV with a high-capacity conductor • Scenario B – construction to 500 kV and initial operation at 330 kV, with future capacity to operate to 500 kV	PADR made publicly available in January 2020 (Transgrid, 2020a).

[2] PSCR available at: https://www.transgrid.com.au/media/chvf0ahp/transgrid-pscr_reinforcing-nsw-southern-shared-network.pdf
[3] PADR available at: https://www.transgrid.com.au/media/xrzd0jv4/transgrid-hume-link-padr-amended.pdf

Timeframe	Key process	Summary of key processes and outcomes	Key public engagement and information
		• Scenario C – construction and operation at 500 kV. The PADR concluded that the 500 kV options connecting Maragle and Bannaby via Wagga Wagga (ie Technical Option 2C and Technical Option 3C) would provide the greatest net benefits of all options (refer to Appendix E (Options Report)).	
July 2021	Best technical option / project solution published in PACR[4]	PACR concluded that Technical Option 3 with Scenario C (Technical Option 3C – refer to Figure 2-5) would be preferred as it would provide the greatest net benefit of all options considered. Technical Option 3C was found to have approximately 23 per cent greater estimated net benefits than the second ranked option (Technical Option 2C). Technical Option 3C would provide more route diversity than Technical Option 2C, reducing the risk of events such as lightning strikes, bushfires or extreme wind impacting power supply in the network. All lines in Technical Option 3C are proposed to be constructed in a double-circuit configuration to minimise the overall costs to consumers, which was identified as a refinement in the PACR compared to the PADR.	PACR made publicly available in July 2021 (Transgrid, 2021a).
December 2021	Addendum to the PACR[5] to provide more information on the best technical option / project solution	In response to the AER, Transgrid amended the HumeLink PACR to include a variant of Technical Option 1C, which involves a new double circuit 500 kV line (instead of two lines) between Maragle and Bannaby. The results of the assessment in addendum to the PACR confirmed the findings of the July 2021 PACR assessment that Option 3C provides the greatest net benefits.	Addendum to PACR made publicly available in December 2021 (Transgrid, 2021b).
January 2022	AEMO confirmation of consistency with optimal development path	AEMO confirmed that the proposed option and preferred cost is consistent with the optimal development path in the 2022 ISP.	ISP Feedback Loop Notice – HumeLink (Early Works) published by AEMO in January 2022 (AEMO, 2022).
August 2022	AER determination	AER confirms that Transgrid may proceed to the next stage of the HumeLink project to deliver the Stage 1 (Early Works) component of HumeLink.	AER determination HumeLink Early Works – August 2022.
Transmission line area of interest assessment and corridor identification and refinements (in parallel with RIT-T process)			
Late 2019 – April 2020	Corridor options assessment	Identified high level constraints through desktop analysis and community engagement processes.	Initial 1 to 5 km wide study corridor published in April 2020.
May 2020 – September 2021	Corridor refinements	Modifications were made to the initial study corridor as a result of consultation with landowners and stakeholders, site visits, design development and improvement in constraints understanding through field studies and environmental assessment. This occurred as an iterative process that was carried out over about 1.5 years.	Consultation with landowners and other key stakeholders.

[4] PACR available at: https://www.transgrid.com.au/media/rxancvmx/transgrid-humelink-pacr.pdf
[5] PACR addendum available at: https://www.transgrid.com.au/media/0ezampbw/humelink-rit-t-pacr-addendum.pdf

Timeframe	Key process	Summary of key processes and outcomes	Key public engagement and information
		It included key changes in May 2020 (refer to Figure 2-6) as follows: • shifted corridor for the double-circuit 330 kV line between the proposed Gugaa 500 kV substation and Wagga 330 kV substation further south of the existing 330 kV Transmission Line 51 as a connection to Line 51 was no longer required • shifted corridor south-east between the existing 330 kV Transmission Line 51 and the existing 132 kV Transmission Line 990 to avoid smaller residential properties • narrowed corridor in the area of the proposed Gugaa 500 kV substation aligned with the short-listing of potential substation sites. Further key changes made in May 2021 to the corridor included (refer to Figure 2-7): • shifting the corridor from the western side of Yaven Creek to the western edge of Green Hills State Forest to increase distance through public land • introducing a new corridor over Blowering Dam due to need to further assess impacts on Tumut Airport.	
		More localised route refinements were made in September 2021 including (refer to Figure 2-8): • changes associated with the decision for a double-circuit configuration as per the PACR: - removed Gugaa to Gobarralong section as it was no longer required - removed Maragle to Line 51 via Bago State Forest and Green Hill State Forest to minimise overall transmission line length and maximise the distance paralleling existing lines - added a new line paralleling the existing Line 51 - added Gilmore Valley crossing (only required for Blowering option) • other more localised changes: - added Tumut North option to minimise impacts on local constraints in this area - minor changes and narrowing of corridor around Bannaby to maximise the distance paralleling existing lines, minimise ecological impacts and bushfire risk - slight widening of the corridor south of Line 990 to consider options around the proposed Jeremiah Wind Farm - narrowed corridor south-east of Bango Nature Reserve to reduce potential impacts on the approved Rye Park Wind Farm.	Further localised changes made publicly available in September 2021.

Timeframe	Key process	Summary of key processes and outcomes	Key public engagement and information
2021 – 2022	Detailed assessment areas to address community feedback and minimise environmental impacts in particularly sensitive areas	To address feedback from the community on specific areas, detailed assessment of potential route options was carried out for the following locations: • Bannaby • Pejar Dam • Tumut • Green Hills North • Yass to Maragle. Key issues (with some variation between locations included): • visual amenity • farming operations, including impacts on cropped lands and associated operations, particularly aerial spraying • property values • biodiversity • bushfire risks and management • maximising use of public land • proximity to residences • heritage • electric and magnetic fields (EMF). In many circumstances the community proposed alternatives were not progressed as they involved similar impacts on private properties/residences within 500 m and/or significantly greater impacts on biodiversity and cultural heritage values. Details of the outcomes of these more detailed investigations are provided in Appendix E (Options Report).	Consultation with landowners and other key stakeholders. Community information fact sheets were made available on the Transgrid website in March 2022 for the route refinement decisions for: • Bannaby • Pejar Dam • Tumut Area • Green Hills State Forest. The 200 m preferred corridor was announced in March 2022. Comprehensive briefing to Department of Climate Change, Energy, the Environment and Water on the Tumut area noting potential impacts of alternatives on National Heritage areas. Further consultation with DPE in December 2022 reaffirmed Transgrid's preferred option through Bannaby as DPE was not supportive of an option that impacted Tarlo National Park.
2023	Consideration of community proposed alternative route	Green Hills and Bago State Forests (2023) Members of the community prepared an alternative alignment for HumeLink from Maragle to Wondalga through the Green Hills State Forest to move infrastructure from private to public land, which was different to the previous Green Hills State Forest option considered in 2022. Following engagement with Forestry Corporation of NSW (FCNSW), this potential alternative western route option was further refined. This option alters community and environmental impacts as the alignment is confined to State-owned land until it leaves Green Hills State Forest at Wondalga. This route option is undergoing additional feasibility analysis. Detailed assessments of this would be conducted separately.	Direct engagement with landowners in the area.

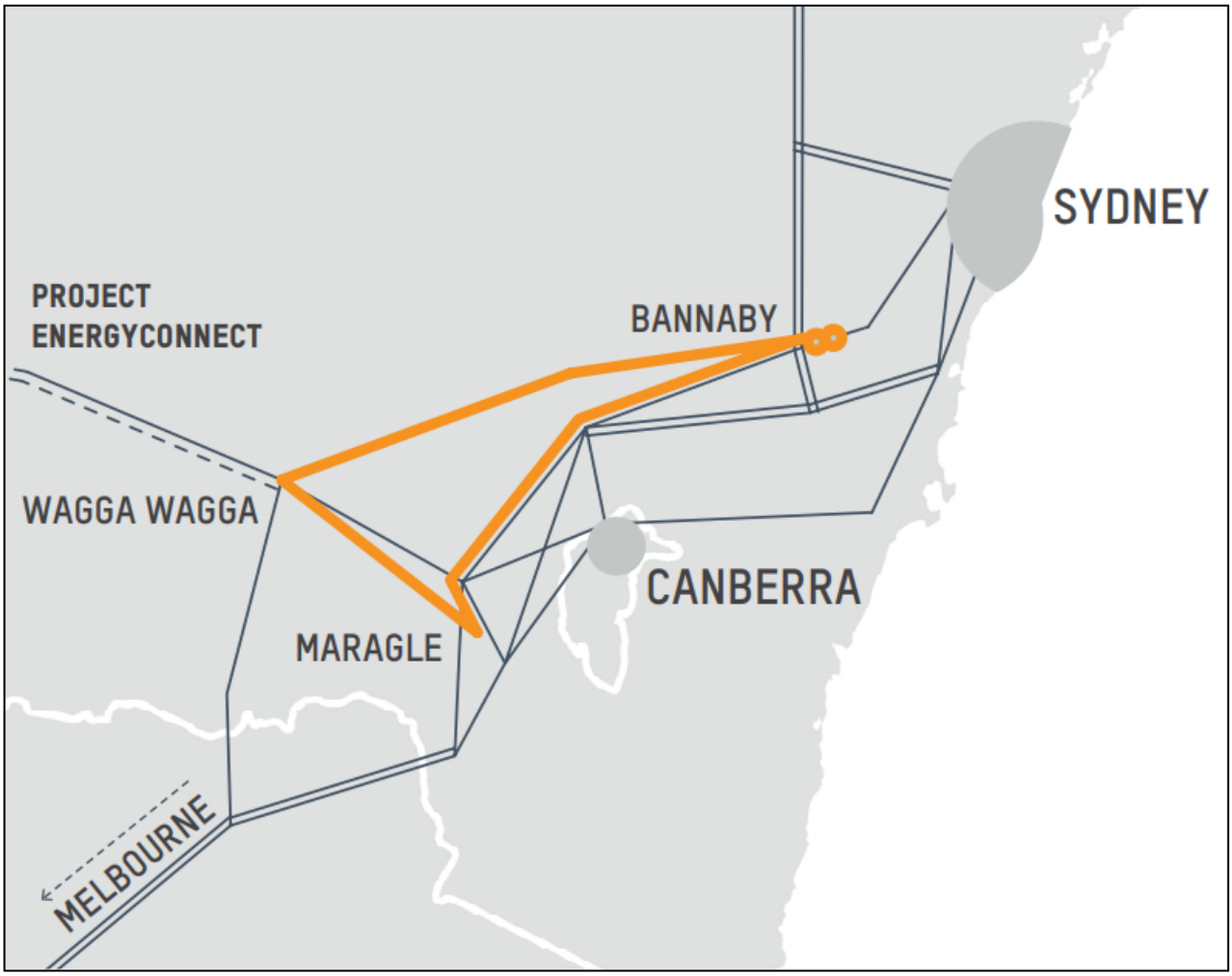


Figure 2-5 Preferred option from RIT-T process (Technical Options 3C)

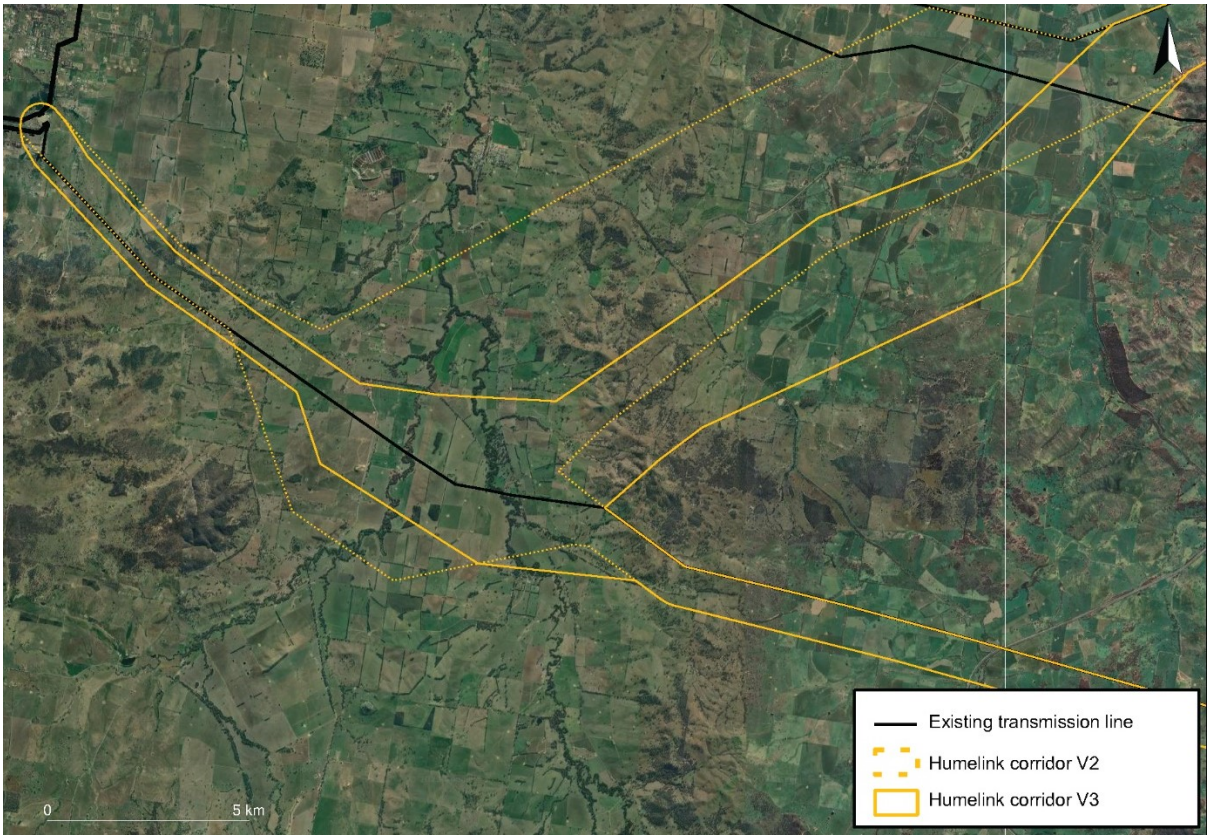


Figure 2-6 May 2020 study corridor refinements

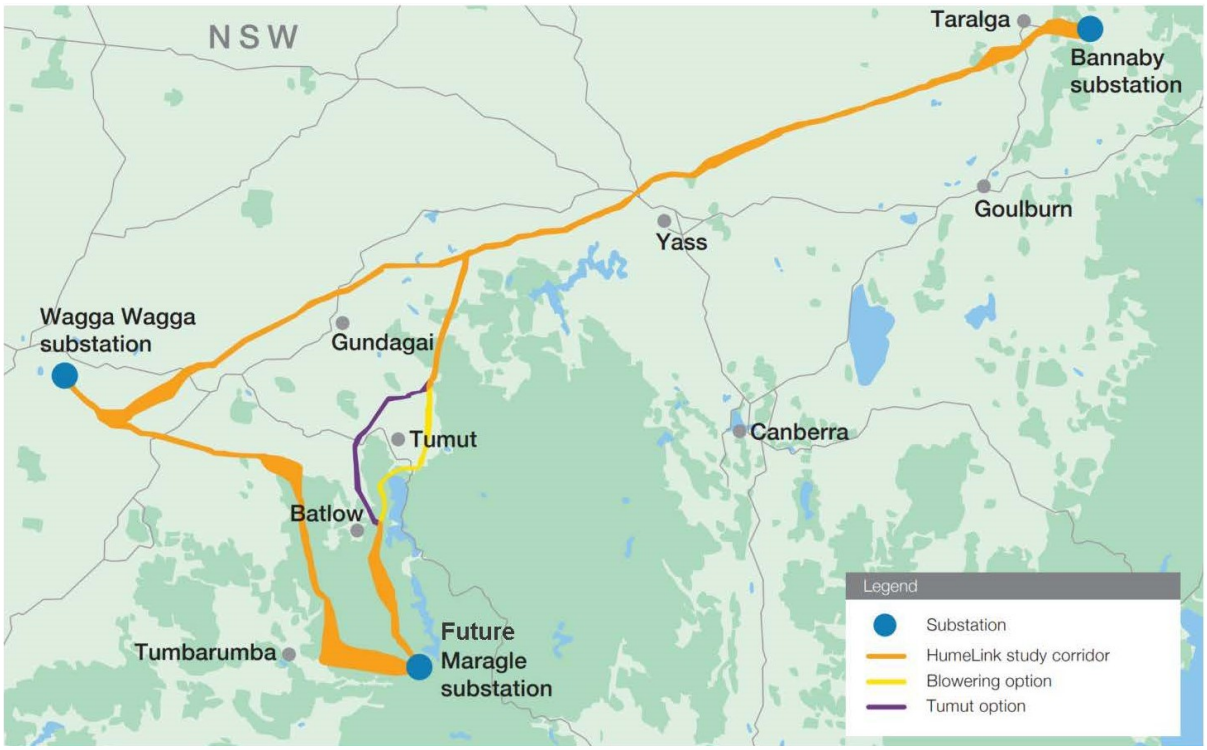


Figure 2-7 May 2021 study corridor refinements

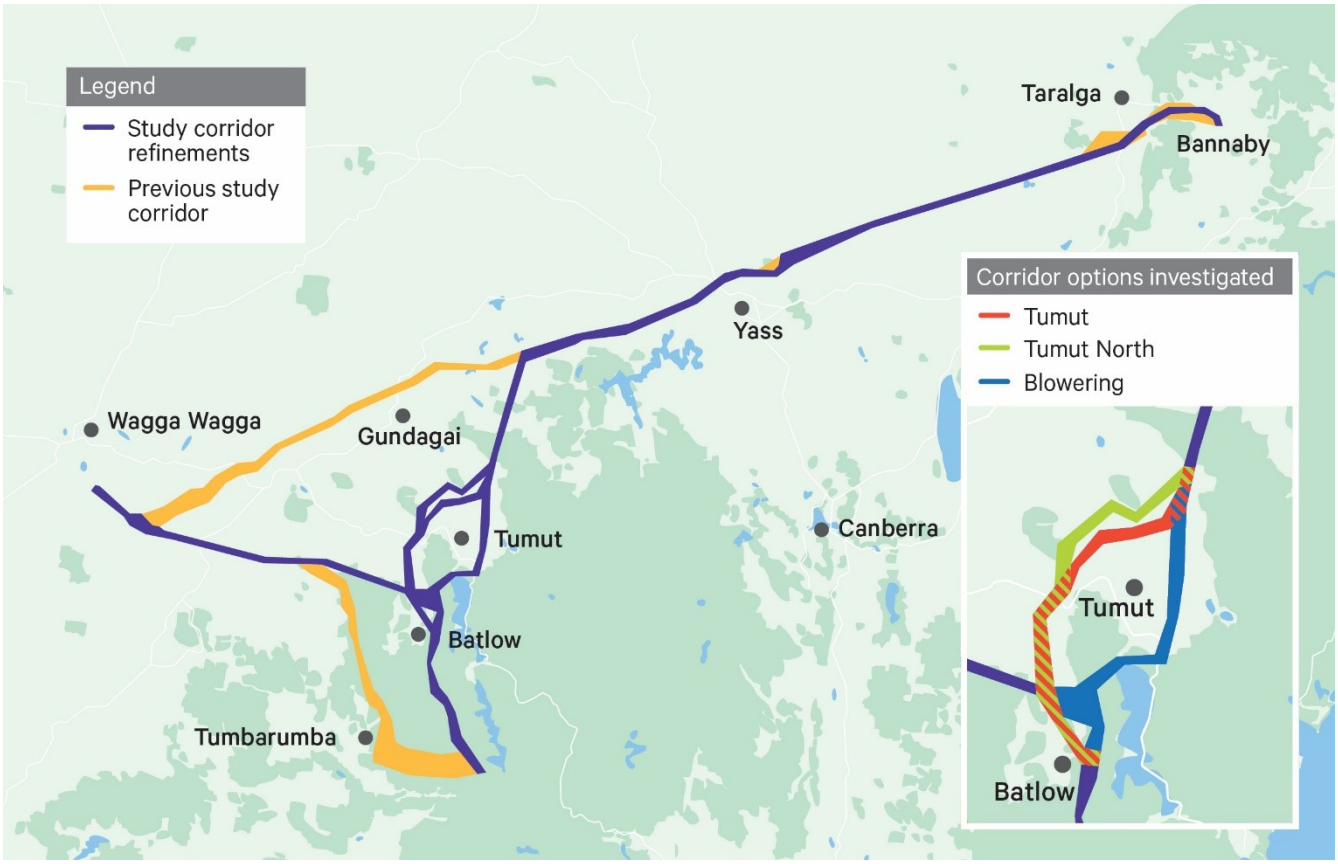


Figure 2-8 September 2021 study corridor refinements

The process for confirming the final transmission line route alignment is ongoing, with an ultimate goal of identifying a transmission line easement generally 70 metres wide within the project footprint. Opportunities to reduce impacts on landowners and the community, construction risks, construction timeframes, and impacts on the environment will continue to be investigated during detailed design and by the construction contractors.

2.6.2. Undergrounding

2.6.2.1. General considerations

Options to underground the transmission lines were considered as a potential way to help minimise the social and environmental impacts of the project. The benefits of undergrounding can typically include:

- reduced visual and noise impacts
- no impacts on aerial operations
- generally lower electric and magnetic fields
- decreased bushfire risk from the transmission lines
- lower risk of damage to the transmission lines due to external factors (eg extreme weather, falling trees, wildlife, bushfires, vehicles).

Other factors that contribute to the consideration of benefits or limitations of undergrounding include:

- underground lines are substantially more expensive than overhead lines
- cable joints are required at regular intervals along the length of any underground sections
- differences in reliability and fault restoration
- limited supply of underground expertise
- shorter asset life expectancy of underground cables.
- construction differences between overhead and underground installations
- operational differences between overhead and underground installations
- underground cables require narrower easements.

Further details are provided in Appendix E (Options Report).

2.6.2.2. Detailed feasibility review

In late 2021, Transgrid was asked by the community and landowners to investigate the feasibility of building the HumeLink project via underground cable instead of overhead transmission lines. Transgrid agreed to form a collaborative Steering Committee which included representative community members from Community Consultative Groups, and developed an underground feasibility study scope of works. GHD and sub-consultants Stantec were engaged to undertake the underground feasibility study due to their High-Voltage Direct-Current expertise.

GHD investigated four potential routes to underground HumeLink. The routes differed from those considered for an overhead transmission line, as it would not be feasible to build an underground line in the same place as an overhead line due to topography and other engineering constraints. The findings of the review are documented in the report *Concept Design and Cost Estimate – HumeLink Project – Underground* (GHD, 22 August 2022) (GHD, 2022).

The cost of undergrounding the HumeLink transmission lines was estimated to be around three times more expensive than the entire project's current cost. It was concluded that this would be unsustainable as the additional cost would need to be passed on to commercial, industrial and private electricity consumers.

Undergrounding transmission lines would also mean a significant delay in completion of the project by up to five years. This delay would threaten the timely connection of the new renewable energy and the related essential new interstate connections to the grid as HumeLink joins EnergyConnect (which connects SA) and the Victoria to NSW Interconnector West. The 2022 ISP (AEMO, 2022) states that HumeLink is to be progressed urgently and completed by 2026 to secure the network before the ageing coal-fired generators are decommissioned. A significant delay would put the energy security and stability of large parts of eastern Australia at potential risk of failure.

Based on the findings from the report, undergrounding HumeLink would not be consistent with the regulatory rules that require Transgrid to propose the most efficient option for consumers based on the capital cost of the solution, the ongoing operational costs, the market benefits, the expected reliability, and the costs associated with the impact on landowners, the community, and the environment.

2.6.3. Substation options

The preferred technical option (Technical Option 3C) requires a 500 kV connection point in the Wagga Wagga area. The existing Wagga 330 kV substation at Gregadoo does not have sufficient space for new 500 kV substation infrastructure to connect to the HumeLink 500 kV transmission lines. Accordingly, a new 500/330 kV substation is required, which would have the capability to connect to 330 kV and 500 kV transmission lines.

The key steps and processes in the selection of the new substation location are summarised in Table 2-2.

Table 2-2 Key steps in the site selection process for substations

Key step	Description
Step 1 – Definition of the need	Transgrid's Network Planning identified a broad area for consideration based on project objectives and strategic network requirements. In particular, suitable sites needed to be: • no further than 15 km from the existing Wagga 330 kV substation • relatively close to Transgrid's existing transmission line, Line 51.
Step 2 – Review initial criteria, constraints and opportunities	This step involved: • desktop review of existing information – identify Tier 1 and 2 constraints and potential opportunities (refer to Figure 2-9) • preliminary site inspections and landowner discussions.
Step 3 – Identification of eight potential sites	This step involved applying key location requirements to screen for potential sites, including areas where the topography would make construction less feasible and a suitable site area of at least 50 hectares (ha).
Step 4 – Short-listing of three potential sites	This step involved applying multi-disciplinary criteria to short-list potential sites and involved property, community and stakeholder, environment, design and construction, and operational considerations.

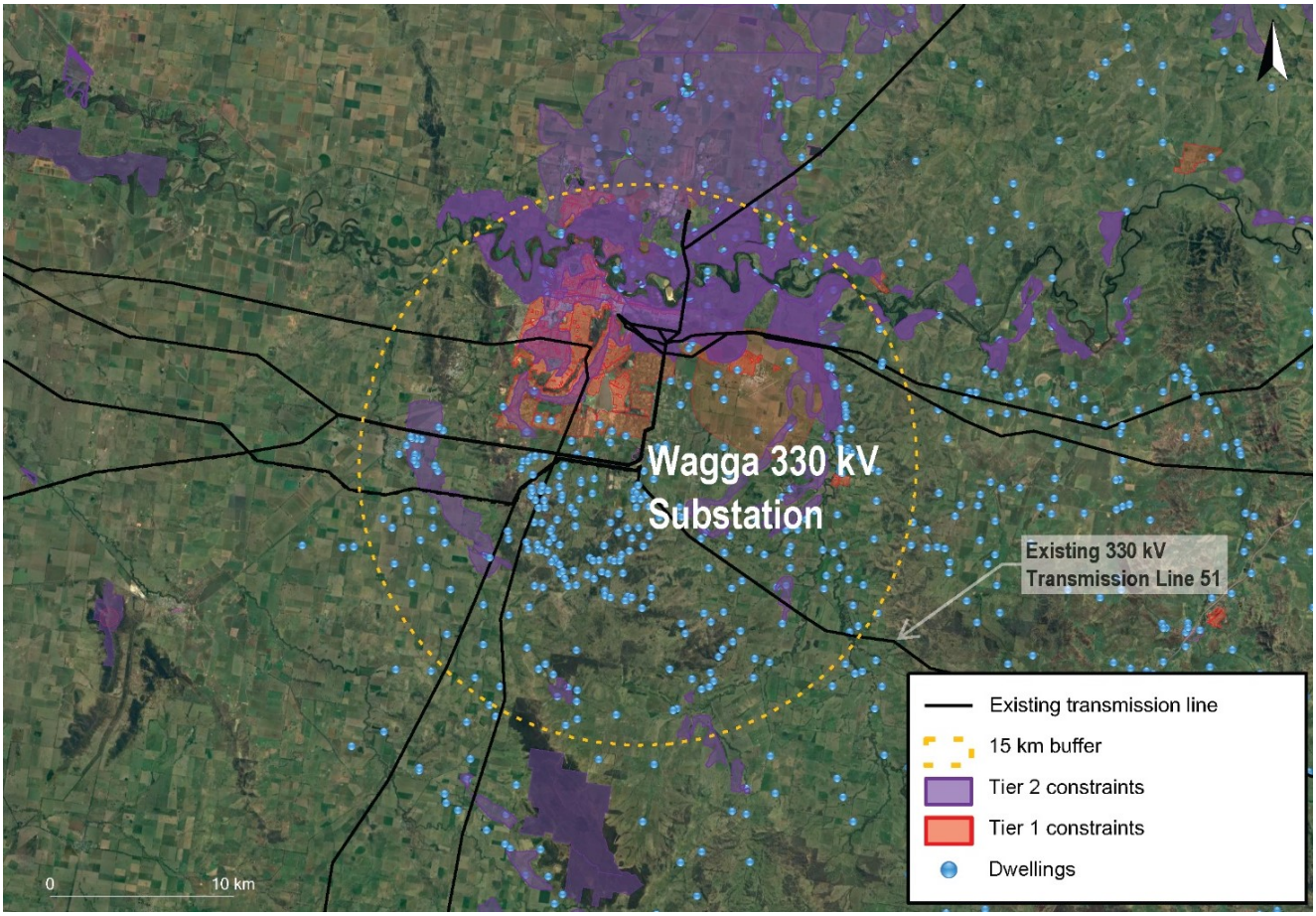


Figure 2-9 General area of interest with Tier 1 and 2 constraints and opportunities

Following the completion of Steps 1 to 3, three sites were short-listed from an initial eight potential sites that met the initial criteria (refer to Figure 2-10). The analysis of the three short-listed sites found:

- One option is closest to the existing Wagga 330 kV substation but furthest from Line 51 (about two kilometres) and would require a new access road. The closest residence is over 1.4 kilometre away.
- One option has good direct access to a public road and is close to Line 51 (about 700 metres). The closest residence is about 700 metres away.
- One option is furthest from the existing Wagga 330 kV substation (about 15 kilometres) but close to Line 51 (about 500 metres). It would require a new access road and road upgrade. The site is relatively low-lying and is susceptible to flooding. The closest residence is about 800 metres away.

No endangered ecological communities or heritage items were identified at the three short-listed sites. Landowners of the three options were engaged to identify concerns, requirements and an openness to sell part of their property. Following landowner discussions, the first option from the list above was confirmed as the preferred option based on a balance of impacts as well as the availability of property for acquisition.

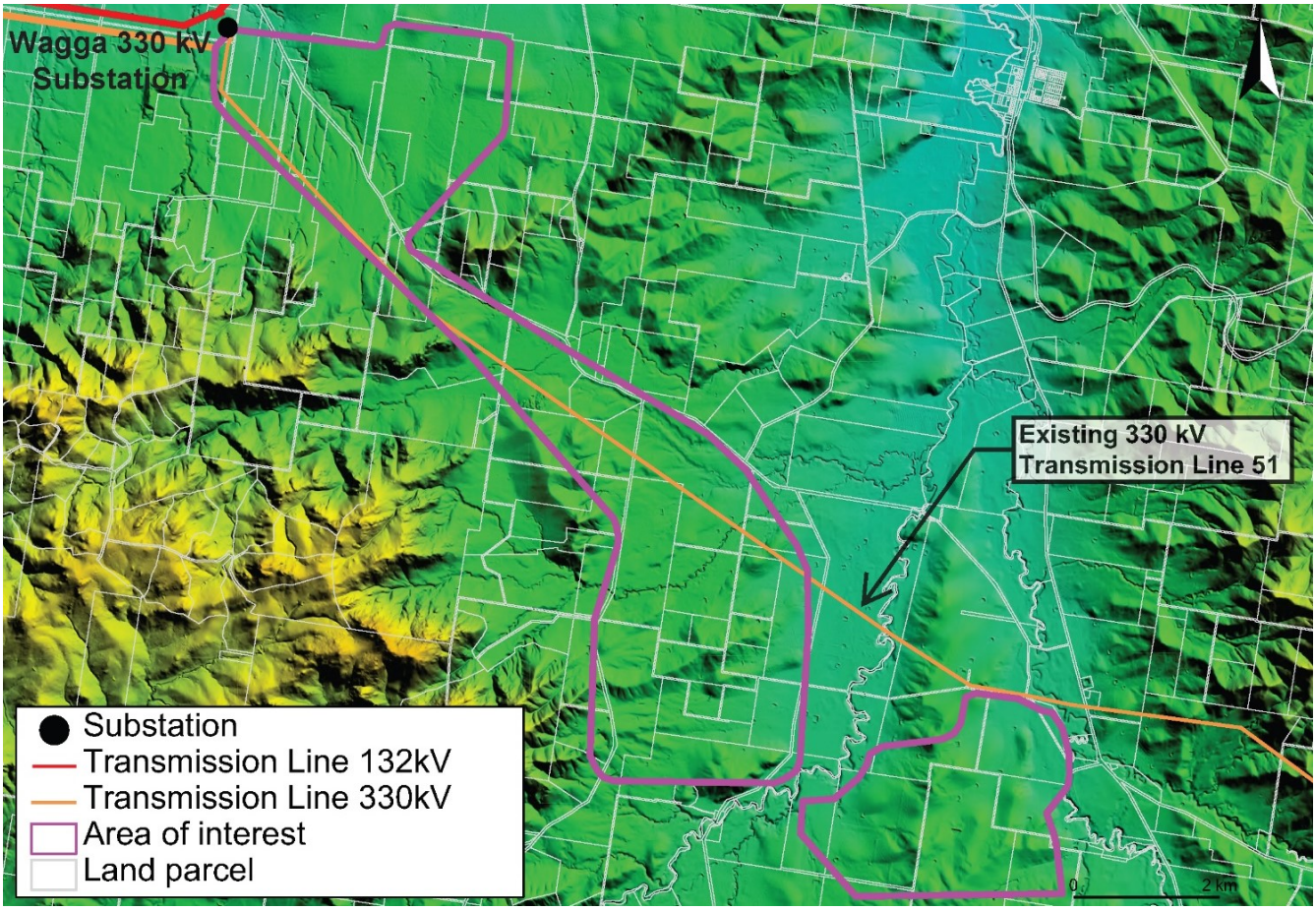


Figure 2-10 Potential substation area of interest

2.6.4. Ancillary infrastructure and construction location selection

2.6.4.1. Temporary construction compounds

Potential construction compound sites were identified, mainly between Yass and Bannaby, and Bago State Forest and the existing Line 990. Key criteria for deciding on construction compound locations included:

- property criteria – minimum landholding size of 50 metres by 100 metres, minimise the number of landowners affected, and avoid use of private property where possible
- community and stakeholder criteria – minimise amenity impacts on sensitive receivers including through adequate separation from residential buildings
- environmental impact criteria – choose sites that would minimise native vegetation or threatened species habitat clearance requirements, maximise distance from waterways, avoid Aboriginal Heritage Information Management System (AHIMS) listed sites and non-Aboriginal heritage items and take advantage of existing disturbed areas
- constructability criteria – minimise site slope, maximise proximity to roads suitable for construction vehicles and proximity to the project footprint (within two kilometres).

The relevant public authorities and other key stakeholders (local councils, Crown Land, Transport for NSW and FCNSW) as well as private landowners were also consulted on potential suitable sites.

Fourteen potential construction compound sites were identified for assessment in this EIS. Chapter 4 (Project description – construction) provides further information on these sites.

The final selection and requirements of construction compound sites would be carried out by the construction contractors. In this regard, there is a potential that the location, layout, number and staging/timing of construction compounds may need to be refined during detailed design. Any potential changes to construction compounds from that assessed would consider the criteria used in the original site selection process and involve consultation with councils and the local community.

2.6.4.2. Worker accommodation facilities

A preliminary review of available worker accommodation in the vicinity of the HumeLink project footprint identified a potential accommodation shortage, especially around Maragle and Tumut. During early project planning and development, as well as through consultation with councils, Transgrid identified Tumbarumba and Batlow as suitable towns to establish temporary worker accommodation. The next steps in the accommodation facility selection process involved:

- consulting with Snowy Valleys Council and Yass Valley Council to identify potential suitable sites
- reviewing sites nominated by the local councils against the same site selection criteria used for construction compounds
- preliminary environmental investigations (including biodiversity and heritage) to identify potential constraints.

Snowy Valleys Council proposed two potential sites that may be suitable for the purpose of a worker accommodation facility:

- a greenfield site in Tumbarumba
- Batlow Caravan Park.

In July 2022, Snowy Valleys Council indicated that the Batlow Caravan Park was no longer available.

Therefore, the potential worker accommodation facility at Tumbarumba – to accommodate around 200 workers – was assessed in this EIS.

The final requirements for worker accommodation would be a consideration of the construction contractors, who would likely use existing accommodation within towns to supplement the proposed worker accommodation facility. Any potential changes to worker accommodation facilities from that assessed would be identified during the detailed design and construction stages. Any changes would involve consultation with councils and the local community.

2.6.5. Justification for the project footprint

The preferred corridor for the proposed transmission line (which forms part of the project footprint) is justified on the basis of best meeting the project objectives having regard to avoiding and minimising the impacts on the environment and community. The option evaluation process has been comprehensive and has been informed through consultation with affected landowners and other key stakeholders and government briefings. Further information on the engagement carried out and how it has informed the project development is provided in Chapter 6 (Engagement) and Appendix E (Options Report).

The preferred technical option (Technical Option 3C) has also been independently reviewed and approved by the AER through the RIT-T process.

The design and construction methodology for the project would be developed and finalised with the objective of further avoiding and minimising potential impacts on the local and regional environment, and the local community.

A detailed discussion on project justification is provided in Chapter 27 (Project justification).

2.7. Implications of not proceeding with HumeLink

HumeLink is one of the state's largest energy infrastructure projects with about 360 kilometres of proposed new transmission lines. To meet our future energy demands, Australia needs to transition to a greater mix of low-emission renewable energy sources, such as wind and solar. HumeLink would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. In particular, AEMO has identified HumeLink as a key "actionable" transmission project to be "progressed urgently" (AEMO, 2022).

Not proceeding with HumeLink:

- means the expected benefits as described above, would not be realised
- would make Australia's shift towards greater renewable energy provision more difficult, impacting on Australia's ability to meet the global needs for reducing its carbon emissions
- would discourage investment in energy generation and storage within the declared South West NSW REZ as well as the candidate Wagga Wagga and Tumut REZs
- would hinder the adoption of new renewable technologies in the future, required to support the delivery of commitments and policies at a State, Commonwealth and international level.

3. Project description – infrastructure and operation

This chapter provides a consolidated description of the infrastructure and operation of the project, including the proposed transmission lines, associated substation work and ancillary development. This chapter also describes how the project would operate and be maintained. The description of the project components is based on the current concept design. Some elements of the project may continue to be refined as part of the finalisation of the detailed design of the project. If approval is granted, any changes to the project would be reviewed for consistency with the approved project in accordance with the process described in Chapter 26 (Environmental management). A description of how the project would be constructed is provided in Chapter 4 (Project description - construction).

3.1. Project overview

The project includes the construction and operation of around 360 kilometres of new 500 kilovolt (kV) electricity transmission lines, substations, permanent and temporary access tracks and roads, and ancillary facilities.

The key components of the project include:

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

Table 3-1 provides a summary of the infrastructure and operations proposed as part of the project.

Table 3-1 HumeLink project summary - infrastructure and operation

Project element	Summary of project	Reference
Project footprint and location	The project footprint extends from the existing Wagga 330 kV substation in the west to the existing Bannaby 500 kV substation in the east and the future Maragle 500 kV substation in the south. The project footprint includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation. As such, the project footprint comprises all proposed infrastructure elements including the proposed transmission line structures, transmission line easements, new substation infrastructure, telecommunications hut and permanent access tracks. The final location of all proposed infrastructure would be confirmed during detailed design.	Figure 3-1
Transmission line sections	The project includes the construction of new 500 kV transmission lines between: • Wagga 330 kV substation and proposed Gugaa 500 kV substation (approximately 11 km) • proposed Gugaa 500 kV substation and Wondalga (approximately 65 km) • Wondalga and future Maragle 500 kV substation (approximately 46 km) • Wondalga and Bannaby 500 kV substation (approximately 234 km). Note that the transmission line section between Wagga 330 kV substation and the proposed Gugaa 500 kV substation would operate at 330 kV under HumeLink. The project also includes the rebuild of approximately 2 km of Line 51 as a new double circuit 330 kV transmission line between the Wagga 330 kV substation and near Ivydale Road, Gregadoo. This would be adjacent to the new transmission line between the existing Wagga 330 kV and proposed Gugaa 500 kV substations.	Figure 3-1 Section 3.3
Substation locations and work	The project includes the following substation work: • construction of a new 500/330 kV substation in Gregadoo, NSW, referred to as the proposed Gugaa 500 kV substation • modification of the existing 330/132 kV substation at Gregadoo, NSW, referred to as the Wagga 330 kV substation • modification of the existing 500/330 kV substation at Bannaby, NSW • connection of the new transmission lines to the future 500/330 kV substation at Maragle, NSW. Note that construction and operation of the future Maragle 500 kV substation will be carried out under the approved Snowy 2.0 Transmission Connection Project (SSI-9717).	Figure 3-5 to Figure 3-9, Section 3.4
Operational ancillary development	The project includes the following operational ancillary development: • one optical repeater telecommunications hut located at Killimicat (about 10 km north-east of Tumut) • new and upgraded operational access tracks and roads (including waterway crossings where required).	Figure 3-10, Sections 3.3 to 3.5
Operational maintenance and resource use	Regular maintenance activities would be required for the transmission lines and substations during operation. Likely maintenance activities would include: • regular inspection and maintenance of transmission lines and structures • ad hoc fault and emergency fly over(s) to assess infrastructure condition should an unplanned outage occur • vegetation management within the transmission line easement to maintain appropriate clearances between ground vegetation and transmission lines and management of trees outside of the easement which could pose a bushfire risk and/or risk to the transmission lines • ad hoc attendance (typically one to two times per month) at substations of one or two switching operators to undertake planned and unplanned switching of equipment • routine inspection and maintenance of substation infrastructure, property and switchyard areas. The operational water requirement for the project is anticipated to be approximately 116 kL/year.	Section 3.6

Project element	Summary of project	Reference
Property requirements	The project would acquire 80.74 ha of freehold land for the proposed Gugaa 500 kV substation and telecommunications hut located at Killimicat. A new transmission line easement would also be required for the project in addition to potential access easements to provide Transgrid operational staff with access from the nearest public road to the transmission line easement.	Section 3.7
Commencement of operations	The project is expected to be operational by the end of 2026.	Chapter 4 (Project description - construction)
Operational workers	The project would require five full-time maintenance workers during operation (in addition to Transgrid's existing workers in the region).	Section 3.6
Operational life	The design life of the project is 50 years, which can be extended to more than 70 years for some infrastructure components and plant items. Components would be replaced or refurbished towards the end of their serviceable life, allowing the service life to be maximised as far as possible.	Section 3.6

3.2. Location and setting

The project extends across the lands of the Wiradjuri, Ngunnawal, Ngarigo and Gundungurra people. It is located within the five Local Government Areas (LGAs) of Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Yass Valley and Upper Lachlan Shire.

The project traverses primarily rural areas with a range of land uses that include cropping, grazing, horticulture, forestry, and renewable power generation (solar and wind). Other land uses in proximity to the project include residences, farm buildings and infrastructure, broad-acre rural residential development, recreation and existing transmission line easements. The project footprint also extends across State forests including Bago State Forest, Green Hills State Forest and Red Hill State Forest and privately owned plantations.

No national parks or reserves are traversed by the project footprint. Several national parks and reserves are located within the vicinity of the project footprint with the closest being Tarlo River National Park, south of Bannaby, and Minjary National Park, north-west of Tumut. The boundaries of both national parks are located less than 10 metres from the project footprint.

A number of waterways cross the project footprint. These include the following key waterways, which consist of named rivers and/or Strahler level 6 stream order waterways (ie large rivers or creeks with steady flow and volume, and average depths of between one and three metres):

- O'Briens Creek
- Kyeamba Creek
- Keajura Creek
- Umbango Creek
- Tarcutta Creek
- Gilmore Creek
- Tumut River
- Adjungbilly Creek
- Murrumbidgee River
- Lachlan River
- Wollondilly River
- Tarlo River.

The nearest major town is Wagga Wagga located about 9.2 kilometres north-west of the project at its closest point (western end of the project footprint). Smaller towns near the project footprint include Adelong, Tumut, Yass, Bowning, Dalton, Crookwell, Taralga, Batlow and Tumbarumba.

3.3. Transmission lines

3.3.1. Transmission line sections

The proposed transmission line sections are shown on Figure 3-1 and described below. The final transmission line route within the project footprint would be confirmed during detailed design.

3.3.1.1. Wagga 330 kV substation to proposed Gugaa 500 kV substation

The proposed new double circuit transmission line between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV substation would be approximately 11 kilometres long (refer to Figure 3-1a). This section would include the construction of 500 kV transmission structures and lines that would be energised at 330 kV. This section would have the capability to be operated at 500 kV if required in the future. Any future energisation at 500 kV would be subject to further assessment and approval.

From the Wagga 330 kV substation, the transmission line route would run in a south-east direction generally parallel with the existing 330 kV single-circuit transmission line (Line 51) before connecting with the proposed Gugaa 500 kV substation. Line 51 is generally located on the northern boundary of the project footprint. This section of the route would also be parallel with Gregadoo East Road, which is located around 350 metres to 900 metres to the north of the project footprint.

The transmission line route in this section would cross four local roads: Ashfords Road, Ivydale Road, Angels Lane and Big Springs Road.

3.3.1.2. Proposed Gugaa 500 kV substation to Wondalga

The section of the new double circuit 500 kV transmission line between the proposed Gugaa 500 kV substation and Wondalga would be approximately 65 kilometres long (refer to Figure 3-1a and Figure 3-1e).

From the proposed Gugaa 500 kV substation, the transmission line route would run in an east-south-east direction continuing to parallel Line 51 for about 53 kilometres, with Line 51 remaining on the northern boundary of the project footprint. Around 12 kilometres before Wondalga, the new transmission line route would split from Line 51 to the south by up to 1.5 kilometres, but generally continues to run parallel with Line 51.

The transmission line route in this section would cross several classified roads including Tumbarumba Road, Hume Highway (about nine kilometres south-west of Tarcutta) and Batlow Road as well as numerous local roads such as Humula Road and Westbrook Road. The route would cross several waterways including but not limited to O'Briens Creek, Kyeamba Creek, Keajura Creek, Umbango Creek, and Tarcutta Creek. Towards Wondalga, the route would also traverse Green Hills State Forest.

3.3.1.3. Wondalga to future Maragle 500 kV substation

The section of the new double circuit 500 kV transmission line between Wondalga and the future Maragle 500 kV substation would be approximately 46 kilometres long (refer to Figure 3-1e to Figure 3-1f). The transmission line route in this section would generally run in a south-south-east direction from Wondalga before connecting with the future Maragle 500 kV substation.

From Wondalga, for around 10 kilometres, the route would be generally parallel with Line 51 until Snubba Road. After splitting with Line 51, the route would head south and run on the western side of Snubba Road for about 10 kilometres. From Snubba Road, the route would traverse Bago State Forest for about 11 kilometres before meeting two existing 330 kV transmission lines (Line 64 and Line 66). The transmission line route then would run generally parallel with Line 64 and Line 66 along East Bago Powerline Road in a southerly direction for about five kilometres. Immediately south of the intersection of East Bago Powerline Road and Powerline Road, the transmission line route would turn in a south-west direction parallel with Line 64 and generally follow East Bago Powerline Road for around 10 kilometres until the future Maragle 500 kV substation on the southern side of Elliot Way.

The transmission line route in this section would mainly cross local roads and trails within Bago State Forest. Gilmore Creek and Honeysuckle Creek would be the main waterways crossed for this section of route.

3.3.1.4. Wondalga to Bannaby 500 kV substation

The section of the new double circuit 500 kV transmission line between Wondalga and the existing Bannaby 500 kV substation would be approximately 234 kilometres long (refer to Figure 3-1b to Figure 3-1e). The transmission line route in this section would generally run in a north-east direction from Wondalga before connecting with the existing Bannaby 500 kV substation.

From Wondalga, the route would run in northerly direction for 23 kilometres crossing Batlow Road near Windowie and Snowy Mountains Highway around three kilometres west of Gilmore before reaching Gocup Road. From Gocup Road, the route would cross the Tumut River and run in a north-east direction for about 15 kilometres before meeting an existing 330 kV transmission line (Line 3) about 500 metres east of Brungle Creek Road. The route would then run parallel to Line 3 for about nine kilometres through Red Hill State Forest. The transmission line route would then continue north for about 20 kilometres crossing Adjungbilly Creek and Adjungbilly Road and traversing another portion of Red Hill State Forest.

From this point, the route would turn north-east and continue for about 11 kilometres before crossing the Murrumbidgee River, several local roads, and Jugiong Creek and meeting again with Line 3 near Burrinjuck Road, a further 15 kilometres north-east. The route would parallel Line 3 for about four kilometres before continuing towards the Hume Highway, a further 15 kilometres north-east. Prior to reaching the Hume Highway, the transmission line route would cross Black Range Road and several waterways including but not limited to Washpen Creek, Bowning Creek and Derringullen Creek near where it flows into the Yass River.

The transmission line route would cross the Hume Highway and Main Southern Railway line about seven kilometres north-west of Yass and continue for five kilometres north-east before meeting an existing 330 kV transmission line (Line 3J) about three kilometres west of Cooks Hill Road. The route would then generally parallel Line 3J running for around 51 kilometres in a north-east direction until the Gullen Range 330 kV substation near Bannister. Classified roads that would be crossed in this area include Rye Park Road about four kilometres west of Dalton, and Grabben Gullen Road about 15 kilometres north-east of Dalton. The Lachlan River and Humes Creek are the main waterways that would be crossed by the route in this area.

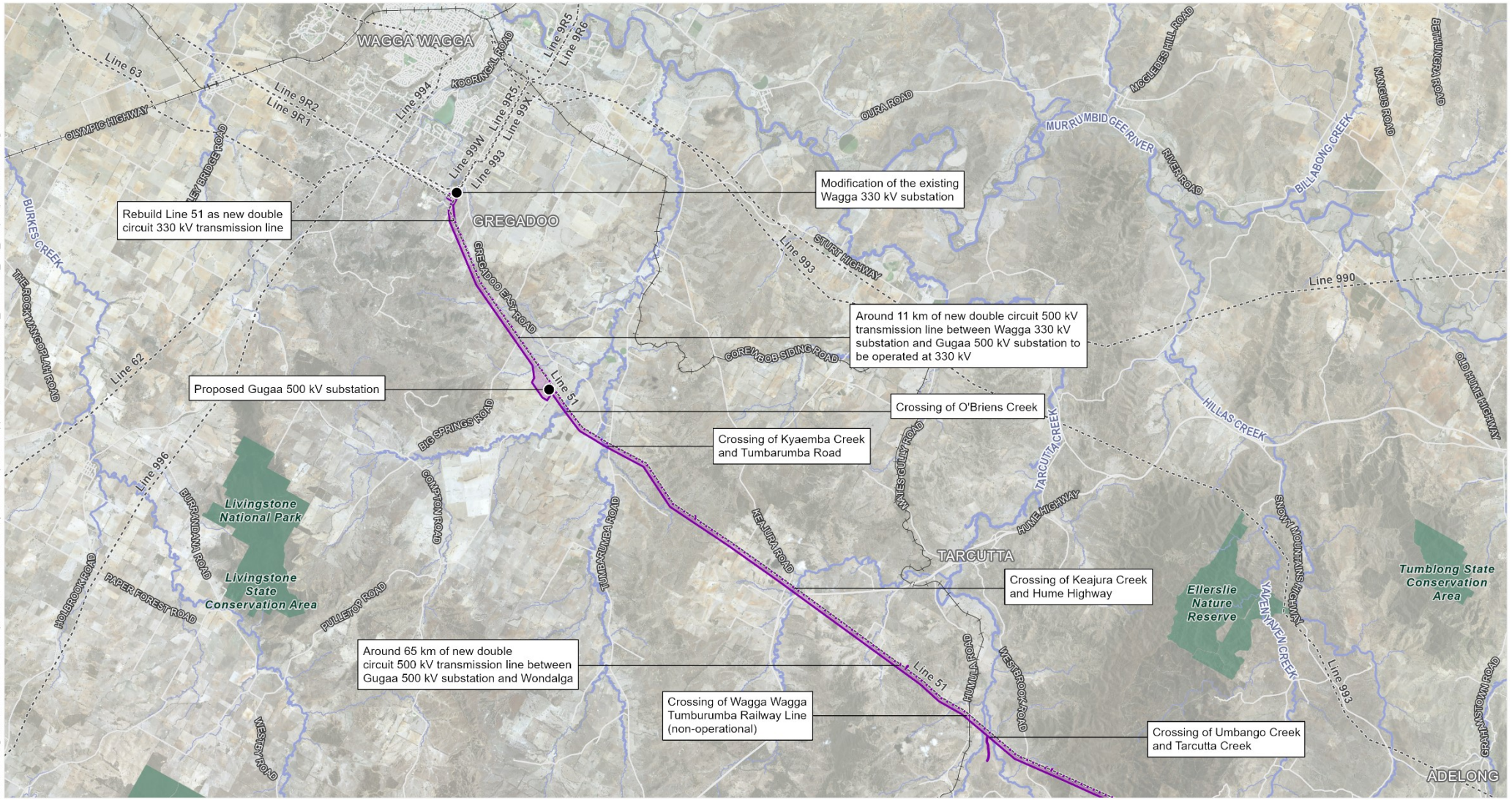
From the Gullen Range 330 kV substation, the transmission line route would continue for around 12 kilometres in a north-east direction and generally parallel an existing 330 kV transmission line (Line 3H) before crossing Crookwell Road/Goulburn Road and the Wollondilly River and Pejar Dam, which is the major waterway crossing in this area. After crossing the Wollondilly River and Pejar Dam, the transmission line route would deviate to avoid the Crookwell 2 Wind Farm.

From here, the transmission line route would continue for around 27 kilometres in a north-east direction and run parallel to an existing 330 kV transmission line (Line 61). In this area the route would cross Woodhouselee Road and Taralga Road, which are the main north-south local roads. Tarlo River would be the main waterway crossed about 11 kilometres north-east of the Crookwell 2 330 kV substation.

From this point, the transmission line route would continue to run for six kilometres in a north-east direction to avoid Tarlo River National Park before crossing Bannaby Road and turning in an easterly direction for around eight kilometres. At this location, the transmission line route would turn south-east and run generally parallel with two existing 500 kV transmission lines (5A6 and 5A7) for about three kilometres, crossing Hanworth Road before connecting to the existing Bannaby 500 kV substation.

3.3.2. Replacement of the existing section of Line 51

In addition to the proposed 500 kV transmission line, the project would include construction of a double circuit 330 kV transmission line south of Wagga 330 kV substation (refer to Figure 3-1a). This new double circuit 330 kV transmission line would replace about two kilometres of existing 330 kV single circuit transmission line infrastructure associated with the existing Line 51. Structures associated with the rebuilt Line 51 would range between 24 metres and 50 metres high and have a typical height of 40 metres.



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

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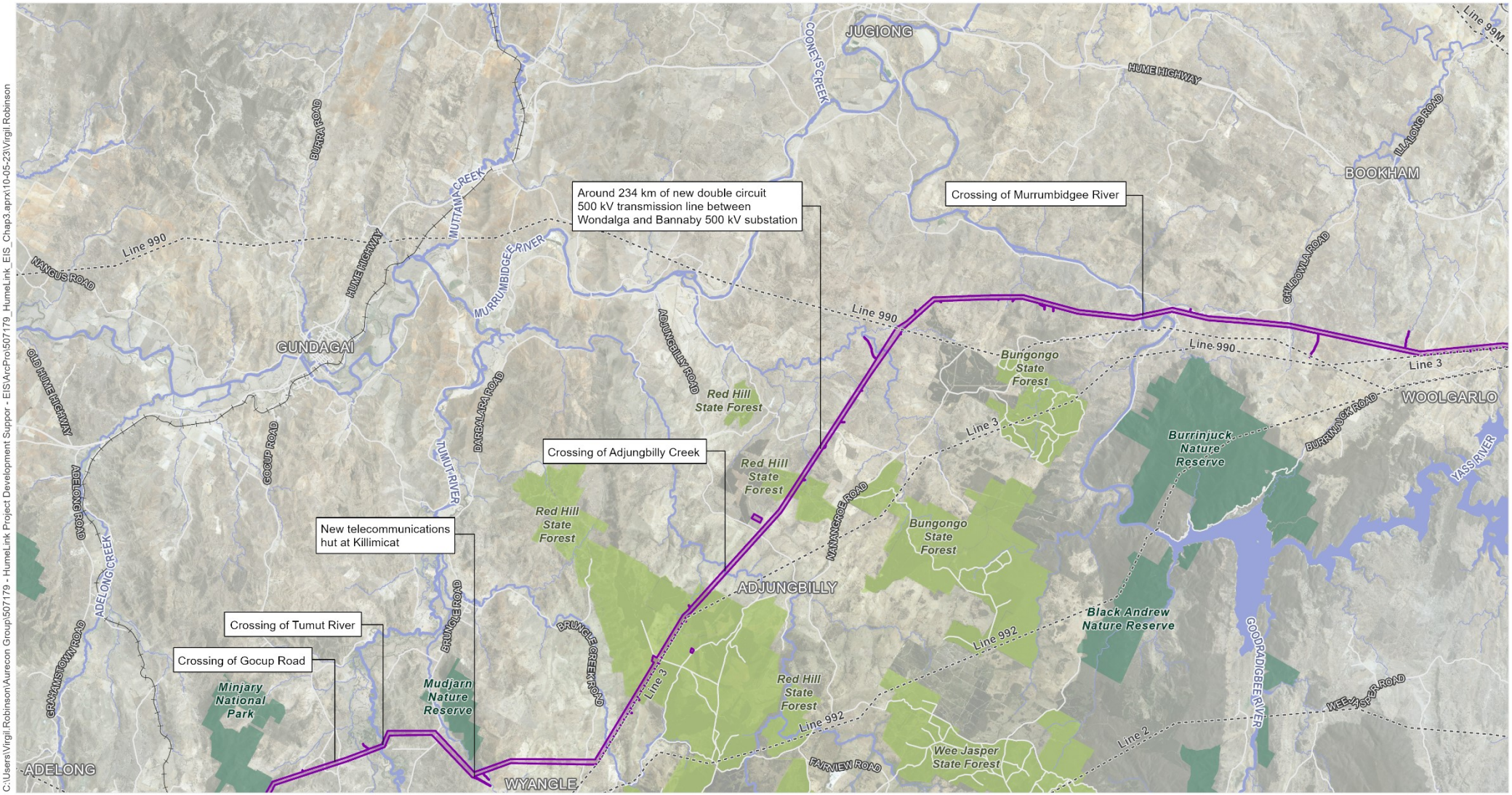
0 4 8km

Projection: GDA 1994 MGA Zone 55

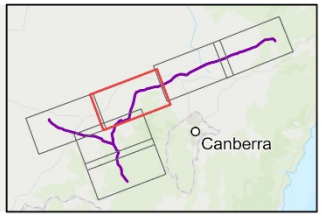
HumeLink

Figure 3-1a: Proposed transmission line route

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Project footprint
National park and reserve
State forest
Waterbody
Existing Transgrid transmission line
Railway



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

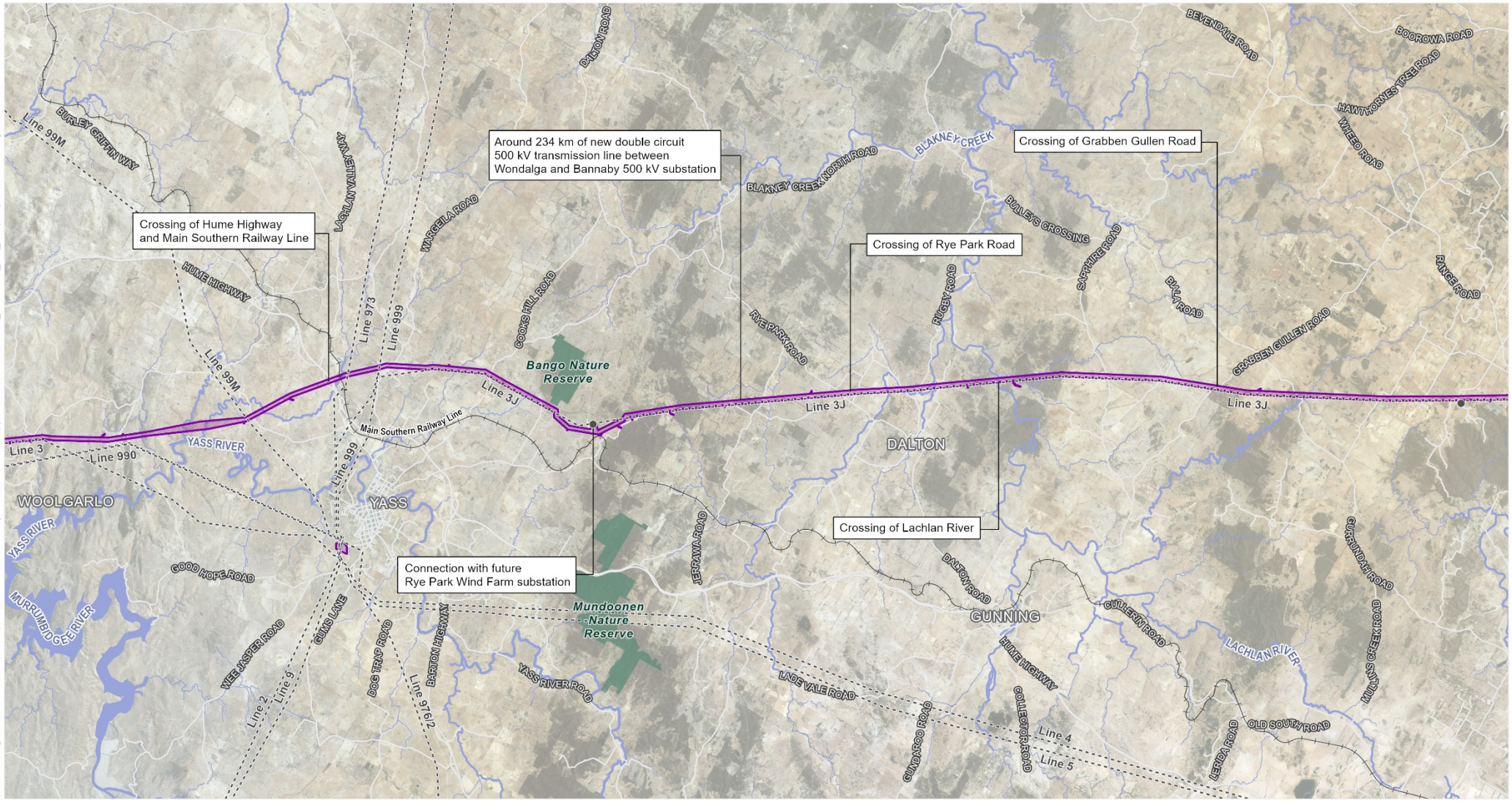
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Projection: GDA 1994 MGA Zone 55

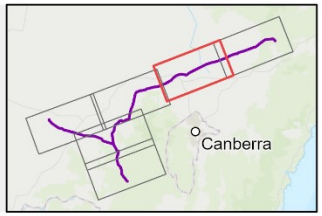
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Figure 3-1b: Proposed transmission line route

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Project footprint
National park and reserve
Waterbody
Existing Transgrid transmission line
Railway



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

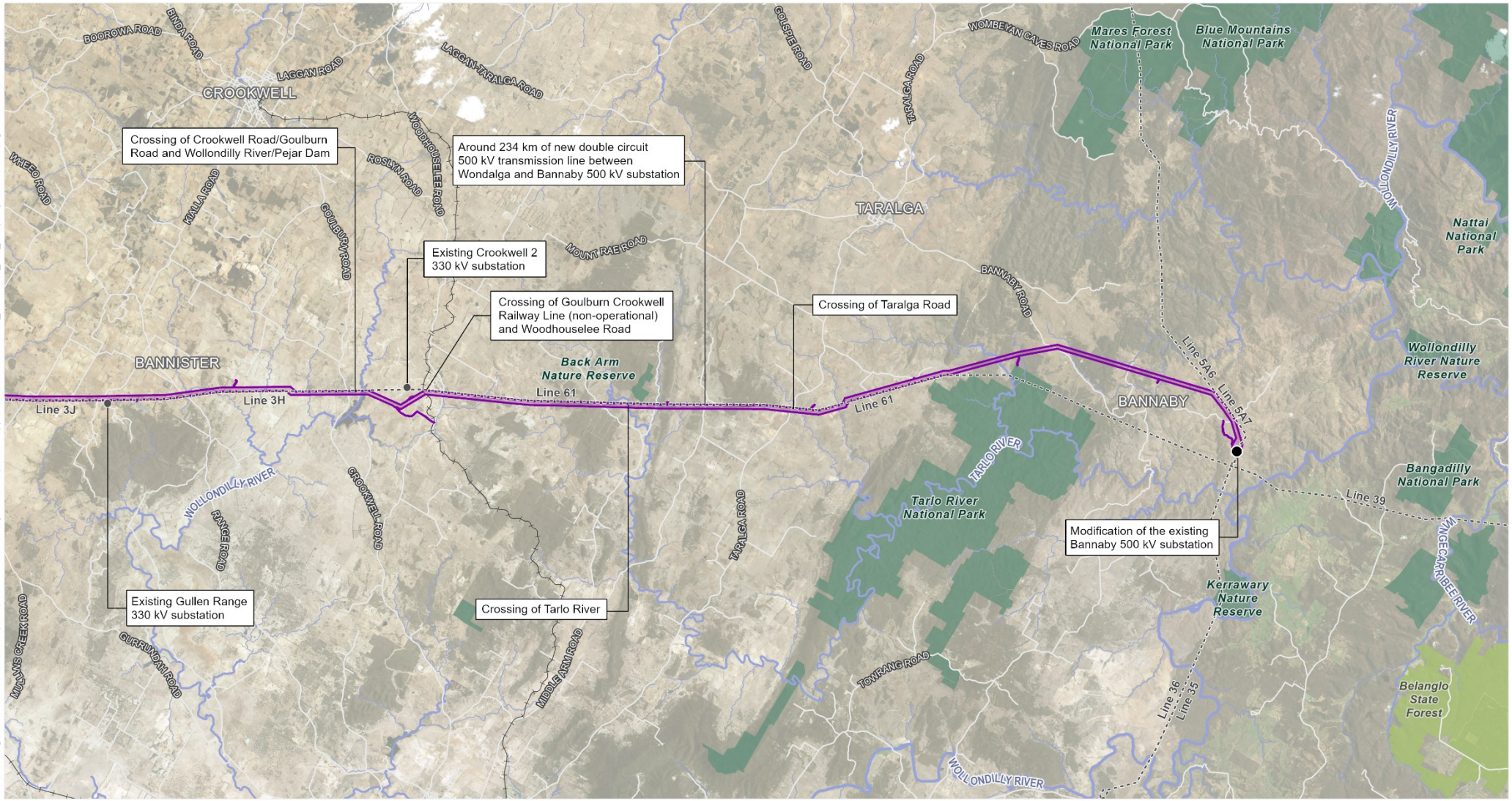
1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 3-1c: Proposed transmission line route

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

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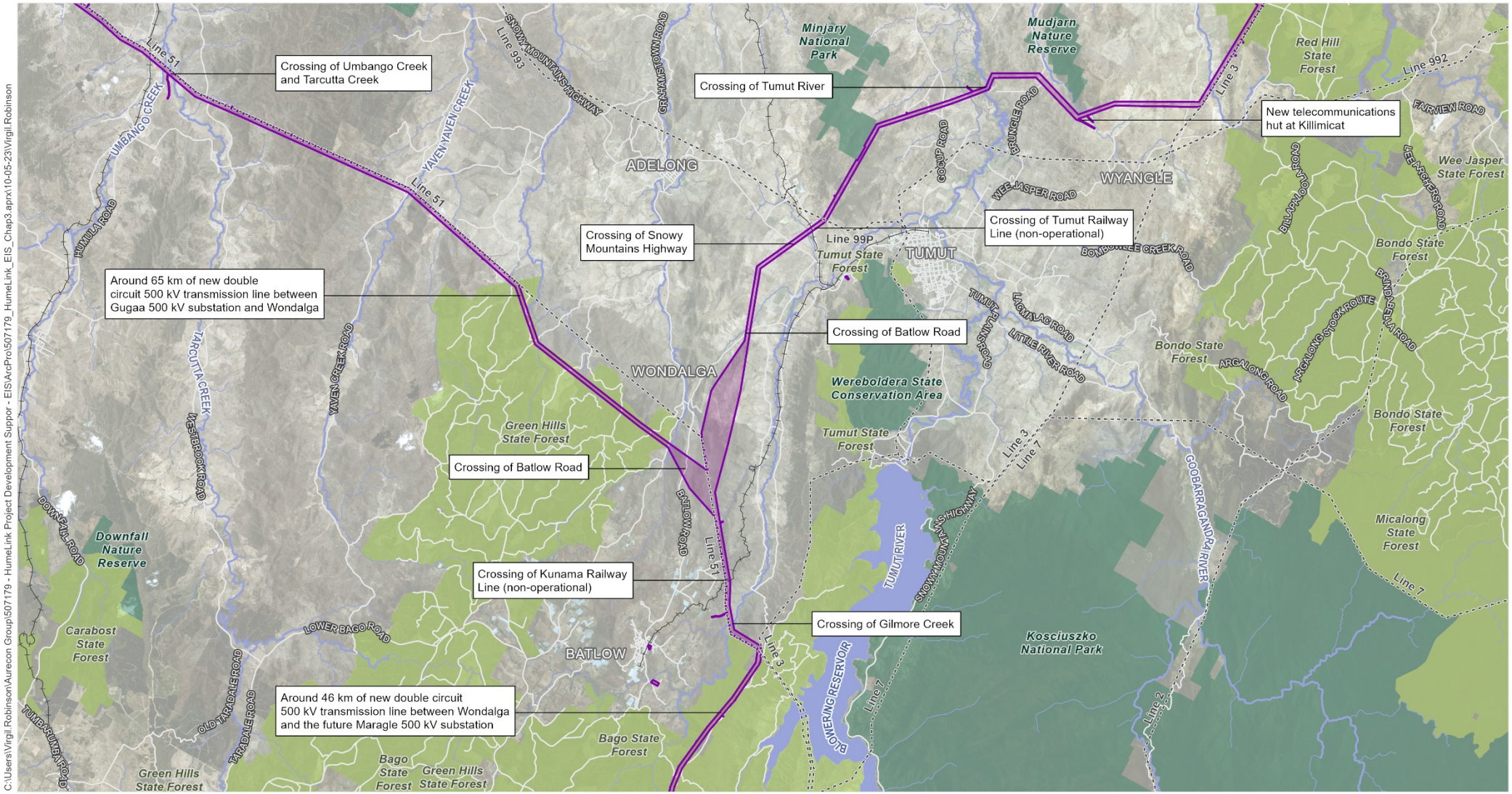
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 3-1d: Proposed transmission line route

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

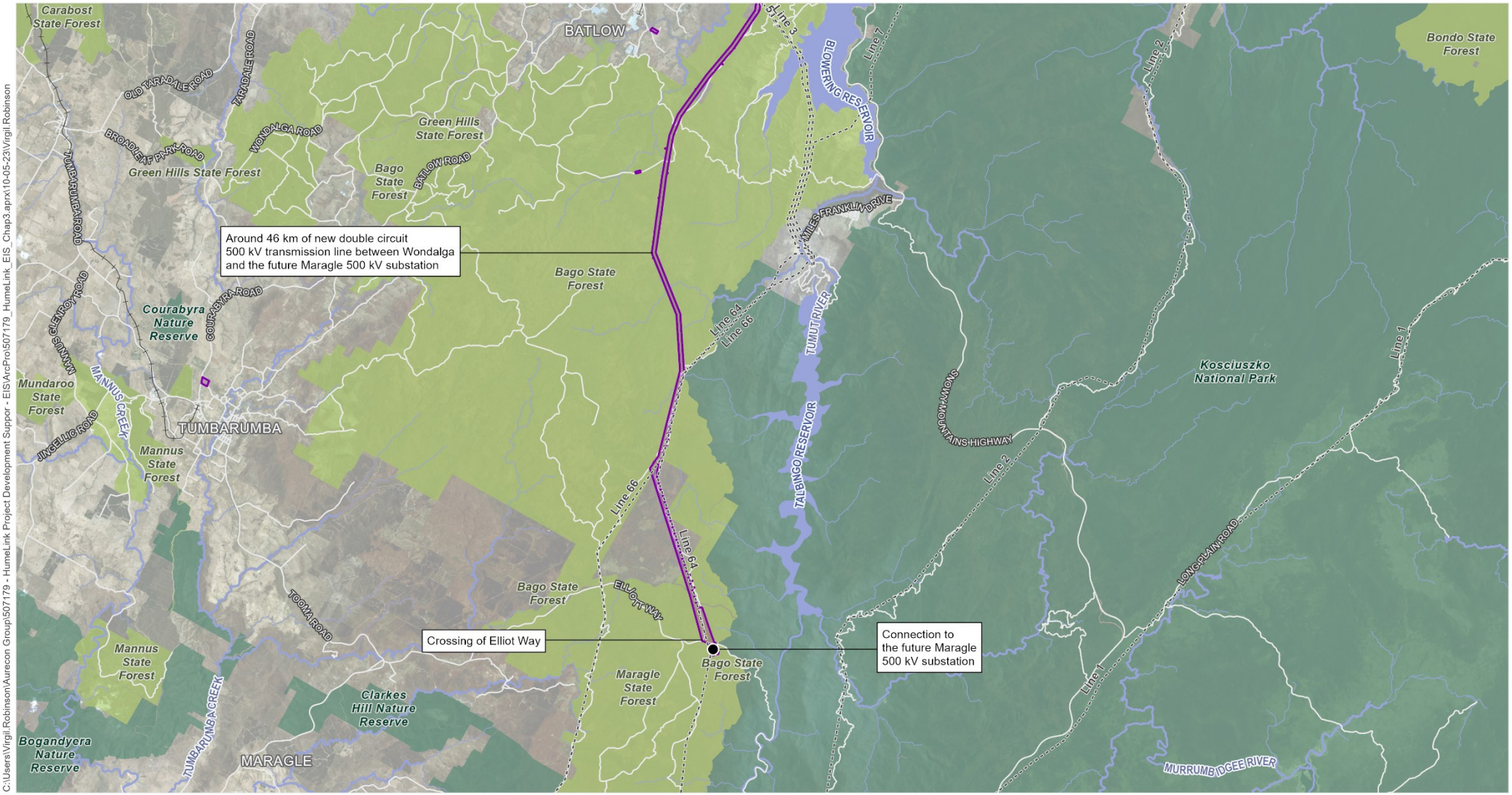
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0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 3-1e: Proposed transmission line route

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

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0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 3-1f: Proposed transmission line route

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3.3.3. Transmission line structures

The 500 kV transmission lines would be supported on a series of free-standing steel lattice structures ranging in height between around 50 metres up to a maximum of 76 metres but typically around 60 metres high. The structures would be generally spaced between 300 to 600 metres apart. The footings of each structure would require an area of up to 300 square metres, depending on ground conditions and the proposed transmission line structure type. Additional disturbance at each structure site may be required to facilitate structure assembly and stringing. Earth wire and communication cables would be co-located on the transmission line structures.

The 500 kV transmission line would be supported by two types of tower:

- Suspension towers would hold up the conductors. These would be steel lattice, free-standing towers.
- Strain towers would be used for the first and last structure of the transmission line, at road or waterway crossings, and where there is a change in direction. They would have a wider base than suspension towers. Strain towers would also be used for structural reasons to break up long runs of suspension towers.

Indicative configurations of the 500 kV and 330 kV transmission line structures that may be used as part of the project are shown in Figure 3-2. In addition, examples of existing transmission line structures similar to those proposed for the project are provided in Figure 3-3 and Figure 3-4.

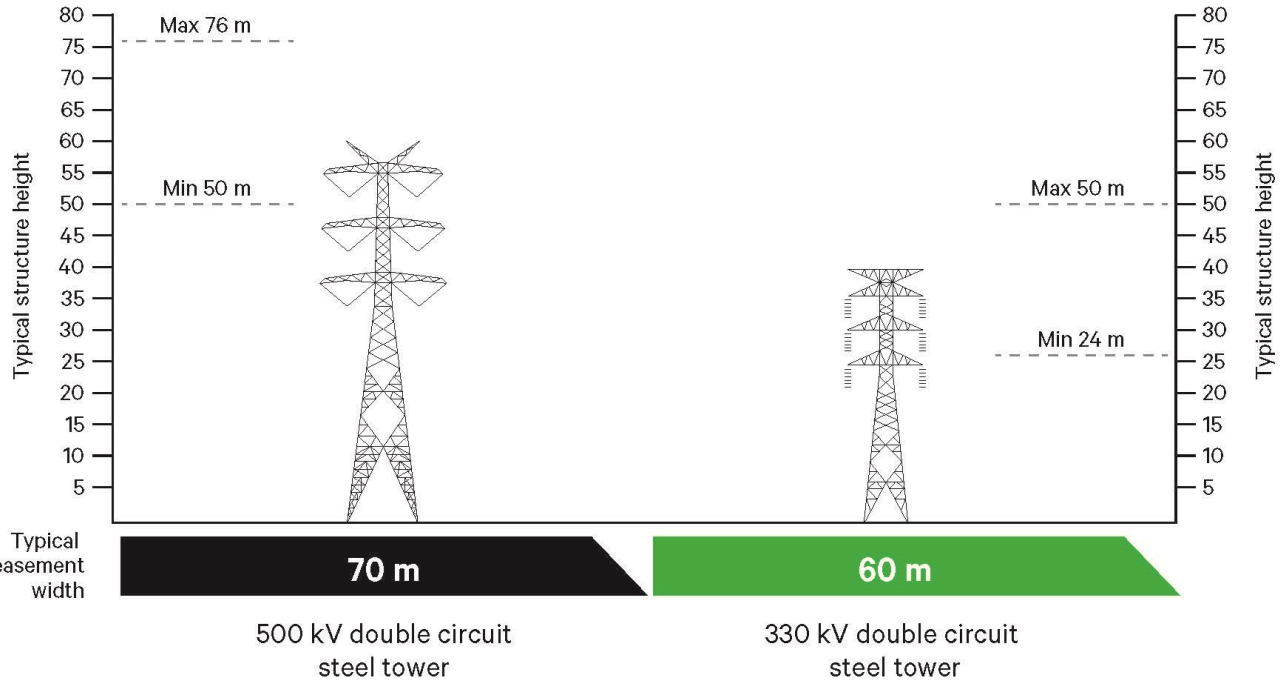


Figure not to scale.

Figure 3-2 Indicative design for the transmission line structures



Figure 3-3 Example of 500 kV transmission line structures



Figure 3-4 Example of 330 kV transmission line structures

The final location and specification of each transmission line structure within the project footprint would depend on a range of factors such as the distance between each transmission line structure, local geotechnical conditions, and local environmental (for example the need to avoid specific areas of biodiversity and/or heritage) or property constraints. The type and arrangement of the transmission line structures would continue to be refined during detailed design with a view to further minimise environmental impacts within the identified transmission line easement, wherever practicable.

3.3.4. Transmission line access requirements

Access to the transmission line easement for operational purposes would preferentially use existing public and private roads and tracks. Access tracks created for construction would generally be retained during operation of the project to provide ongoing access.

The access tracks created for construction would include a trafficable surface between three to six metres wide with a one or two metre shoulder. The access tracks would be designed and formed so they are suitable for operation and maintenance vehicles (namely, long wheel-base four-wheel-drive vehicles).

The access tracks (and any required waterway crossing) would be designed in accordance with:

- *Guidelines for the planning, construction and maintenance of tracks* (Department of Land and Water Conservation (DLWC), 1994)
- *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (Department of Environment and Climate Change (DECC), 2008a)
- *Policy and Guidelines for Fish Friendly Waterway Crossings* (Department of Primary Industries (DPI), 2003)
- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003)
- *Controlled activities – Guidelines for watercourse crossings on waterfront land* (DPE, 2022b)
- *Controlled activities – Guidelines for riparian corridors on waterfront land* (DPE, 2022c).

Further detail on access tracks is included in Chapter 4 (Project description - construction).

Operational parking requirements for the transmission line easement are not anticipated at this stage.

3.4. Substations

3.4.1. Proposed Gugaa 500 kV substation

A new substation is needed as the Wagga 330 kV substation does not have sufficient space for new infrastructure to connect to the 500 kV transmission lines provided as part of the project.

The proposed Gugaa 500 kV substation would be constructed at Gregadoo, about 11 kilometres south-east of the existing Wagga 330 kV substation. The substation would be located approximately 500 metres west of Livingstone Gully Road and 1.1 kilometres south of Gregadoo East Road.

A summary of the features of the proposed Gugaa 500 kV substation is provided in the following sections.

3.4.1.1. Built form and layout

The substation would occupy an area of approximately 22 hectares, which would include a substation bench with a maximum width of about 250 metres, a maximum length of about 490 metres and a 20 metre buffer area around the substation. The configuration of the proposed Gugaa 500 kV substation would include two line bays at the western end to connect with Wagga 330 kV substation and two line bays at the eastern end to provide a connection to Bannaby 500 kV substation and the future Maragle 500 kV substation. The buffer area would include (but would be limited to) the asset protection zone (APZ), stormwater, drainage, and oil containment infrastructure, wastewater infrastructure and access and parking (refer to sections below for further details).

Two new auxiliary services buildings would be included for the proposed Gugaa 500 kV substation as follows:

- 500 kV auxiliary services building – approximately 17 metres long, five metres wide and six metres high (excluding the lightning protection rods)
- 330 kV auxiliary services building – approximately 22 metres long, five metres wide and six metres high (excluding the lightning protection rods).

The auxiliary services buildings would include secondary systems such as control, automation, protection and communications systems, ancillary services such as fire detection, security system and air conditioning and 125 volt direct current (DC) and 50 volt DC battery systems.

The typical infrastructure and equipment in the new substation would include:

- seven new single-phase 500/330 kV transformers (including one spare transformer)
- three new three-phase 500 kV reactors (including one spare reactor)
- a range of supporting 500 kV and 330 kV electrical components including overhead conductors, busbars and gantries
- 500 kV and 330 kV circuit breakers, current transformers, voltage transformers, disconnectors, earth switches and other high voltage equipment
- 125 volt DC and 400 volt alternating current electrical distribution systems
- drainage infrastructure and oil containment system.

The maximum height of new equipment proposed at the new substation is estimated to be around 33 metres.

Figure 3-5 provides an indicative layout of the proposed Gugaa 500 kV substation and Figure 3-6 provides a photomontage of the proposed substation.

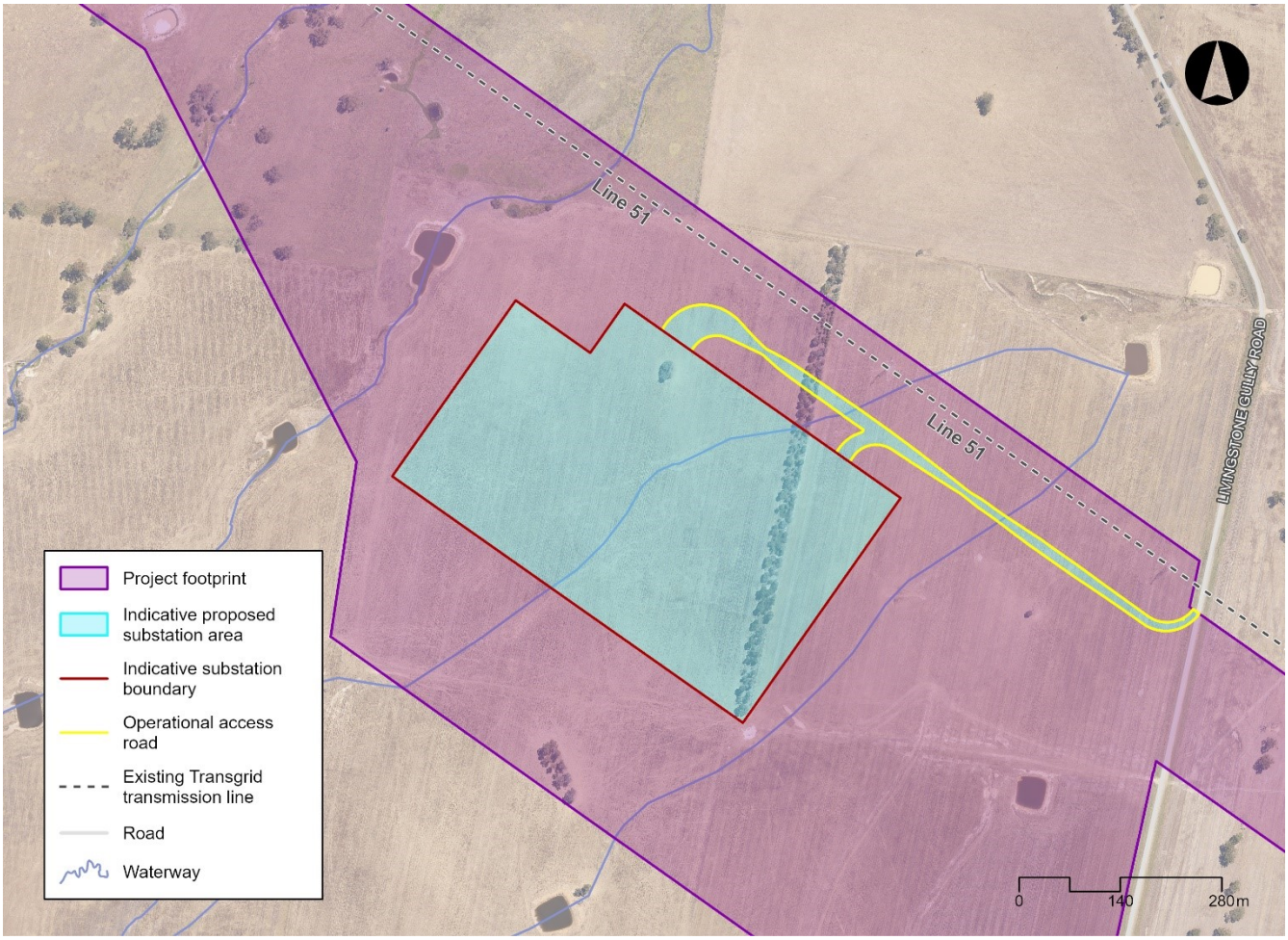


Figure 3-5 Indicative layout of the proposed Gugaa 500 kV substation



Figure 3-6 Photomontage of the proposed Gugaa 500 kV substation looking south from Livingstone Gully Road

3.4.1.2. Access and parking

An operational access road around 900 metres long would be provided from Livingstone Gully Road to the new substation as shown in Figure 3-5. The access road would allow access for maintenance and operational workers and would also be suitable to allow heavy vehicles as required (such as vehicles bringing replacement equipment). The access road would be designed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008a).

It is anticipated that road improvement work would be required for Livingstone Gully Road to facilitate connection with the operational access road. The extent of work would likely extend for about 50 metres along the Livingstone Gully Road. The design of the road improvement work would be confirmed during detailed design and would be carried out in accordance with the relevant Austroads Guides, any road occupancy licence(s), and in consultation with the relevant road authority. Further detail on the types of road improvement work is provided in Chapter 4 (Project description - construction).

Parking for a small number of maintenance and operational worker vehicles and heavy vehicles would be provided within the substation boundary.

3.4.1.3. Safety and security

The proposed Gugaa 500 kV substation would have security fencing approximately three metres high around all sides of the switchyard. The security fencing would comprise galvanised steel (or similar material). Gates would also be installed to provide an overall opening of around seven metres at the main entrance point to the substation, which would be on the northern side.

To comply with Transgrid's safety requirements, the following additional security measures would be required:

- security cameras within the substation
- operational lighting
- safety and public information signage at the substation
- an APZ, which would be an area kept clear of all trees and vegetation that may affect the substation during a bushfire; the APZ would comply with Transgrid's design and safety standards.

Based on the bushfire hazard analysis carried out in *Technical Report 13 – Bushfire Risk Assessment*, an APZ of nine metres is proposed for all boundaries of the proposed Gugaa 500 kV substation.

3.4.1.4. Lighting

Operational lighting would be required at the proposed Gugaa 500 kV substation for site security and for the safety of workers operating and maintaining the substation equipment. Substation lighting would operate from dusk until dawn, seven days a week and would aim to maintain 2.5 lux as a minimum level. There may be areas that exceed 2.5 lux (in some cases up to 30 lux).

Lighting would typically be located on substation steelwork (ie gantries). The final lighting design would focus illumination to within the substation boundary in accordance with the requirements of Australian Standard *AS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019).

3.4.1.5. Water supply

The proposed Gugaa 500 kV substation would require about 62 kilolitres of water annually for operation and maintenance purposes. Operational water requirements would be sourced from a rainwater tank fed from the secondary systems building that would also allow for water truck deliveries if required. Connection to water mains is not anticipated at this stage.

3.4.1.6. Stormwater and drainage

The proposed Gugaa 500 kV substation would include suitable drainage infrastructure to capture and discharge stormwater collected from within the substation site during operation. The stormwater drainage system would be designed for a rainfall corresponding to a 10 per cent annual exceedance probability (10% annual exceedance probability (AEP)) event and include series of surface drains which would interconnect with a grid of stormwater pits. The system would predominantly discharge along the northern boundary of the substation site.

Grassed swales between two and 12 metres wide would be installed around the western, southern, and eastern boundaries of the site to divert runoff around the site. The swales would be designed for rainfall corresponding to a two per cent annual exceedance probability (2% AEP) event. The runoff would be diverted to natural waterways using appropriate dispersion/dissipation structures.

Appropriately sized and designed cross-drainage would be installed under the operational access road to the substation to direct flows.

3.4.1.7. Wastewater

A freestanding building containing toilet facilities is proposed for the proposed Gugaa 500 kV substation with connection to a town sewerage system (or a suitable disposal system such as a septic tank or a treatment plant with the treated water pumped to a suitable landscaped area).

3.4.1.8. Oil containment

The proposed Gugaa 500 kV substation would include an oil containment system designed in accordance with Transgrid's standards and procedures and the requirements of the *Protection of the Environment Operations Act 1997* (POEO Act). This would include consideration of appropriate bunding, dedicated drainage points and spill oil containment tanks to manage any potential spills or leaks from the new transformers and reactors, as required.

3.4.2. Wagga 330 kV substation

The existing Wagga 330 kV substation at the corner of Ashfords Road and Boiling Down Road, Gregadoo would be modified to accommodate new bays for two new 500 kV transmission line circuits (operated at 330 kV) within the existing substation property.

A summary of the features of the modified substation is provided in the following sections.

3.4.2.1. Modified form and layout

The general layout and built form of the existing Wagga 330 kV substation would not be significantly altered by the project with modifications mainly proposed for the south-eastern part of the substation. The typical infrastructure and equipment that would be installed and work associated modifying the existing substation would include:

- modifications to the busbars, line bays, existing line connections, bench and associated earthwork
- additional drainage infrastructure
- modification to internal substation roads
- installation of new concrete cable trenches and cable pits
- steelwork, cabling and installation of secondary communication systems.

The new equipment to be installed at the existing Wagga 330 kV substation would have an estimated maximum height of around 28.5 metres. The height of existing equipment at the substation is around 27 metres.

An existing vacant bay at the substation would be used for new equipment for the new 330 kV double-circuit infrastructure associated with Line 51.

It is anticipated that existing parking arrangements would be used at the Wagga 330 kV substation with no new parking for maintenance and operational workers being required as part of the project.

Given the limited scale of modifications and that the work would be within the existing Wagga 330 kV substation property boundary, there would be no proposed changes to existing wastewater infrastructure or existing safety and security measures. Additionally, no new spill containment measures are proposed for the modified substation as no new transformers or reactors are proposed.

Figure 3-7 shows the indicative layout of the proposed modifications to the of Wagga 330 kV substation. These changes would be subject to detailed design.

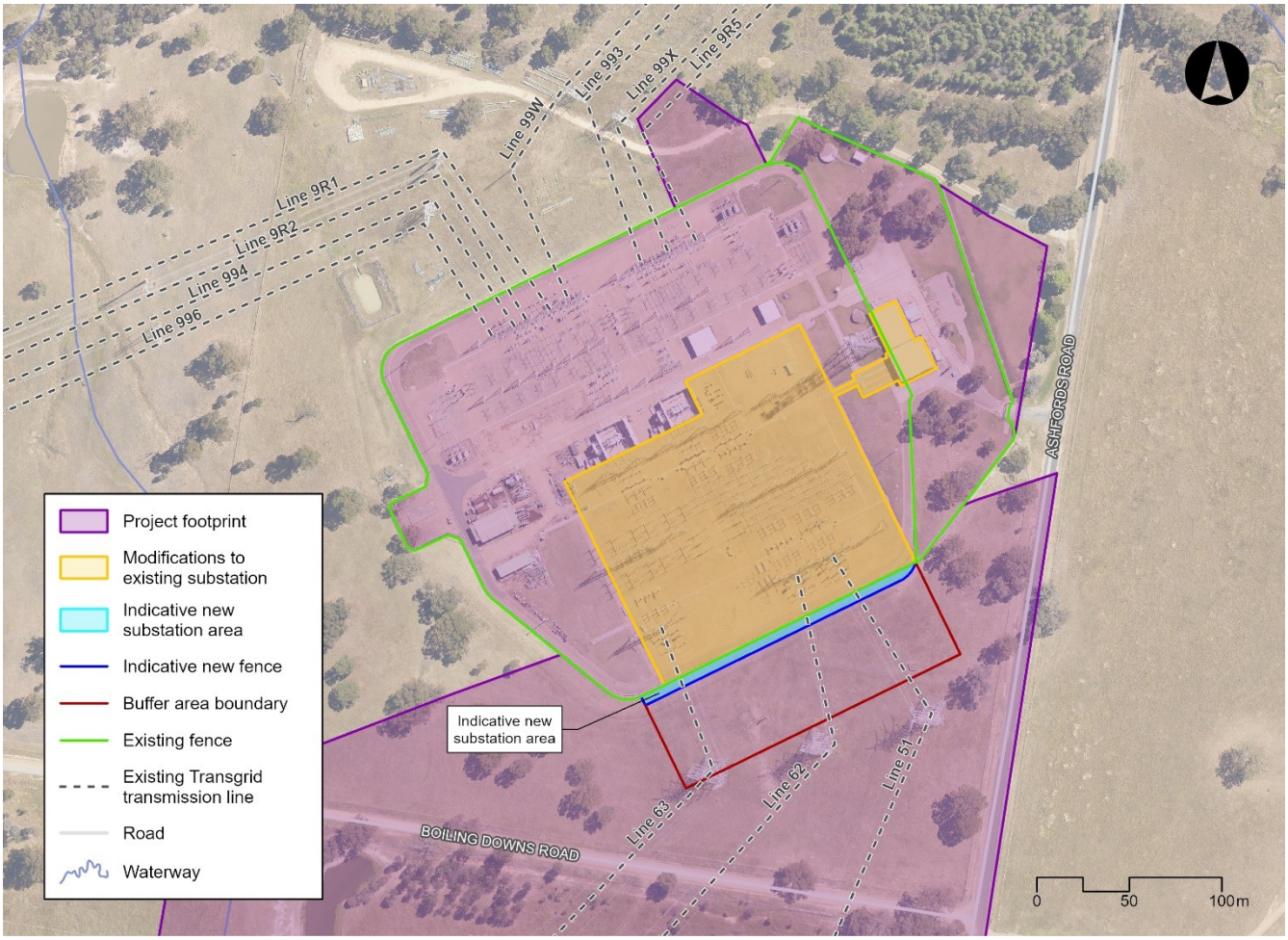


Figure 3-7 Indicative layout of the modified Wagga 330 kV substation

3.4.2.2. Lighting

Additional operational lighting would be required at Wagga 330 kV substation for site security and for the safety of workers operating and maintaining the substation equipment. Substation lighting would operate from dusk until dawn, seven days a week and would aim to maintain 2.5 lux as minimum level. There would be areas that exceeds 2.5 lux (in some cases up to 30 lux).

Lights would typically be located on substation steelwork (ie poles). The final lighting design would focus illumination to within the substation boundary in accordance with the requirements of Australian Standard *AS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019).

3.4.2.3. Water supply

The existing Wagga 330 kV substation sources water for maintenance and operational activities via connection to water mains. The modified Wagga 330 kV substation would require an additional 27 kilolitres of water per year for maintenance and operational activities. This would be sourced from the existing water supply arrangements.

3.4.2.4. Stormwater and drainage

An on-site stormwater drainage system currently exists within the Wagga 330 kV substation to capture and discharge stormwater collected within the site. Additional stormwater drainage would be required to support the modifications including drainage connections to the new concrete cable trenches and pits. All drainage work would be undertaken within the existing substation boundary.

3.4.3. Bannaby 500 kV substation

The existing Bannaby 500 kV substation on Hanworth Road, Bannaby would be expanded to accommodate connections for new 500 kV transmission line circuits. All modification work at the existing Bannaby 500 kV substation would occur within the existing substation property.

A summary of the features of the modified substation is provided in the following sections.

3.4.3.1. Modified form and layout

As part of the proposed modification, the existing Bannaby 500 kV substation would mainly be expanded on the northern and western sides with the total area of new development being approximately 10 hectares. Modifications within the existing substation bench are also proposed.

No modifications are required for the existing Bannaby 330 kV substation, which is located about 300 metres to the south of the existing 500 kV substation.

The typical infrastructure and equipment that would be installed, and work associated with modifying the existing substation, include:

- extension of the existing substation bench by up to about 80 metres on the northern side and up to about 41 metres on the western side including bulk earthwork and external palisade fencing
- construction of a new unsealed reactor access road adjacent to substation
- additional drainage and spill oil containment system
- installation of concrete footings, compounds, tanks, cable trenches, kerbs, fire walls, drains and pits
- installation of steel support structures
- installation of new electrical equipment including up to two 500 kV reactors, extension of 500 kV busbars, high-voltage switchyard equipment, insulators, conductors, earthing, lighting and cabling
- installation of secondary systems in the existing control building.

The new equipment would have an estimated maximum height of around 33 metres. The height of existing equipment at the substation is around 35 metres.

Given the scale of modifications, no additional wastewater infrastructure is proposed as part of modified Bannaby 500 kV substation.

Figure 3-8 shows the indicative layout of the proposed modifications to the of Bannaby 500 kV substation. These changes would be subject to detailed design.

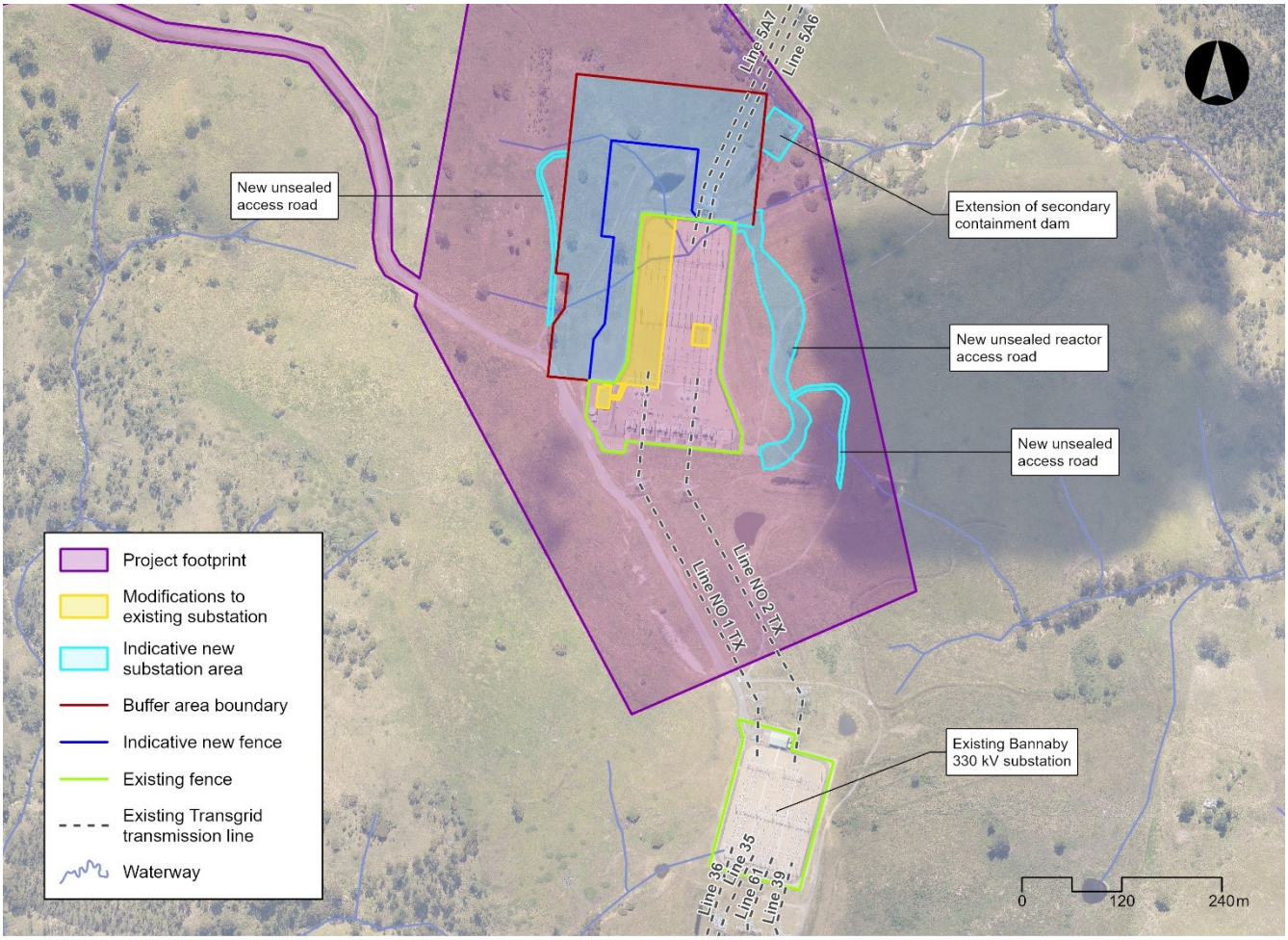


Figure 3-8 Indicative layout of the Bannaby 500 kV substation following modification

3.4.3.2. Access and parking

The existing unsealed access road from Hanworth Road to the Bannaby 500 kV substation would be upgraded as part of the modification work. The upgrade work would mainly be limited to the existing access road formation and involve work to ensure the access road is suitable for heavy vehicles used in the modification of the Bannaby 500 kV substation (eg grading and resurfacing vehicles). The extent of the upgrade work would be confirmed during detailed design and would be designed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008a).

It is anticipated that existing parking arrangements for maintenance and operational workers would be used at the Bannaby 500 kV substation with no new parking required as part of the project.

3.4.3.3. Safety and security

The project would include security fencing approximately three metres high at the modified Bannaby 500 kV substation. The fencing would be installed around all sides of the modification work and integrate with the existing security fencing. The security fencing would comprise a galvanised steel (or similar) material. If required, motorised sliding gates or manual swing gates would also be installed to provide an overall opening of around seven metres at the main entrance point to the site.

To comply with Transgrid's safety requirements, additional security measures may be incorporated, which would include (but not be limited to):

- security cameras within the substation
- safety and public information signage at the substation to ensure public safety
- an APZ, which would be an area kept clear of all trees and vegetation that may affect the substation during a bushfire; the APZ would comply with Transgrid's design and safety standards.

Based on the bushfire hazard analysis is carried out in *Technical Report 13 – Bushfire Risk Assessment*, an APZ of up 35 metres (eastern boundary) is proposed with other boundaries requiring an APZ of between eight and 21 metres.

Additional operational lighting would be required at Bannaby 500 kV substation for site security and for the safety of workers operating and maintaining the substation equipment. Substation lighting would operate from dusk until dawn, seven days a week and would aim to maintain 2.5 lux as a minimum level. There would be areas that exceeds 2.5 lux (in some cases up to 30 lux).

Lights would typically be located on poles. The final lighting design would focus illumination to within the substation boundary in accordance with the requirements of Australian Standard *AS 4282-2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019).

3.4.3.4. Water supply

The existing Bannaby 500 kV substation sources water for maintenance and operational activities from onsite water tanks. The modified Bannaby 500 kV substation would require an additional 27 kilolitres of water per year for maintenance and operational activities. This would be sourced from the existing water tanks.

3.4.3.5. Stormwater and drainage

An on-site stormwater drainage system exists within the Bannaby 500 kV substation to capture and discharge stormwater collected from within the site. Some additional stormwater drainage would be required as part of the modified Bannaby 500 kV substation, including:

- a new pit and pipe or concrete 'V' drain drainage system to manage runoff within the site
- grassed swales about five to six metres wide around the western and northern boundaries of the site to divert off site runoff from entering the site.

New drainage to manage runoff within site would be designed for rainfall corresponding to a 10% AEP event. New drainage to divert offsite runoff would be designed for rainfall corresponding to a 2% AEP event. The new drainage would connect with the existing system and off-site runoff would be diverted to natural waterways using appropriate dispersion and dissipation structures.

3.4.3.6. Oil containment

The proposed work at Bannaby 500 kV substation would upgrade the existing oil containment system infrastructure. This would include installation of a new primary oil containment tank and extension of the secondary containment dam by about seven metres. The upgrade would be designed in accordance with Transgrid's standards and procedures and the requirements of the POEO Act. This would include consideration of appropriate bunding, dedicated drainage points and spill oil containment tanks to manage any potential spills or leaks from the new transformers and reactors, as required.

3.4.4. Future Maragle 500 kV substation

The project would connect to the future Maragle 500 kV substation approved under the Snowy 2.0 Transmission Connection Project (SSI-9717). Construction of the future Maragle 500 kV substation is proposed to be undertaken between 2023 and 2026. Further detail on the Snowy 2.0 Transmission Connection Project is available at the Department of Planning and Environment's Major Project website: www.planningportal.nsw.gov.au/major-projects/project/10591.

The connection work required for the project would include:

- stringing conductors between transmission line structures and the future Maragle 500 kV substation gantry (including overhead earth wire and optical ground wire (OPGW))
- installing droppers from the future substation gantry to the switchgear.

All other work associated with the future Maragle 500 kV substation, including operational access and parking, safety and security, lighting drainage and spill containment, would be constructed as part of the Snowy 2.0 Transmission Connection Project. It is not envisaged that any refinement or adjustment would be required as a result of the HumeLink project.

An indicative layout of future Maragle 500 kV substation showing the connection location is provided in Figure 3-9.

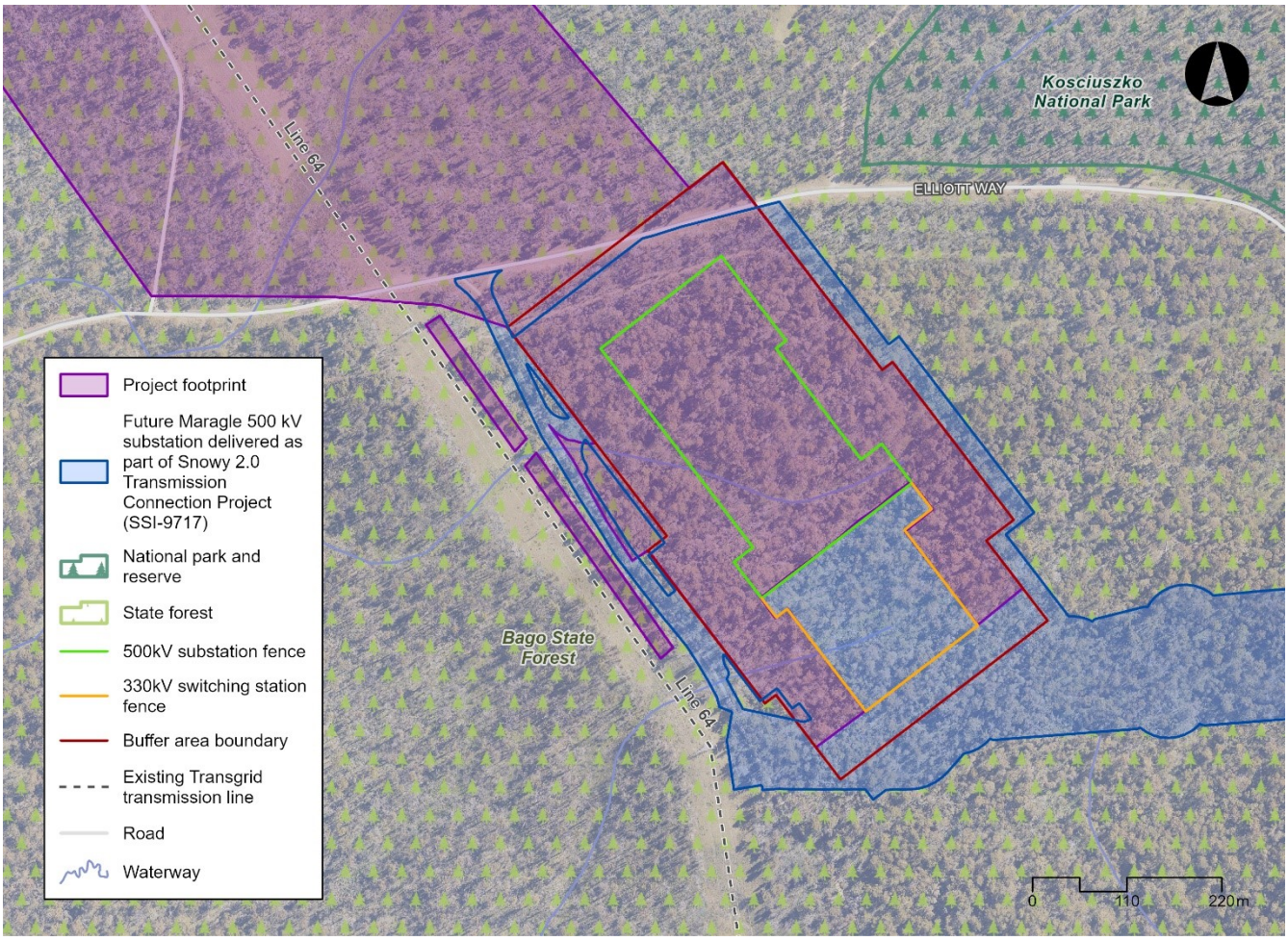


Figure 3-9 Indicative layout of the future Maragle 500 kV substation

3.5. Telecommunications hut

Telecommunications huts are generally required to be located along transmission lines greater than 135 kilometres long. Telecommunications huts contain optical repeaters, which boost the signal in the OPGW, and back-up power supplies to ensure the stability of the communications system over long distances. Telecommunications huts facilitate the communication of protection and control systems between substations.

3.5.1. New telecommunications hut at Killimicat

One telecommunications hut is required for the project. The hut would be located adjacent to existing transmission line structures at Killimicat (about 10 kilometres north-east of Tumut). Its dimensions would be six metres by three metres. The hut's main features would include:

- a metal cladding exterior
- a security fence around the perimeter of the optical repeater site, enclosing an area of approximately 400 square metres
- connection to the local power supply via a new power line about 980 metres long.

The requirements for an APZ for the telecommunications hut would be investigated and confirmed during detailed design (refer to *Technical Report 13 – Bushfire Risk Assessment*). Access to the telecommunications hut during operation would be via the transmission line easement and nearby access track retained for operation.

Figure 3-10 shows the location of the proposed telecommunications hut and Figure 3-11 provides photo of a typical an of a telecommunications hut.

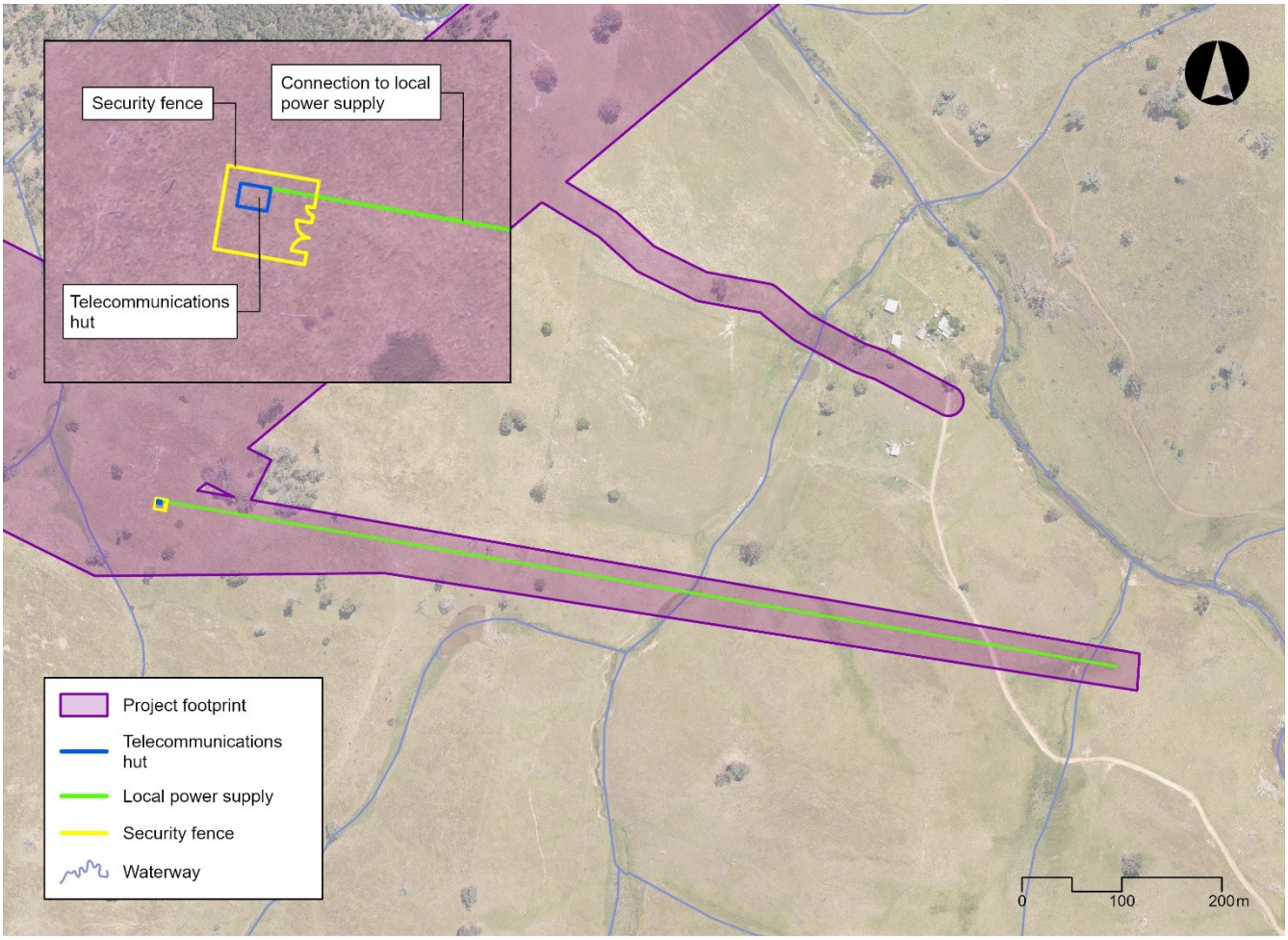


Figure 3-10 Location and indicative layout of the proposed telecommunications hut at Killimicat



Figure 3-11 Example of a telecommunications hut

3.5.2. Rye Park Wind Farm substation connection

A telecommunications connection with the future Rye Park Wind Farm substation is proposed as part of the project (refer to Figure 3-1). This connection removes the need for an additional telecommunications hut in the eastern end of the project and would involve connection of OPGW between two proposed transmission line structures and the Rye Park Wind Farm substation through buried cabling. The length of the connections between the transmission line structures and the Rye Park Wind Farm substation would be between 200 to 350 metres.

The Rye Park Wind Farm substation will be constructed separately to this project in accordance with the approved Rye Park Wind Farm Project (SSD-6693).

3.6. Operation and maintenance

The proposed infrastructure would be safely operated and maintained in compliance with the Transgrid's safety rules, operation and maintenance procedures.

Maintenance activities of the transmission lines and substations would be undertaken by Transgrid operational and maintenance workers. Further details of these activities are provided in Sections 3.6.1 and 3.6.2. The project would require about five workers during operation for ongoing maintenance. The five

workers would be in addition to Transgrid's existing 58 maintenance workers working in the Transgrid regions in which the project is located.

The maintenance activities would be guided by a number of Transgrid operational procedures and guidelines including:

- *Maintenance Plan – Transmission Line Assets* (Transgrid, 2021c)
- *Maintenance Plan – Easement and Access Tracks* (Transgrid, 2022a)
- *Environmental Handbook* (Transgrid, 2021d)
- *Electricity Network Safety Management System* (Transgrid, 2020b)
- *Bushfire Risk Management Plan* (Transgrid, 2021e)
- *Waste Management Procedure* (Transgrid, 2022b)
- *Preparing and Approving Environmental Checklists Procedure* (Transgrid, 2020c)
- *Environmental Assessment Framework* (Transgrid, 2020d).

The design life of the project is 50 years, which can be extended to more than 70 years for some infrastructure components and plant items. Maintenance activities would be regularly undertaken for all project infrastructure components and plant items. These components would be replaced or refurbished towards the end of their serviceable life, allowing the service life to be maximised. At the point in the future where project infrastructure is required to be decommissioned, it would be recycled, reused or disposed of appropriately. Rehabilitation and revegetation of decommissioned operational areas would be consistent with the existing land use or as otherwise agreed with the relevant landowners, where possible.

Chapter 26 (Environmental management) provides details on the approach to environmental management during operation and decommissioning.

3.6.1. Transmission lines operation and maintenance

The transmission lines would require regular maintenance. Likely maintenance activities for transmission lines and structures would include:

- regular inspection and maintenance, including:
  - an annual fly over (aerial inspection) as part of seasonal bushfire prevention surveys
  - routine infrastructure inspections. This would typically involve two to three maintenance workers driving a light vehicle from public roads to the easement utilising access tracks, then along the easement inspecting each transmission line structure in turn. Structures would be inspected both from the ground and by maintenance workers climbing the structure on a six-yearly cycle
  - reactive transmission line maintenance in response to unexpected issues identified during routine inspections. This would typically involve maintenance workers using light vehicles, an elevated work platform and a medium sized truck to rectify any defects found during routine inspections. Generally, this would occur within the same maintenance cycles as the routine infrastructure inspection.
- ad-hoc fault and emergency fly-over(s), as required, to assess infrastructure condition should an unplanned outage occur (eg through a weather event or other failure of infrastructure). The amount of maintenance and/or crew required for repair of any damaged infrastructure would depend on the extent of repairs required.
- vegetation management within the transmission line easement and hazard tree zone (refer to Section 3.6.3).

3.6.2. Substation operation and maintenance

3.6.2.1. Proposed Gugaa 500 kV substation

During operation, the proposed Gugaa 500 kV substation would not accommodate full-time staff or contractors. Maintenance at the new substation would typically include routine and ad hoc attendance (typically one to two times a month) of one to five workers to undertake planned and unplanned maintenance. It is expected that this work would only require light vehicles and/or small to medium plant (depending on the work required). Any waste generated during operation would be minimal and disposed of in accordance with Transgrid's *Waste Management Procedure* (Transgrid, 2022b) by the maintenance workers.

Maintenance activities at the proposed Gugaa 500 kV substation would typically include (but not be limited to):

- routine inspection of substation infrastructure (such as transformers and other electrical plant and equipment) throughout the year by around two to three workers
- routine maintenance of substation equipment, property, and switchyard areas on a scheduled basis. This would typically be monthly and undertaken by between one and five maintenance workers
- ad-hoc fault and emergency work to repair any damaged infrastructure (eg through a weather event or other failure of infrastructure), as required. The amount of maintenance and number of crew would depend on the extent of repairs required.
- vegetation management along the operational access road and within the substation's APZ (refer to Section 3.6.3 for further detail).

Maintenance activities would be regularly undertaken for the different infrastructure components and plant items. These components would be replaced or refurbished towards the end of their serviceable life, allowing the service life of the substation to be maximised.

3.6.2.2. Wagga 330 kV substation and Bannaby 500 kV substation

The modification of the Wagga 330 kV substation and Bannaby 500 kV substation would not change the existing operational or maintenance requirements that currently occur for this infrastructure.

3.6.3. Vegetation management during operation

Vegetation would be required to be managed during operation of the project to ensure vegetation clearance requirements and APZs are maintained. A summary of the anticipated vegetation management requirements is provided in the sections below.

3.6.3.1. Transmission line structures and easements

Vegetation within the transmission line easement would be managed in accordance with Transgrid's *Maintenance Plan – Easement and Access Tracks*, which specifies a vegetation clearance requirement at maximum line operating conditions of 3.9 metres for 500 kV transmission lines plus a regrowth allowance of 1.5 metres. The regrowth allowance is based on the annual regrowth rate for the area.

Vegetation within the easement with a mature height, which does not exceed the clearance requirement of 5.4 metres can be retained.

In addition, the area within a 20 metre radius around each transmission line structure footing would be kept free of shrub and tree regrowth.

The management of vegetation at transmission line structures and within the easement would occur on a cyclic basis, determined by vegetation response and growth rate. Based on Transgrid's existing transmission assets in the local region, the easement management cycle is expected to be between four and six years.

Annual light detection and ranging (LiDAR) surveys would be carried out to identify any hazard trees. A hazard tree is defined as a tree or part of tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines. Potential hazard trees would be inspected by a suitably qualified arborist to determine the appropriate management response, which could include felling, pruning, or no action (if the inspection confirms that a potential hazard tree is of no risk to the transmission line).

3.6.3.2. Permanent access tracks

Maintenance would be carried out as required along access tracks retained for operational use. This would typically involve repair or reinstatement of damaged/eroded track surfaces/drainage (if resulting from Transgrid's operations) and slashing of any vegetation regrowth within the shoulders and/or management of trees which encroach the access track corridor and prevent safe vehicle passage.

3.6.3.3. Substations and telecommunications hut

Vegetation management for the substations and the telecommunications hut during operation would be generally limited to the operational access roads and maintenance of the APZs.

Vegetation within the APZ (but outside the asset fence line) would be managed by either slashing or mulching. Trees would be removed but root systems and ground cover vegetation would be retained. Other vegetation would be mown or slashed to a height of around 100 millimetres.

Vegetation management for the substations and the telecommunications hut would occur on a cyclic basis, which would be determined by vegetation response and growth rate. Based on Transgrid's existing assets in the local region, the cyclic management period is expected to be monthly for substations and annually for the telecommunications hut.

3.7. Property acquisition and easements

3.7.1. Transmission line easements

An easement provides a right of access for Transgrid staff and contractors to construct, maintain and operate the transmission line and other operational assets. The easement also generally identifies the zone of initial vegetation clearance and ongoing vegetation management to ensure safe electrical clearances during the operation of the transmission lines. Vegetation management beyond the easement may also occur where nearby trees have the potential to fall and breach safety clearances.

To protect landowner and community safety and provide a safe, reliable network, Transgrid restricts the activities that can be carried out within the easements.

The easement for the new 500 kV transmission lines would typically be 70 metres wide. However, a few locations (such as at transposition locations) may require easements up to 110 metres wide and up to 130 metres wide where the new 500 kV transmission line would parallel the relocated section of Line 51.

Transgrid is working with landowners to finalise the location of and acquire the new transmission line easement for the project.

All acquisitions or easements would be by agreement with landowners or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Property Acquisition Standards* (Department of Finance, Services and Innovation, 2019).

Easements through Crown land would be in accordance with the *Crown Land Management Act 2016* (as applicable).

Easements through State forests would be by agreement with FCNSW via a Deed of Easement, and/or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Some structures within the final easement may also need to be demolished and/or relocated. This would be undertaken in consultation with and subject to negotiations with the landowners and in accordance with Transgrid's *Easement guidelines - Living and working with electricity transmission lines*.

3.7.2. Access easements

As discussed in Section 3.3.4, access to the transmission line easement would be required for operational purposes. Access easements may be required to provide Transgrid operational staff with access from the nearest public road to the transmission line easement. These access easements would be negotiated with landowners as necessary. Transgrid may install locked and signed access gates to enable access to the access easement should a landowner not have a suitable gate nearby. Access for landowners would be maintained and landowner access requirements would be complied with (such as biosecurity protocols).

3.7.3. Substations and telecommunications hut

Freehold property acquisition would be required for the proposed Gugaa 500 kV substation and the telecommunications hut at Killimicat as detailed in Table 3-2.

Table 3-2 Property acquisition required for the project

Location	Lot and DP	Area
Proposed Gugaa 500 kV substation	Lot A DP 376288 Lot 56 DP 757261	80.70 ha[1]
Telecommunications hut at Killimicat	Lot 85 DP 750990	0.04 ha

Note:
1. Operational substation infrastructure would only occupy approximately 22 hectares.

All acquisitions for the proposed Gugaa 500 kV substation and the telecommunications hut would be carried out in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Property Acquisition Standards* (Department of Finance, Services and Innovation, 2019).

In addition to the freehold acquisition for the telecommunications hut, an easement would be required for the connection to the local power supply. The easement is anticipated to be two metres wide. It would be acquired in accordance with the requirements detailed in Section 3.7.1.

No property acquisition or property adjustments are anticipated for the modification of the Wagga 330 kV substation or Bannaby 500 kV substation, as these would occur within the existing substation properties.

Property acquisition for the future Maragle 500 kV substation is being undertaken as part of the Snowy 2.0 Transmission Connection Project. No additional property acquisition or property adjustments are anticipated as a result of the proposed connection work.

4. Project description - construction

This chapter provides a consolidated description of construction for the project. The chapter includes the indicative construction methodology, timing, likely resources and program. The description of the project components presented in this chapter is based on the current concept design. Some elements of the project may continue to be refined as part of detailed design and construction of the project. If approval is granted, any changes to the project would be reviewed for consistency with the approved project in accordance with the process described in Chapter 26 (Environmental management). A description of how the project would be operated is provided in Chapter 3 (Project description - infrastructure and operation).

4.1. Construction overview

Construction of the project is planned to commence once all the necessary approvals are obtained. It is anticipated that construction would commence in 2024.

The indicative approach to construction is described in Sections 4.2 to 4.7. Detailed construction planning, including timing, phasing and work sequencing, would be refined and confirmed with the construction contractors. Further information on the construction program and timing is provided in Section 4.8.

Construction of the project would typically include (but not be limited to):

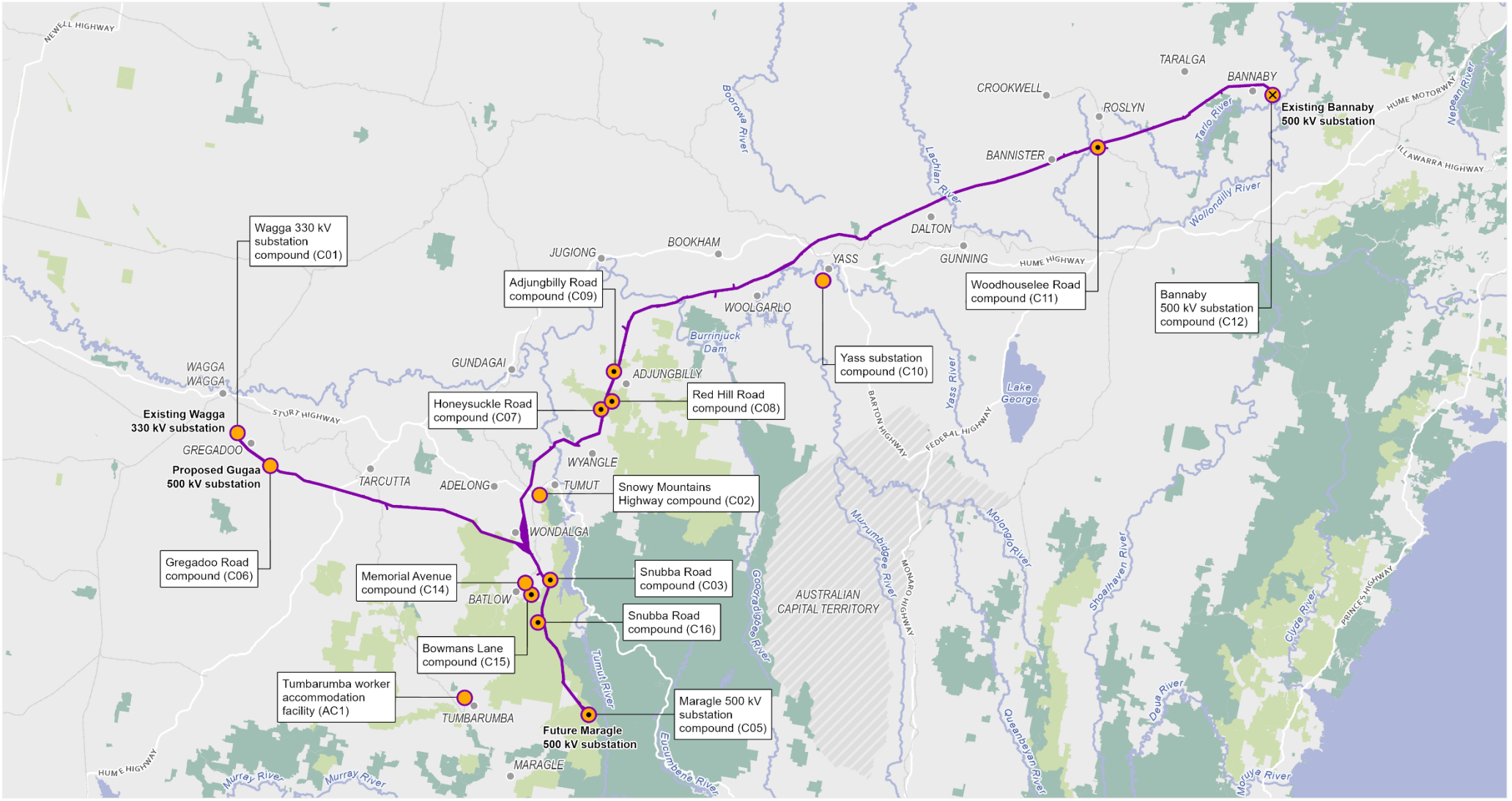
- site establishment (refer to Section 4.2.1)
- main construction work (refer to Section 4.2.2)
- testing and commissioning (refer to Section 4.2.3)
- demobilisation and rehabilitation (refer to Section 4.2.4).

Some activities would be defined as pre-construction work as their purpose is to make the key construction sites ready and to manage specific features or issues of the project. Pre-construction work is typically low impact work and proposed to take place prior to the approval of the Construction Environmental Management Plan (CEMP) by the Department of Planning and Environment (DPE). Pre-construction work would be managed in accordance with an Enabling Works Management Plan or Environmental Work Method Statements or similar environmental management documents. Chapter 26 (Environmental management) provides further information on the approach to environmental management during construction including details of activities considered as pre-construction work.

A summary of the key construction features of the project is provided in Table 4-1 and shown on Figure 4-1.

Table 4-1 HumeLink project summary - construction

Project element	Summary of the project	Reference
Project footprint	The project footprint extends from the existing Wagga 330 kV substation in the west to the existing Bannaby 500 kV substation in the east and the future Maragle 500 kV substation in the south. The project footprint includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement and permanent access tracks required during operation. As such, the project footprint includes the area of temporary construction disturbance, such as construction compounds, laydown areas, the worker accommodation facility, construction benches for transmission line structures, brake and winch sites, a concrete batching plant, temporary access tracks and waterway crossings. The final locations for these project elements would be confirmed by the construction contractors during detailed design.	Figure 4-1 Figure 4-7
Construction program	Construction is expected to commence in 2024 and take about 2.5 years to complete. The project is expected to be fully operational by the end of 2026.	Section 4.8
Construction workers	The number of construction workers would vary depending on the phase of construction and associated activities. During peak construction activities, the project is expected to employ up to 1,200 full-time equivalent workers across multiple work fronts.	Section 4.6.1
Ancillary development	The construction of the project would involve establishment and use of: • new and upgraded access tracks including connection to the existing road network as required • a temporary worker accommodation facility at Tumbarumba • 14 construction compounds nominated to support laydown areas, stockpiling areas, a concrete batching plant, site offices and parking • helipad/helicopter support facilities (within nominated construction compounds) • other minor storage and laydown ancillary areas along the transmission line route.	Section 4.2.1 Section 4.3 Figure 4-7 Figure 4-8
Construction water management	It is estimated that about 564 megalitres (ML) of water would be required for construction. This includes 498 ML of non-potable water and 66 ML of potable water. Non-potable water sources would include construction sedimentation basins, farm dams, rainwater tanks, groundwater bores and water purchased from existing water user allocations. Potable water sources would include council standpipes or connection to council water supply systems. The total annual volume of wastewater generated during construction is expected to be about 8.81 ML.	Section 4.5.2
Earthworks estimate	Earthworks for construction of transmission line structures and access tracks would involve an estimated 283,590 m^3 of cut and 115,690 m^3 of fill. Earthworks for substation construction would involve an estimated 382,440 m^3 of cut and 302,580 m^3 of fill.	Section 4.5.1
Construction access routes	Hume Highway, Sturt Highway, Snowy Mountains Highway, Batlow Road and Gocup Road are the main national and state roads proposed to provide access to the project footprint. Access would also be facilitated by the use of regional and local roads throughout the Local Government Areas (LGAs) of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional and Upper Lachlan Shire that connect to the project footprint.	Section 4.7.2 Figure 4-9



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

1:925,000

0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 4-1: Overview of key construction features

4.2. Construction methodology

4.2.1. Site establishment

Site establishment involves preparing the site for future activities, such as the building of construction compounds and the worker accommodation facility. Most site establishment activities would commence as pre-construction work as described in Chapter 26 (Environmental management).

Site establishment activities include:

- installing site environmental management and traffic controls, including drainage and erosion and sediment management controls, in accordance with a separate activity-specific management plan or work method statement
- installing temporary fencing to ensure construction areas are clearly delineated
- clearing vegetation and topsoil, where required, including stockpiling for reuse during rehabilitation
- establishing construction infrastructure including construction compounds, helipad/helicopter facilities and the temporary worker accommodation facility (refer to Section 4.3)
- relocating, adjusting or protecting utilities, where required
- constructing new access tracks and waterway crossings and/or upgrading existing access tracks
- carrying out road improvement work
- establishing vehicle access and egress points including adjustment of roads to ensure safe vehicle movements as required
- establishing hardstand areas for storage, laydown and car parking
- carrying out geotechnical and contamination investigations
- carrying out property adjustment and demolition work including adjustments to property fencing, barricades, gates and access, and demolition and relocation of existing dwellings and structures as required.

Some of the site establishment activities are discussed in further detail below.

4.2.1.1. Vegetation clearing

Vegetation clearing or pruning would be required to:

- construct transmission line structures
- establish transmission line easements
- construct access tracks
- construct or modify substations
- construct the telecommunications hut
- establish construction compounds, the worker accommodation facility or other ancillary facilities
- manage hazard trees.

Some vegetation clearing and pruning would be carried out as pre-construction work. Such clearing would exclude threatened flora species, vegetation that is part of a threatened ecological community or is critical habitat for a threatened fauna species (refer to Chapter 26 (Environmental management)).

Clearing would be undertaken with the use of machinery, or manually where it is unsafe to operate machinery or access is limited. Root balls would be retained where possible and as required due to identified environmental and heritage constraints. The clearing method would be determined by:

- vegetation type or structure
- slope and terrain
- environmental and ecological constraints.

A summary of the vegetation clearing requirements is provided in Table 4-2 and indicated in Figure 4-2, Figure 4-3, Figure 4-4 and Figure 4-5.These areas have been categorised into different zones of vegetation clearing (total clearing zone (TCZ), easement clearing zone (ECZ) and hazard tree zone (HTZ)) and collectively form the disturbance area for the project. An indicative disturbance area based on the concept design for the project has been developed for the purpose of assessing potential biodiversity impacts as described in Chapter 8 (Biodiversity).

Table 4-2 Vegetation clearing requirements

Aspect	Requirements
Transmission line structures (part of the TCZ)	Construction of transmission line structures would require vegetation removal for the following: • establishment of construction benches – which would require a cleared area of around 70 m by 50 m (with the 70 m side placed along the length of the easement and the 50 m section across the width of the easement) for the construction of each structure • brake and winch sites – which would require a cleared area of around 50 m by 50 m where a direction change of the transmission line occurs. Due to the variable terrain, complete removal of vegetation would typically be required within these areas to facilitate safe access and use of construction vehicles, plant and equipment.
Transmission line easement (part of the ECZ)	Vegetation clearing within the transmission line easement would involve the removal of tall growing vegetation that exceeds the clearance requirements for the transmission line. Groundcover and understorey vegetation would not be required to be cleared but may be impacted during clearing of the mid-storey and upper storey vegetation. Full vegetation clearing to the width of transmission line easement would be required for sections of the transmission line that traverse plantation forests.
Hazard trees (part of the HTZ)	For the purpose of the EIS, hazard trees have been assessed as being removed.
Access tracks (part of the TCZ)	Construction of access tracks would generally require full vegetation clearing to a width of 10 m.
Substations and telecommunications hut (part of the TCZ)	Areas required for the construction of the proposed Gugaa 500 kV substation and modifications at Wagga 330 kV substation and Bannaby 500 kV substation, the telecommunications hut including associated access roads and asset protection zones (APZs) would require full vegetation clearing.
Construction ancillary facilities (part of the TCZ)	The areas required for the construction compounds and the worker accommodation facility would require vegetation clearing.

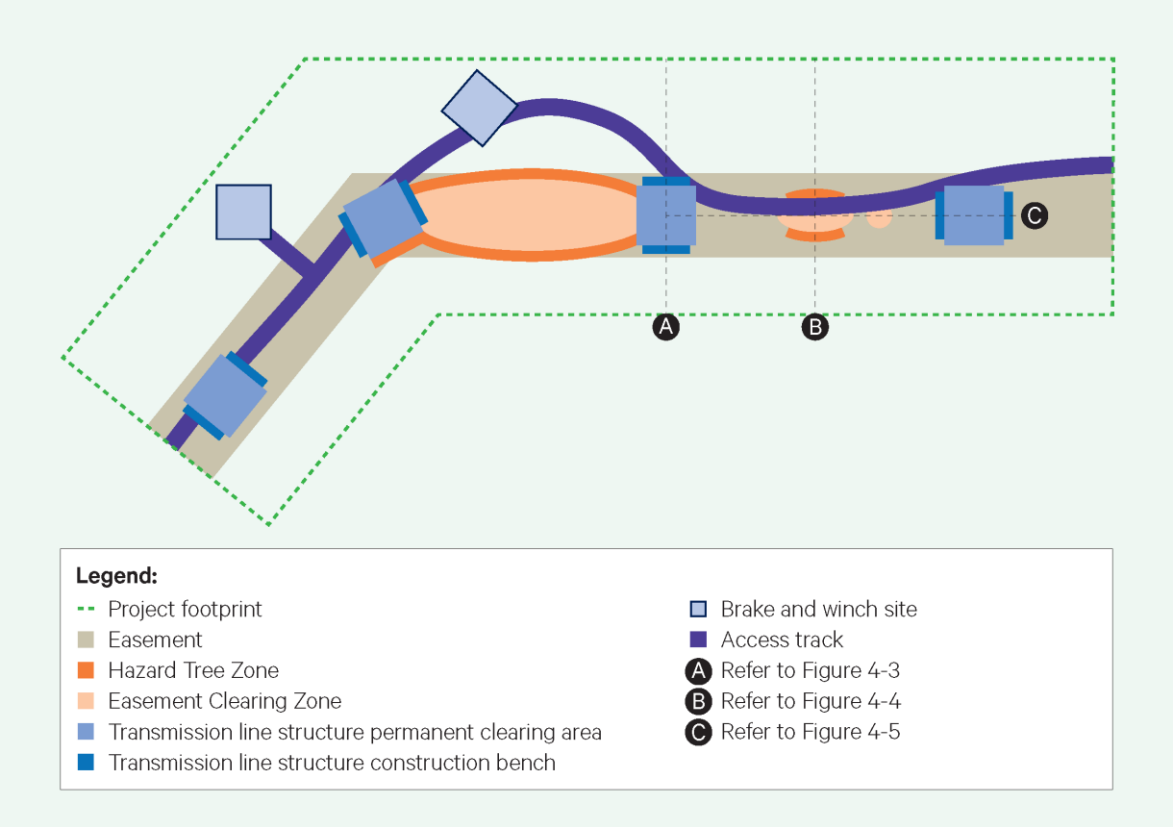


Figure 4-2 Indicative vegetation clearing zones within the project footprint

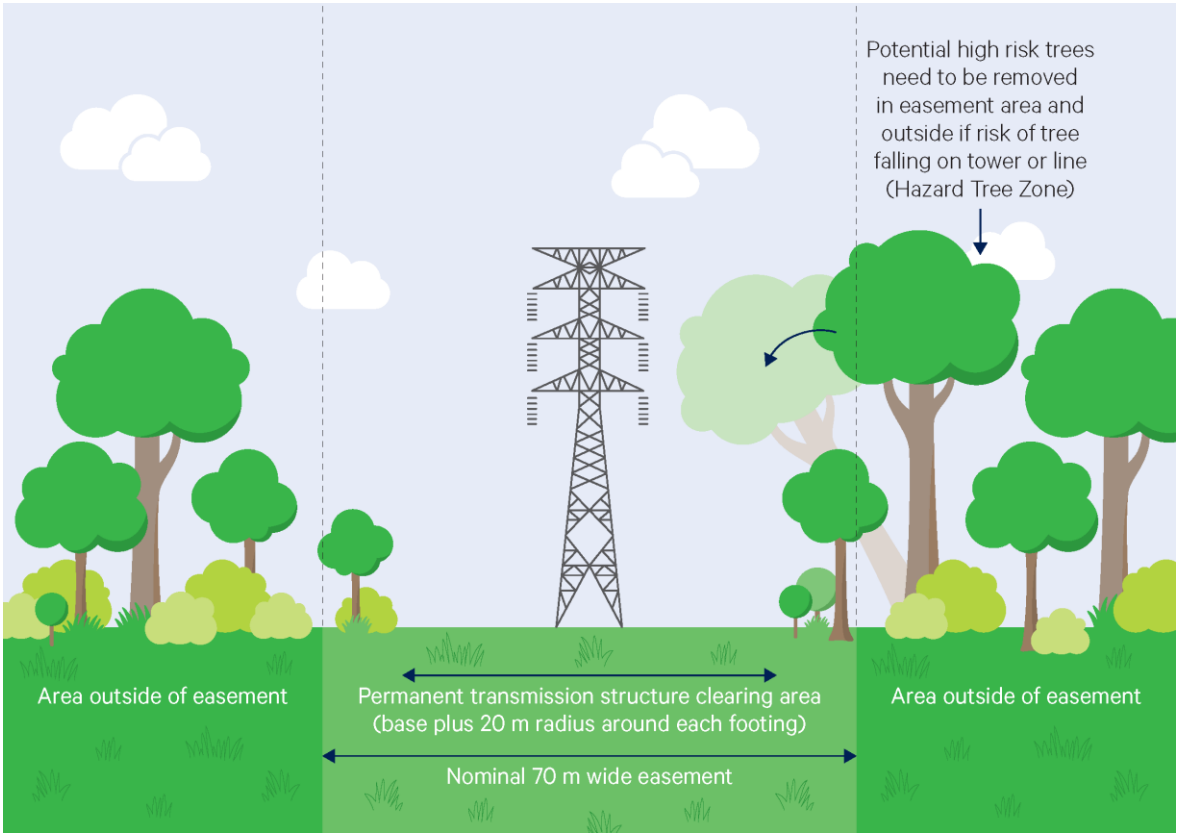


Figure 4-3 Indicative vegetation clearing around a typical transmission line structure

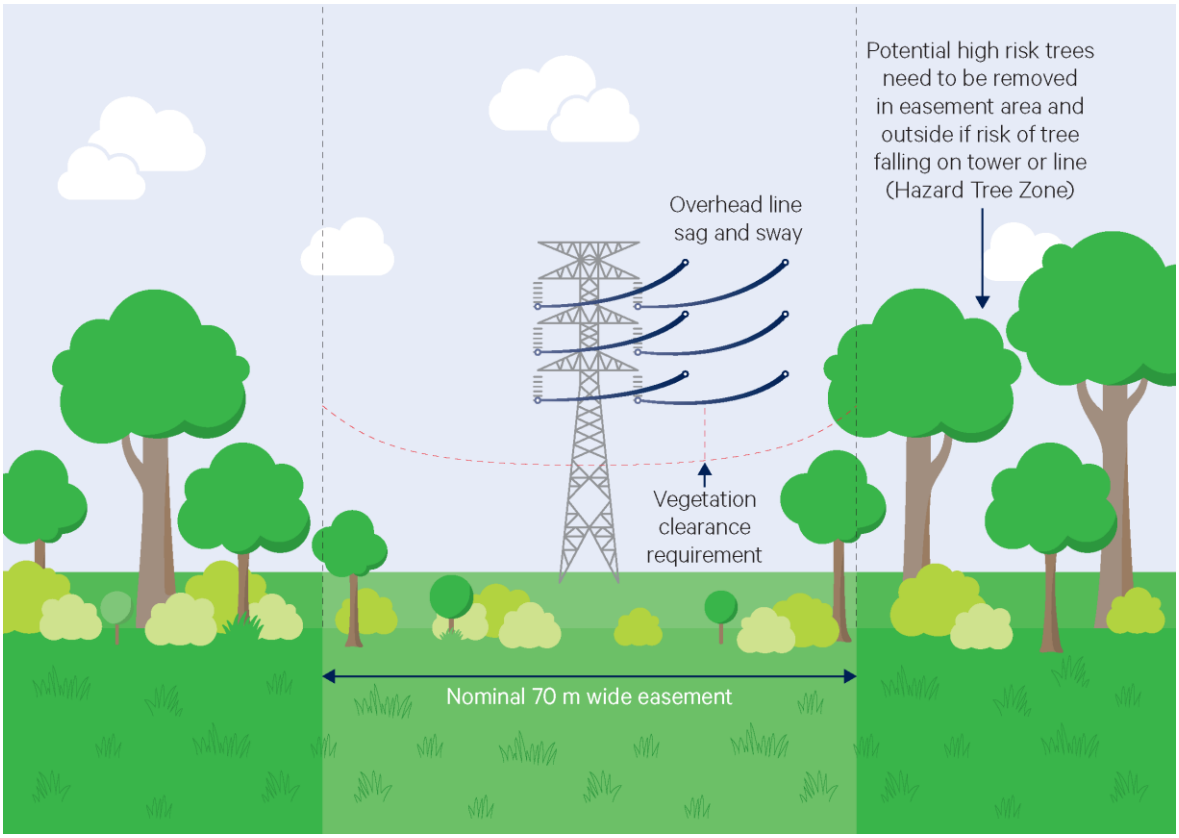


Figure 4-4 Indicative vegetation clearing within the easement

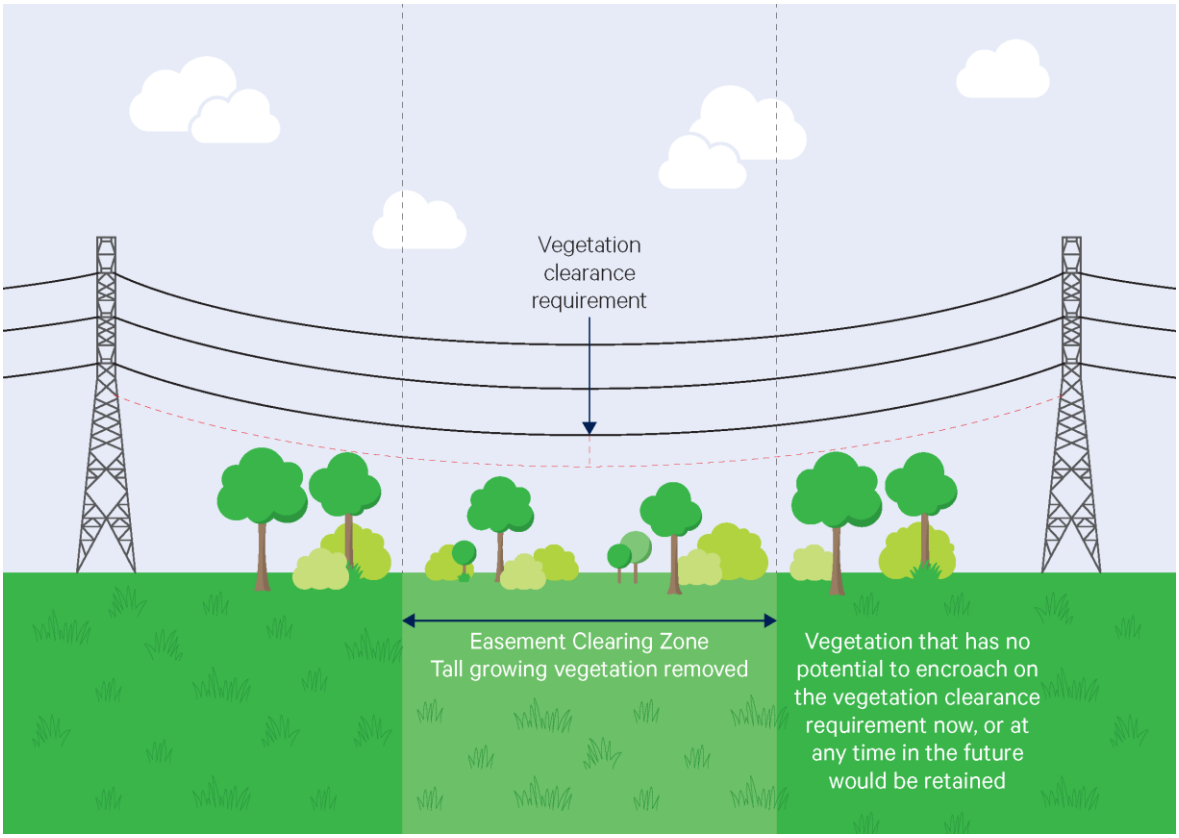


Figure 4-5 Indicative vegetation clearing mid-span

4.2.1.2. Utility connections, adjustments and protection work

It is anticipated that utility service connections would be required for the construction compounds and worker accommodation facility during site establishment. Depending on availability of existing services, this could include power, water and wastewater services. The extent of connection work would be confirmed by the construction contractors during detailed design and further construction planning.

The project footprint contains a number of existing local utility services including council assets (eg water mains), telecommunication lines, and power distribution lines (eg 11 kV, 33 kV and 66 kV lines) that may require relocation and/or protection work during site establishment. Potential impacts on existing utility services would be confirmed during detailed design and further construction planning. Any proposed relocation and/or protection work would be determined in consultation with the relevant asset owners.

Where the extent of connection work or any proposed relocation and/or protection work is to be undertaken outside of the project footprint, additional environmental investigation would be carried out and the work reviewed for consistency with the approved project in accordance with the process described in Chapter 26 (Environmental management).

There are no major utilities, such as water or gas pipelines, within the project footprint that would require relocation and/or protection work during site establishment.

Work associated with rebuilding around two kilometres of an existing 330 kV single-circuit transmission line (Line 51) south of the Wagga 330 kV substation and a connection to the Rye Park Wind Farm are detailed in Section 4.2.2.

Chapter 11 (Land use and property) provides further details on existing utility services within and surrounding the project footprint.

4.2.1.3. Property adjustments

Temporary property access arrangements, and installation or adjustment of gates and fences, would be required at some locations along the transmission line route to enable access from the nearest roadway to construction areas. These would be constructed in consultation with the relevant council and/or landowner.

Earthing and isolation panels would be required for any metal property fences that run parallel to the transmission line within the transmission line easement or across the easement within 25 metres of the base of a transmission line structure. Installation of earthing and isolation panels would be in accordance with Transgrid's *Fencing Guidelines* (Transgrid, 2017).

The demolition or relocation of dwellings and other structures (eg sheds and other farm infrastructure) may be required to construct the transmission lines and establish the new transmission line easement. Nine dwellings are located within the project footprint. Based on the current concept design, one dwelling is likely to require demolition or relocation. The need for the demolition or relocation of dwellings and other property structures would be confirmed during detailed design and in negotiation with landowners.

4.2.1.4. Access tracks

Access tracks would need to be established to accommodate safe access of construction machinery and vehicles to the transmission line structures, substations and other construction work sites.

Access to each transmission line structure would be required during construction and would generally be retained for operational purposes. Access tracks would be required to be traversable by a range of vehicles and would fall into two broad groups:

- unimproved access tracks
- constructed access tracks.

Access tracks may need to be connected to the existing road network. Where this occurs, road improvement work may be required to facilitate safe vehicle access. The type of work would depend on factors such as the existing environment and road type at the point of connection, existing traffic volumes and the type of vehicle requiring access.

Section 4.2.1.6 provides further detail on the type of work and detailed design requirements for connections to the existing road network.

Table 4-3 provides a description of the types of access tracks that would be used for the project.

Table 4-3 Types of access tracks

Type	Detail
Unimproved access tracks	Unimproved access tracks would provide access to work sites by using existing roads or tracks or driving on existing soil or ground surface with minimal or no prior preparation. Existing roads, tracks and other existing disturbed areas would be used wherever possible to minimise vegetation clearing requirements. Where access is across open spaces, particularly in cultivated areas, pasture improved grazing land or native grasslands, care would be exercised to ensure that minimum damage is caused to the surface by confining movement, as far as possible, to one route. Stabilisation of unimproved access tracks with a suitable capping material may be required where there are potential erosion and sedimentation risks.
Constructed access tracks	Constructed access tracks would be required in areas where there are no existing roads or tracks, or where terrain conditions prevent continuous access along the transmission line easement between road crossings. In these situations, 'off easement' access may be required, and suitable access tracks would be constructed. All new access tracks would include a trafficable surface between 3 and 6 m wide with a 1 or 2 m shoulder and would generally follow the natural contour of the land as far as practicable to minimise the amount of cut and fill and soil disturbance. Access tracks would be stabilised with suitable capping material and include drainage control features such as table drains or cross banks to minimise potential erosion and sedimentation risks. In the case of cultivated land, it may be necessary to locate access tracks along fence lines or otherwise in accordance with landowner requirements. Track construction would be carried out so as to cause minimum disturbance to soil and vegetation both on and adjacent to the track, including restricting the use of bulldozers where practical. Access tracks would be constructed and maintained in accordance with Transgrid's environmental and engineering requirements and the following guidelines: • *Guidelines for the planning, construction and maintenance of tracks* (Department of Land and Water Conservation, 1994) • *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008a). Where tracks are, or are required to be, located in areas which are not suitable for use by vehicles and plant following adverse weather conditions, the area would be temporarily bypassed (ie alternative access routes would be identified). Access tracks would be designed and formed such that the track is suitable for use by vehicles during subsequent use as part of future maintenance access (ie suitable for use by long wheel-base 4WD vehicles).

4.2.1.5. Waterway crossings

A number of minor waterway crossings may need to be constructed where an access track for vehicles, plant and equipment needs to cross a small creek or drainage line.

Where required, bed-level fords (ie construction of a good footing where a waterway may be crossed) or causeways may be required to be constructed to provide access. Where these crossings are required, they would typically be constructed by:

- removing all loose material from the watercourse at the point to be crossed, forming a depression with firm base and sides
- filling the depression with graded layers of rock, placing the rock layers to produce an interlocked bed of rock, sloped and dished to allow water to drain freely through and flow over the causeway (minimum thickness of around 450 millimetres but not higher than the bed of the waterway).

If required as part of a waterway crossing, culverts may also be installed in accordance with relevant standards (such as *AS/NZS 4058-2007 Precast concrete pipes (pressure and non-pressure)* (Standards Australia/Standards New Zealand, 2007)).

Soil and vegetation disturbance would be kept to a minimum during the construction of all waterway crossings. Additional controls would be installed on the approaches to all waterway crossings as required to minimise potential erosion and sedimentation risks. Areas that are disturbed during the construction of the waterway crossing but are not required for operation would be stabilised and rehabilitated.

All waterway crossings would be designed, installed and maintained in accordance with relevant guidelines for waterway crossings including:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI, 2003)
- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003)
- *Controlled activities – Guidelines for watercourse crossings on waterfront land* (DPE, 2022b)
- *Controlled activities – Guidelines for riparian corridors on waterfront land* (DPE, 2022c)
- *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom, 2004).

4.2.1.6. Road improvement work

Road improvement work would be required to facilitate safe vehicular access to the proposed Gugaa 500 kV substation, ancillary facilities described in Section 4.3, and where access tracks require connection to the existing road network. Table 4-4 describes the potential work that could be required based on the existing road type.

Table 4-4 Road improvement work based on road type connection

Road type	Potential work required for connection
National and state road	The potential work that could be required for connection includes: • pavement and minor earthwork to facilitate the appropriate turning treatment required, eg basic right turn, basic left turn, channelised right turn and/or auxiliary left turn • drainage work at the point of connection to maintain existing roadside drainage, eg installation of pipe culvert or gutter • minor vegetation clearing to ensure required sight distances are achieved where required • line marking and signage.
Regional and local road – sealed	The potential work that could be required for connection includes: • minor earthwork, eg grading and/or resurfacing, within existing road shoulder based on type of vehicle requiring access • drainage work at the point of connection to maintain existing roadside drainage, eg installation of pipe culvert or table drain • minor vegetation clearing to ensure required sight distances are achieved where required • line marking and signage.
Regional and local road – unsealed	The potential work that could be required for connection includes: • minor earthwork, eg infill, grading and/or resurfacing, of existing road surface and shoulder based on type of vehicle requiring access • minor drainage work at the point of connection to maintain existing roadside drainage, eg installation of table drain • minor vegetation clearing to ensure required sight distances are achieved where required • signage.

The extent and design of the road improvement work would be confirmed during detailed design and would be informed by road dilapidation surveys to be completed for all local roads to be used during construction. Road improvement work would be carried out in accordance with the relevant Austroads Guides, any road occupancy licence(s), and in consultation with the relevant road authority. Relevant Austroads Guides include (but may not be limited to):

- *Guide to Road Design* (Austroads, 2023)
- *Guide to Road Safety* (Austroads, 2021a)
- *Guide to Traffic Management* (Austroads, 2020a)
- *Guide to Temporary Traffic Management* (Austroads, 2021b).

The existing unsealed access road from Hanworth Road to the Bannaby 500 kV substation/Bannaby substation 500 kV compound (C12) would be upgraded as part of the modification work. This would mainly be limited to the existing access road formation to make the access road suitable for heavy vehicles used in construction, eg grading and resurfacing work. The extent of the upgrade work would be confirmed during detailed design and would be designed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008a).

It is also anticipated that some widening, and modification of the Gregadoo East Road and Livingstone Gully Road intersection would be required to facilitate delivery of large plant items on oversize delivery vehicles to the proposed Gugaa 500 kV substation and Gregadoo Road compound (C06). The extent of intersection work would be confirmed during detailed design and would be carried out in accordance with the relevant Austroads Guides described above, any road occupancy licence(s) and in consultation with the relevant road authority. The confirmation of the extent of intersection work would also consider the need for any further environmental investigations. Refer to Chapter 20 (Traffic, transport and access) for consideration of traffic related impacts associated with the intersection work.

4.2.2. Main construction work

4.2.2.1. Transmission line construction

Overview

The main work associated with the construction of the new 500 kV transmission lines would include (but not be limited to):

- earthwork and footing construction, including:
  - earthwork and establishment of construction benches and brake and winch sites for each transmission line structure
  - construction of footings and foundation work for the new transmission line structures including either concrete or steel piles (driven and/or screw), boring and/or excavation, steel fabrication work and concrete pours
- erection of the transmission line structures
- stringing of the conductors and overhead earth wire (OHEW) and optical fibre ground wire (OPGW)
- installation of earthing conductors
- earthing of fences and gates (as required).

As described in Chapter 3 (Project description – infrastructure and operation), construction of the new 500 kV transmission line south of the Wagga 330 kV substation would also require the rebuilding of around two kilometres of an existing 330 kV single-circuit transmission line (referred to as Line 51, refer to Figure 3-1) as a double-circuit 330 kV line.

Further details of the key tasks are provided below.

Earthwork and transmission line structure footing construction

Excavation work at each transmission line structure site would be required for the installation of foundations, levelling around the individual structure foundations, drainage and grading or preparation for construction at the structure site. Excavations would typically be up to five metres deep. Where groundwater is shallow, alternative construction methodologies and designs would be implemented (such as boring) to limit interaction with groundwater.

The typical transmission line structure piling depth would range from four metres up to 27 metres below ground level and would depend on the transmission line structure type and ground conditions (eg greater piling depths would be required where soft soil types are present).

The foundation type would also vary based on ground conditions and would be confirmed during detailed design. Foundation types could consist of bored or cast in-situ reinforced concrete piles, which would both be constructed by drilling holes in the ground, removing the spoil and filling the holes with concrete and steel reinforcement as required. Driven or screw piles could also be used. Driven piles would be constructed by driving or hammering a concrete or steel casing into the ground with the use of vibration; screw piles would be constructed by screwing a pile shaft into the ground. Use of driven and screw piles would minimise the amount spoil produced compared to bored or cast in-situ reinforced concrete piles.

If groundwater is encountered or the excavations are filled by rainwater, the excavation would be dewatered and appropriately managed.

A construction bench may be required to provide a level platform for equipment setup, the erection of the transmission line structure and other construction activities. Benching would be constructed using earthwork plant and equipment such as bulldozers, graders and excavators.

Excavated material would be stockpiled to be used for backfill around the transmission line structure foundations and embankment filling at the tower site from which it was excavated. Topsoil would be kept separate from the excavated material to allow for placement at ground level during backfilling. Any excess excavated material would be spread evenly around the site after completion of the foundation backfilling (if suitable), used elsewhere onsite or removed from the site and disposed of in accordance with the appropriate waste classification.

Blasting may be required depending on geotechnical conditions. This would be confirmed during detailed design and further construction planning and would be subject to further investigation (refer to Chapter 15 (Noise and vibration) for further detail).

Rebuild of the existing section of Line 51

The methodology for rebuilding the existing 330 kV single-circuit infrastructure would typically consist of the following key activities:

- disconnection and removal of the existing transmission lines
- dismantling of transmission line structures and removal from site (including removal of foundations to one metre below ground)
- erection of new transmission line structures for the rebuild of Line 51
- stringing of conductors, OHEW and OPGW
- installation of associated transmission line structure fittings, including all earthing below ground level.

Construction of transmission line structures

The transmission line structures would typically be assembled in sections on the ground and then hoisted or lifted into place using cranes. Alternatively, transmission line structures may be erected in place on the footings by installing individual members.

The transmission line structures would include elements such as step bolts, climbing attachment plates, ladders, platforms, climbing barriers, identification plates, warning plates, and other fixtures and fittings for the attachment of earth wires and insulators.

Stringing of the transmission lines

Once the structure is erected and secured, the transmission line would be strung by either ground pulled draw wire (with brake and winch sites), helicopter or line stringing drone.

The area required for the construction of each transmission line structure would require access for assembly and stringing work. At a typical site, this would include a temporary area of up to 50 metres by 70 metres at each transmission line structure location.

Where a transmission line structure is proposed to allow for a direction change of the transmission line, additional areas of 50 metres by 50 metres would be required to allow for brake and winch sites. Brake and winch sites needed for this activity are typically located about 150 metres away from the structure. Figure 4-6 provides an indicative diagram of how the transmission line would be strung.

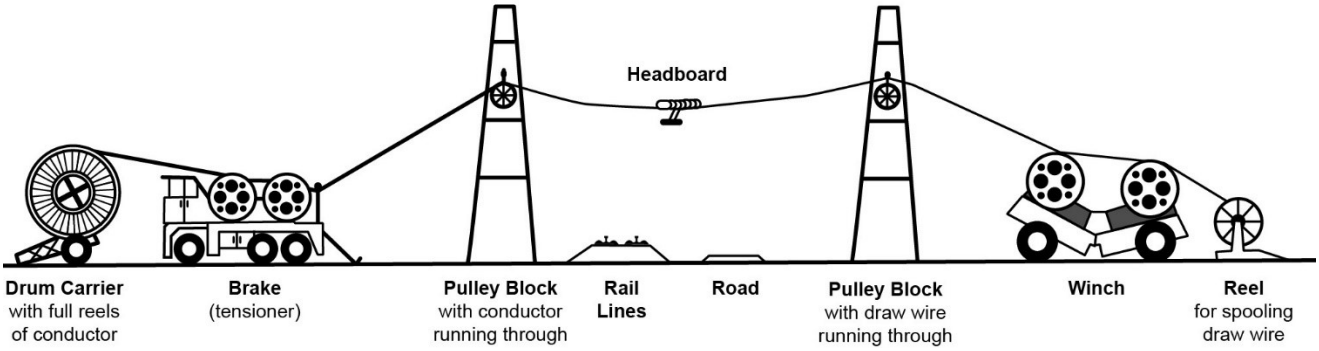


Figure 4-6 Diagram of how the transmission line would typically be strung over roads or railway lines

Transmission line crossings over waterways

The proposed transmission line would cross several key waterways including O'Briens Creek, Kyeamba Creek, Keajura Creek, Umbango Creek, Tarcutta Creek, Gilmore Creek, Tumut River, Adjungbilly Creek, Murrumbidgee River, Lachlan River, Wollondilly River and Tarlo River.

Generally, the design of the transmission line would include a transmission line structure on either side of each key waterway near the crossing location. A drone would then be used to take a lead wire over the waterway to allow cables to then be pulled and strung to each transmission line structure. In some locations (eg the crossing of the Wollondilly River and Pejar Dam) it may be impractical to use a drone, and in such cases alternative methods, such as watercraft, might be required.

It is not envisaged that any bridges would be required for stringing the transmission line over key waterways due to the design and proposed construction method of the transmission line at these locations.

To minimise potential impacts on recreational users of Pejar Dam, a temporary exclusion zone would be established during stringing work. The exclusion zone would be about 100 metres wide either side of the proposed transmission line route and all water activity would be restricted in this zone. The exclusion zone would only be in place for a short duration (a matter of hours) for each conductor and OHEW. In total, 24 conductors and two OHEWs would need to be strung over a period of about two to three weeks. General access and use of other sections of the dam would be maintained for recreational activities.

Transmission line crossings over road and railway lines

The proposed transmission line would cross:

- several classified roads – Tumbarumba Road, the Hume Highway, Batlow Road, the Snowy Mountains Highway, Gocup Road, Burrinjuck Road, Rye Park Road, Grabben Gullen Road, Crookwell Road/ Goulburn Road and Taralga Road
- one operational railway line – the Main Southern Railway Line
- local roads
- four non-operational railway lines.

Similar to the proposed method for stringing the transmission line over the key waterways outlined above, the design of the transmission line would include a transmission line structure on either side of each road or rail crossing location.

During stringing work over roads, it is expected road closures would be required with specific arrangements confirmed during detailed design in consultation with the relevant road authority and subject to the requirements of a road occupancy licence.

It is envisaged that all stringing work across the Main Southern Railway Line would be undertaken during rail possessions and would be undertaken in accordance with the rail line owner/operator's requirements. Stringing work across the four non-operational railway lines would have reduced construction and safety requirements and is unlikely to be restricted to certain time periods.

4.2.2.2. Substation construction and modification work

Overview

Substation work would be undertaken at the following locations:

- proposed Gugaa 500 kV substation: construction of a new 500/330 kV substation at Gregadoo, NSW
- Wagga 330 kV substation: modification of the existing 330/132 kV substation at Gregadoo, NSW to accommodate new bays for two new transmission line circuits
- Bannaby 500 kV substation: modification of the existing 500/330 kV substation at Bannaby, NSW to facilitate additional 500 kV transmission line circuits
- future Maragle 500 kV substation: connection to the future Maragle 500 kV substation previously approved under the Snowy 2.0 Transmission Connection Project (SSI-9717).

The final scope for the substation construction and modification work would be determined during detailed design. Further detail on the associated construction activities is provided below.

Proposed Gugaa 500 kV substation

The construction methodology for the proposed Gugaa 500 kV substation would generally include:

- bulk earthwork to form the substation bench, access roads, drainage, and oil containment structures
- excavation and installation of concrete foundations, bund walls, fire walls, noise walls and kerbs
- installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
- excavation and installation of electrical conduits, electrical trenches, general site stormwater drainage, oil containment work and associated concrete pits, pipes and tanks
- construction of two auxiliary services buildings
- erection of galvanised steel structures to support electrical equipment
- installation of electrical equipment on foundations and/or steel support structures
- installation of conductors, cabling, wiring, electrical panels and electrical equipment
- erection of the substation site boundary security fencing, including site access gates
- connection of the proposed transmission lines to the substation.

It is expected that the maximum foundation depths (piling) for structures associated with the proposed Gugaa 500 kV substation would be about 20 metres.

Blasting may be required, depending on ground conditions. This would be confirmed during detailed design and further construction planning and would be subject to further investigation (refer to Chapter 15 (Noise and vibration) for further detail).

Modification of the existing Wagga 330 kV substation

The construction methodology for the modification of the existing Wagga 330 kV substation would generally include:

- demolition and removal of redundant electrical equipment, fencing and cabling
- bulk earthwork to form the extended substation bench and modified drainage structures
- installation of concrete foundations and kerbs; the work would include excavation
- installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
- erection of galvanised steel structures to support electrical equipment
- installation of electrical equipment on foundations and/or steel support structures
- installation of electrical conduits, electrical trenches, and modified site stormwater drainage including excavation
- installation of conductors, cabling, wiring, electrical panels and electrical equipment
- installation of fencing, lighting and other security features
- connection of the proposed transmission lines to the substation.

It is expected that the maximum foundation depths (piling) for structures associated with the modified Wagga 330 kV substation would be about 20 metres.

Modification of the existing Bannaby 500 kV substation

The construction methodology for the modification of the existing Bannaby 500 kV substation would generally include:

- bulk earthwork to form the extended substation bench, new access road, modified stormwater drainage, modified oil containment and modified sediment control structures
- installation of concrete foundations, retaining walls, bund walls, fire walls and kerbs; the work would include excavation
- installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
- erection of galvanised steel structures to support electrical equipment
- installation of electrical equipment on foundations and/or steel support structures
- installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment work and associated concrete pits, pipes and tanks; the work would include excavation
- installation of conductors, cabling, wiring, electrical panels and electrical equipment
- installation of fencing, lighting and other security features
- demolition of redundant fencing including footings and kerbs
- connection of the proposed transmission lines to the substation.

It is expected that the maximum foundation depths (piling) for structures associated with the modified Bannaby 500 kV substation would be about 20 metres.

Blasting may be required, depending on ground conditions. This would be confirmed during detailed design and further construction planning and would be subject to further investigation (refer to Chapter 15 (Noise and vibration) for further detail).

Connection to the future Maragle 500 kV substation

The connection to the future Maragle 500 kV substation would generally include:

- stringing conductors between the proposed transmission line structures and the future Maragle 500 kV substation gantry (including OHEW and OPGW)
- installing droppers from the future substation gantry to the switchgear.

4.2.2.3. Telecommunications hut construction and connection

One optical repeater telecommunications hut is proposed to be constructed near the transmission line route at Killimicat (refer to Figure 3-1). The construction methodology for the telecommunications hut would involve:

- bulk earthwork to form the base for the telecommunications hut
- excavation and preparation for concrete foundations
- installation of reinforced concrete and piled foundations
- excavation and installation of electrical equipment conduits, trenches and general site drainage work
- installation of the building, site wiring and electrical equipment
- erection of security fencing, including site access gates
- surfacing and stabilising work for access, dust and vegetation suppression and drainage.

It is expected that the maximum foundation depths (piling) for structures associated with the telecommunications hut would be about three metres.

As discussed in Chapter 3 (Project description – infrastructure and operation), the project would connect with the Rye Park Wind Farm substation, which removes the need for an additional telecommunications hut in the eastern end of the project. The connection work would involve stringing OPGW between two proposed transmission line structures and the Rye Park Wind Farm substation. The connections between the transmission line structures and the Rye Park Wind Farm substation would be 200 to 350 metres long.

The Rye Park Wind Farm substation will be constructed separately to the project in accordance with the approved Rye Park Wind Farm project (SSD-6693).

4.2.3. Testing and commissioning

Pre-commissioning activities would form part of the final construction and installation work and would incorporate all tests and checks to confirm that construction quality assurance documentation, inspection and test plans, checklists and associated activities have been completed for each individual component of plant. This would be to ensure the project has been installed in accordance with the design and statutory standards and is safe to proceed to commissioning.

The key pre-commissioning and commissioning activities would include (but not be limited to):

- testing and commissioning of the new substation equipment
- point-to-point testing of the new transmission lines and substation connections
- earthing testing
- high voltage testing
- high voltage equipment operational checks
- testing of the installed protection, metering, control, and communication systems.

Once all high voltage and low voltage testing is completed, the electrical protection systems have been set and all quality assurance documentation has been completed, commissioning would proceed.

The key activities involved in the main commissioning process may include (but not be limited to):

- transmission line cut-in and connection to the electrical network
- protection, control and metering checks
- high voltage equipment operation and energisation
- audible noise, thermographic imaging and electric and magnetic field (EMF) testing
- any necessary testing of site related systems.

The new substation components would be commissioned and integrated with any Transgrid external facilities, as necessary.

4.2.4. Demobilisation and rehabilitation

Demobilisation and site rehabilitation would be undertaken progressively throughout the project footprint and would include the following typical activities:

- demobilisation of construction compounds and the worker accommodation facility
- removal of materials, waste and redundant structures not required during operation of the project
- removal of temporary fencing and environmental controls.

Disturbed areas would be restored to their previous condition as far as practicable in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom, 2004) or other comparable guidelines. Some areas would be landscaped, which would include replacement of topsoil and establishment of grass or suitable vegetation. Work may also be undertaken to restore:

- natural drainage in areas where temporary facilities were provided
- fences, gates and other property infrastructure, which may have been damaged during construction.

Installation of any permanent Transgrid property boundary fence surrounding the substation sites and telecommunications hut would also likely occur during this phase.

Topsoil stockpiled during site establishment would be reused for revegetation and rehabilitation work where required.

Construction areas that do not include permanent infrastructure and are outside of an APZ would be rehabilitated as soon as practicable consistent with the existing surrounding landscape and any operational maintenance requirements. Where required, rehabilitation would be carried out in consultation with the relevant council and/or affected landowner/s.

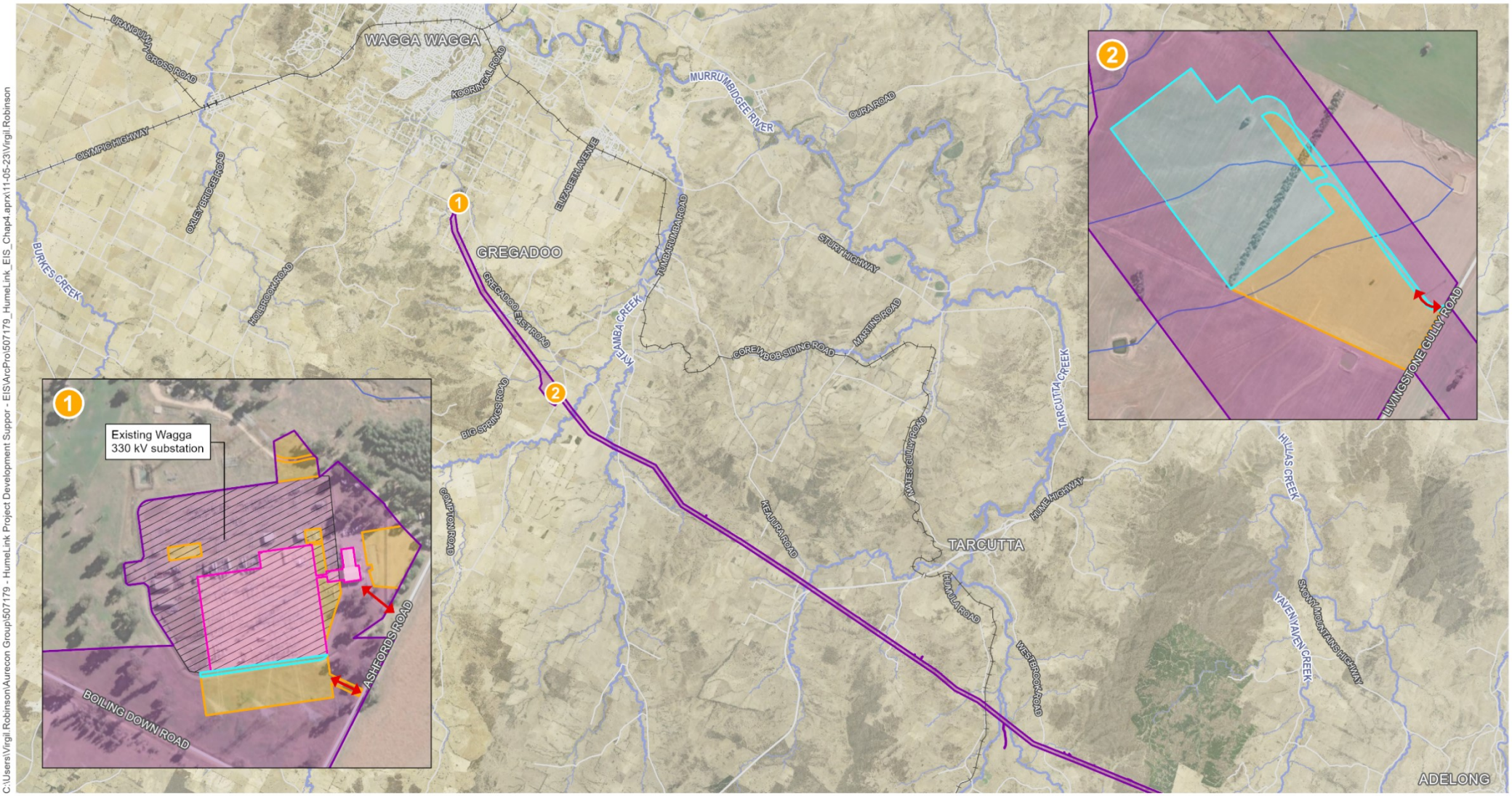
4.3. Ancillary facilities for construction

4.3.1. Construction compounds

Construction compounds would be required to support the construction of the project. As discussed in Chapter 2 (Strategic context and project need), potential construction compound locations have been identified based on a number of factors and in consultation with relevant councils. A shortlist of 14 potential construction compounds has been nominated for consideration as part of the EIS. This shortlisting has resulted in the unique construction compound identifier not being sequential.

The 14 potential construction compound sites are located in Gregadoo, Gilmore, Red Hill, Adjungbilly, Yass, Woodhouselee, Bannaby, Batlow and Nurenmerenmong. The proposed use of the construction compounds, the boundaries and layout would be refined as the project design develops in consultation with relevant stakeholders and the construction contractors. Depending on the construction phasing and methodology, the construction contractors may elect not to use all nominated potential construction compounds. The process described in Section 4.3.2.3 would be followed should additional construction compounds be required.

Figure 4-7 shows the indicative location of construction compounds.



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Project footprint
Construction compound site
Modifications to existing substation
Indicative new substation area
Indicative access point
Waterway
Railway

Construction ancillary facilities

1. Wagga 330 kV substation compound (C01)
2. Gregadoo Road compound (C06)

Canberra

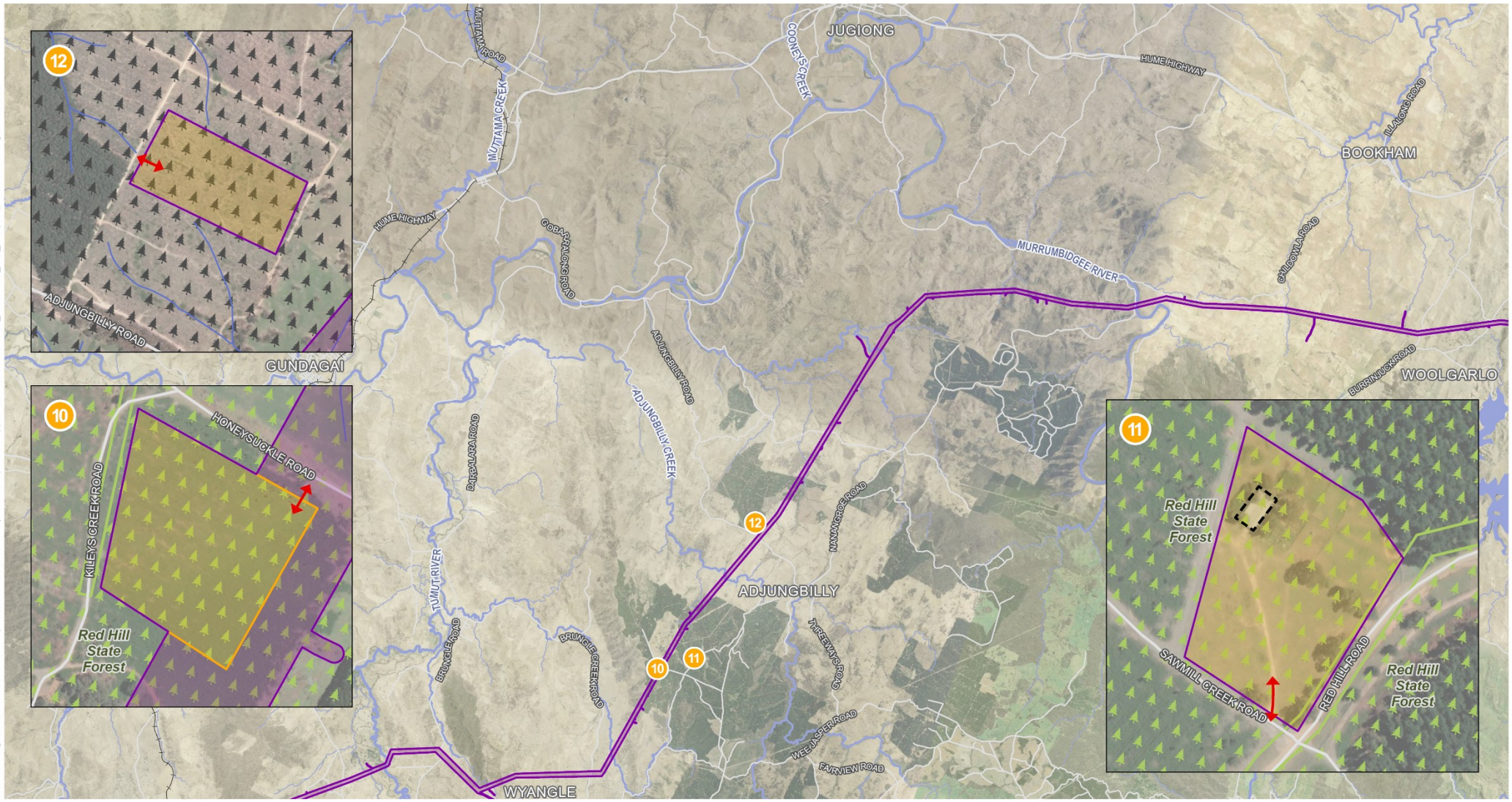
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Projection: GDA 1994 MGA Zone 55

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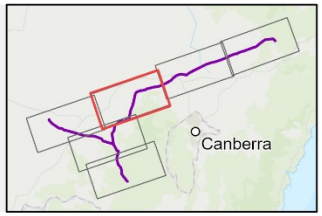
Figure 4-7a: Overview of ancillary facilities



Project footprint
Construction compound site
Existing building
Indicative access point
Private plantation
State forest
Waterway
Railway

Construction ancillary facilities

10 Honeysuckle Road compound (C07)
11 Red Hill Road compound (C08)
12 Adjungbilly Road compound (C09)



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

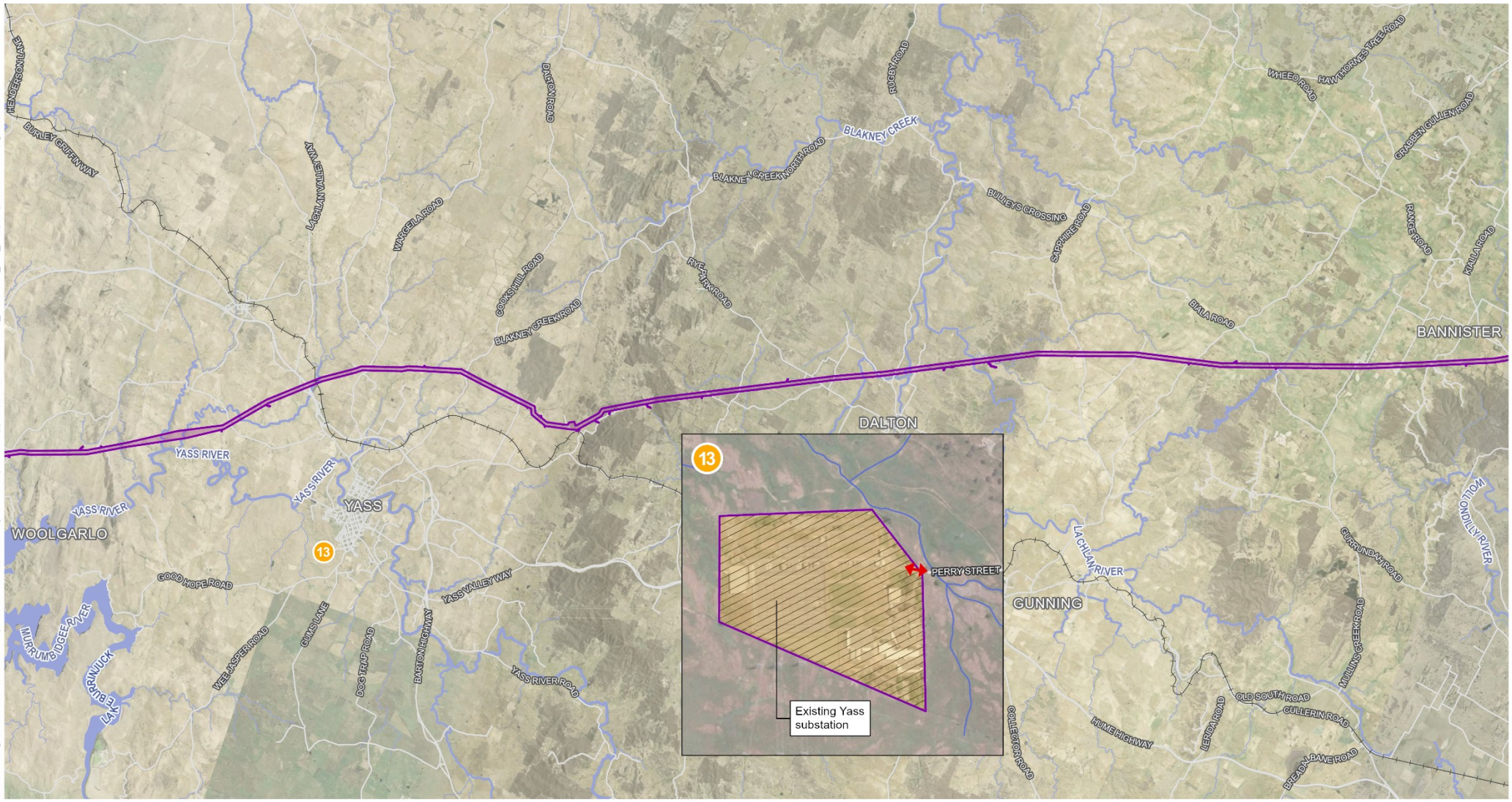
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Projection: GDA 1994 MGA Zone 55

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Figure 4-7b: Overview of ancillary facilities

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

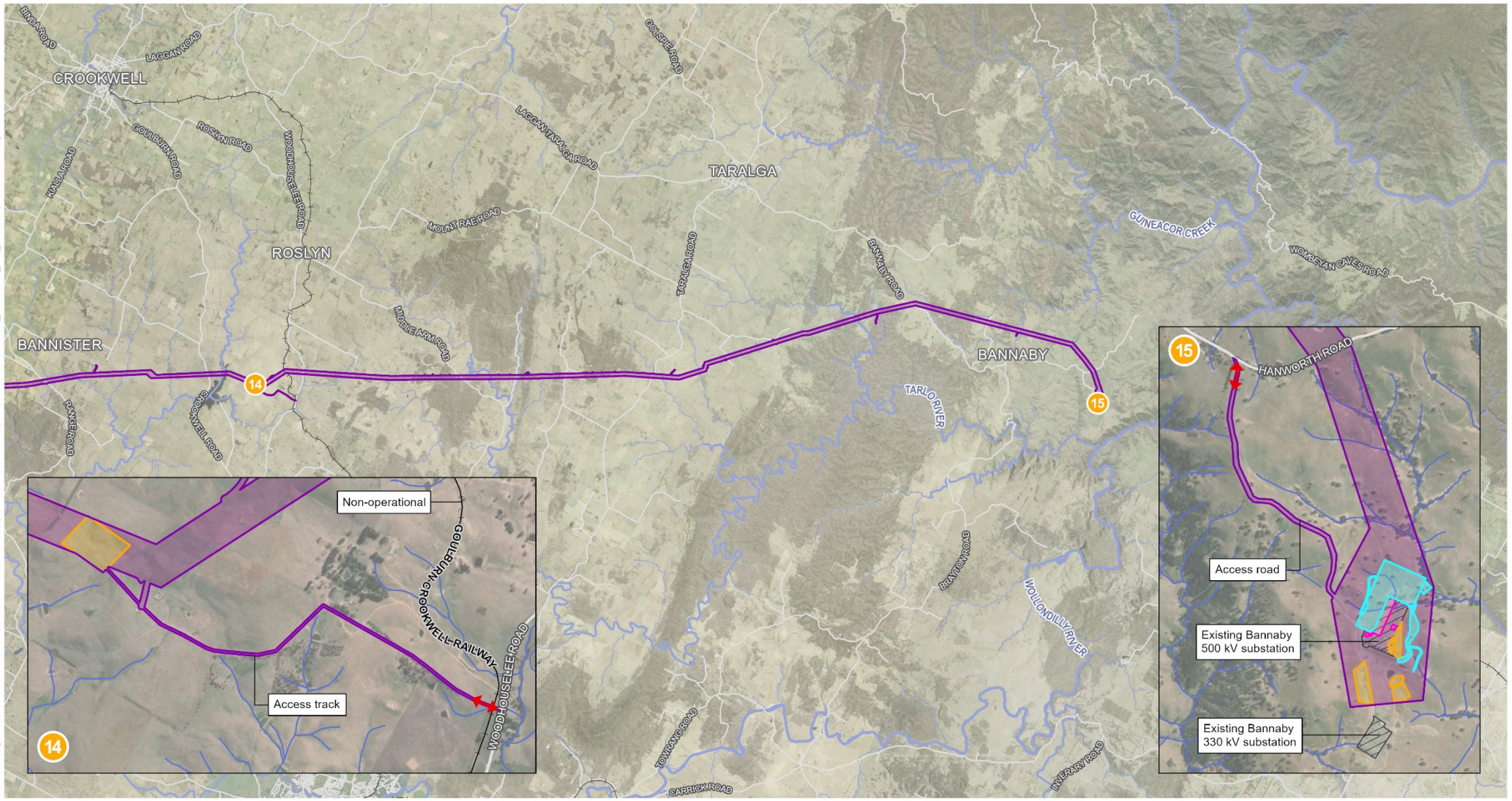
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Projection: GDA 1994 MGA Zone 55

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Figure 4-7c: Overview of ancillary facilities



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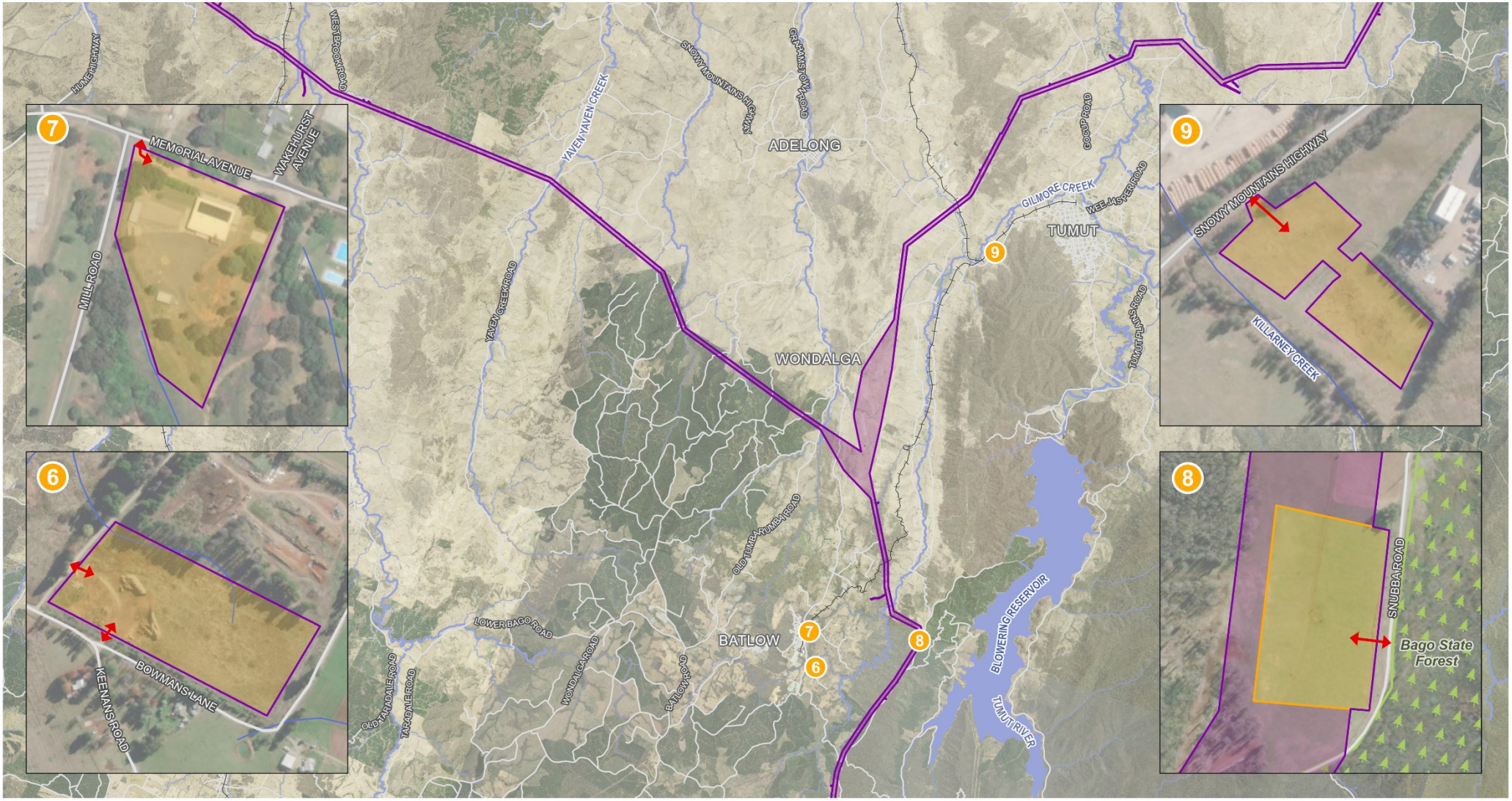
Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 4-7d: Overview of ancillary facilities

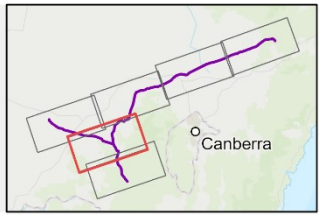


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Project footprint
Construction compound site
Indicative access point
State forest
Waterway
Railway

Construction ancillary facilities

6 Bowmans Lane compound (C15)
7 Memorial Avenue compound (C14)
8 Snubba Road compound (C03)
9 Snowy Mountains Highway compound (C02)



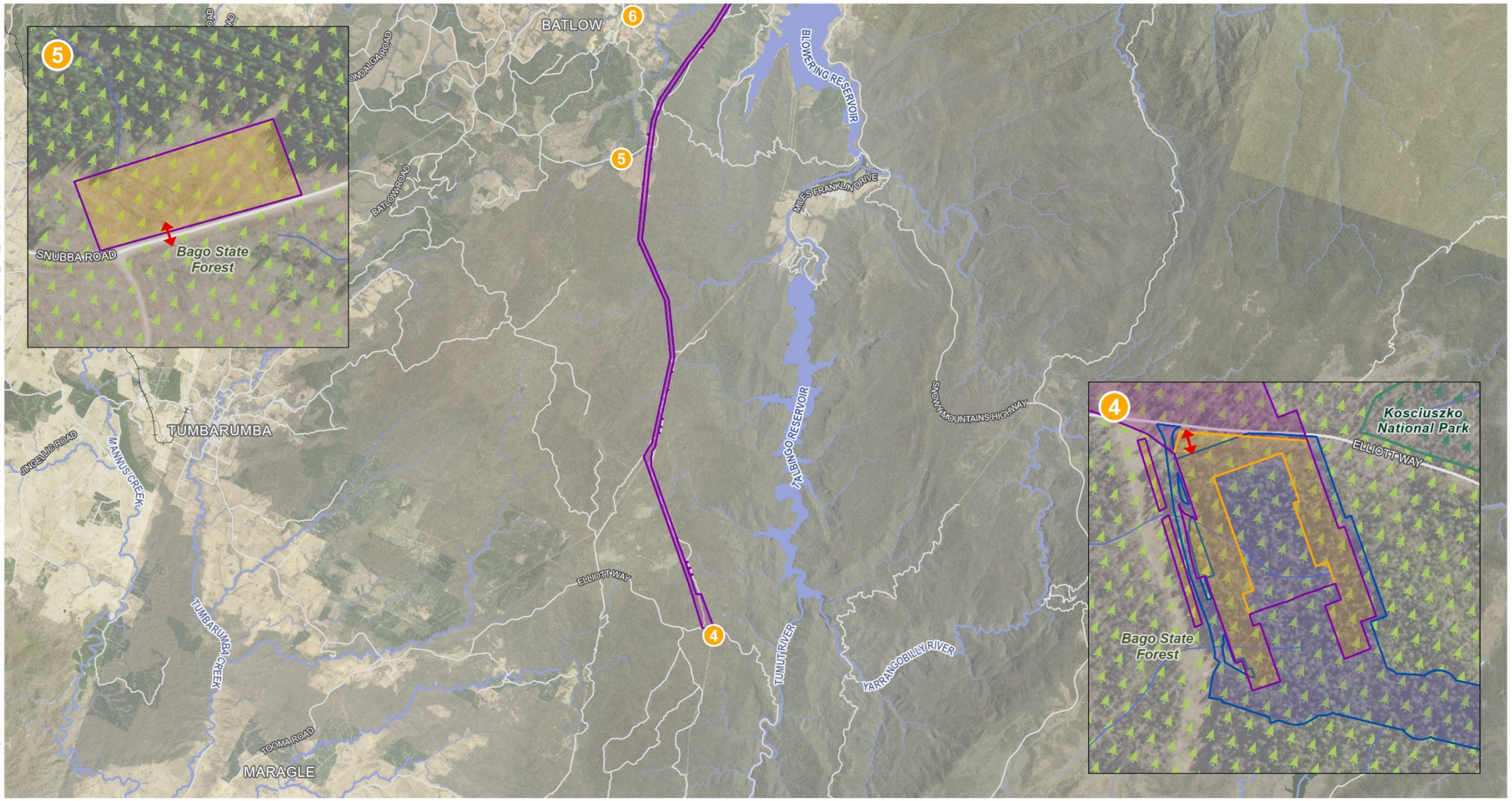
Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 4-7e: Overview of ancillary facilities



Project footprint
Worker accommodation facility site
Construction compound site
Future Maragle 500 kV substation delivered as part of Snowy 2.0 Transmission Connection Project (SSI-9717)
Indicative access point

National park and reserve
State forest
Waterway
Railway

Construction ancillary facilities

4 Maragle 500 kV substation compound (C05)
5 Snubba Road compound (C16)
6 Bowmans Lane compound (C15)

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

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Projection: GDA 1994 MGA Zone 55

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Figure 4-7f: Overview of ancillary facilities

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Before work begins at these construction compounds, temporary lease agreements would be established with property owners for use of their land.

The construction compounds would accommodate a range of facilities, which may include:

- storage and laydown areas
- crushing and screening plants
- stockpiling areas
- vehicle and equipment storage
- maintenance sheds
- chemical and fuel stores
- parking areas
- demountable site offices and amenities.

A concrete batching plant is expected to be established at the Bannaby 500 kV substation compound (C12). It is anticipated that the concrete batching plant would be a mobile plant with the capability of batching around 50 tonnes of concrete per hour. The plant would likely only be required early in the construction period for a period of two to three months. The type of concrete batching plant and expected establishment and duration timeframes would be confirmed during detailed design and further construction planning.

All construction compounds would be appropriately fenced to secure the work site and provide a level of protection from external influences. If required, hoarding may be implemented. Where higher value equipment/material is being stored (eg cabling), additional security measures such as security patrols or security cameras may be employed to protect from theft. In addition, construction compounds would include temporary lighting, measures to protect against fire and appropriate water quality and erosion and sediment controls.

Wastewater treatment facilities may also be established at the Gregadoo Road compound (C06) and the Bannaby 500 kV substation compound (C12) (refer to Section 4.5.2.1 for further detail).

The construction compounds would be in place throughout the entire construction period (up to 2.5 years) and would typically operate in accordance with the standard construction hours detailed in Section 4.6.

Following completion of construction, the construction compounds would be cleared of any temporary infrastructure and equipment and rehabilitated as detailed in Section 4.2.4.

Further detail on each construction compound is provided in the following sections.

4.3.1.1. Wagga 330 kV substation compound (C01)

A construction compound is proposed to be established at the Wagga 330 kV substation to support transmission line construction as well as modification to the existing Wagga 330 kV substation. A summary of the key features of the construction compound is included in Table 4-5. The Wagga 330 kV substation compound (C01) is shown on Figure 4-7a.

Table 4-5 Key features of Wagga 330 kV substation compound (C01)

Key feature	Summary
Site area	Approximately 1.92 ha
Ownership	Transgrid
Land zoning	RU1 Primary Production
Site description	Located in the Wagga Wagga City LGA at the site of the existing Wagga 330 kV substation on the corner of Ashfords Road and Boiling Down Road, Gregadoo. The construction compound would be surrounded by residential and farm infrastructure land uses and is located on level ground. Ground conditions are a mix of hardstand associated with the existing Wagga 330 kV substation and vegetation consisting mainly of pasture grasses. Isolated trees surround the construction compound along Ashfords Road and Boiling Down Road. The closest sensitive receiver is a residential dwelling located about 270 m south-east of the construction compound. The closest waterbody to the construction compound is a farm dam about 170 m to the south-west. Boiling Down Creek is located about 270 m further west from the construction compound.
Access arrangements	Access to the construction compound would be via a temporary connection with Ashfords Road. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.1.2. Snowy Mountains Highway compound (C02)

A construction compound is proposed to be established adjacent Snowy Mountains Highway to support the transmission line construction. A summary of the key features of the construction compound is included in Table 4-6. Snowy Mountains Highway compound (C02) is shown on Figure 4-7e.

Table 4-6 Key features of Snowy Mountains Highway compound (C02)

Key feature	Summary
Site area	Approximately 1.38 ha
Ownership	Snowy Valleys Council
Land zoning	IN1 General Industrial
Site description	Located in the Snowy Valleys LGA, off the Snowy Mountains Highway, south of the Tumut Resource Recovery Centre at Gilmore. The construction compound would be in an area of agricultural land. However, the land was rezoned for industrial use in 2021 under the Tumut Local Environmental Plan 2012. The construction compound is located on moderately sloping land which has been largely cleared of vegetation. Groundcover consists of pasture grasses. Killarney Creek is located about 10 m south of the construction compound. The closest sensitive receiver is a residence about 500 m south-west of the construction compound.
Access arrangements	Access to the construction compound would be via a temporary connection with Snowy Mountains Highway about 380 m north of its intersection with Gilmore Mill Road. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.1.3. Snubba Road compound (C03)

A construction compound is proposed to be established adjacent Snubba Road to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-7. Snubba Road compound (C03) is shown on Figure 4-7e.

Table 4-7 Key features of Snubba Road compound (C03)

Key feature	Summary
Site area	Approximately 5.12 ha
Ownership	Private property
Land zoning	RU1 Primary Production
Site description	Located in the Snowy Valleys LGA along Snubba Road, Gilmore, about 6 km east of Batlow town centre. The construction compound would be in an area of agricultural land, on moderately sloping land. Vegetation within the construction compound is limited to groundcover consisting mainly of pasture grasses. Bago State Forest surrounds the construction compound to east, south and west. Unnamed drainage lines are located to the east and west of the construction compound with the closest being about 360 m to the east. The closest sensitive receiver is a residence about 750 m north of the construction compound.
Access arrangements	Access to the construction compound would be via a temporary connection with Snubba Road. Minor roadwork would be required to facilitate access.

4.3.1.4. Maragle 500 kV substation compound (C05)

A construction compound is proposed to be established at the future Maragle 500 kV substation to support transmission line construction and connection to the future Maragle 500 kV substation.

The area proposed for the construction compound would overlap with the area required for construction and installation of the substation as described in *Snowy 2.0 Transmission Connection Project Amendment Report* (Transgrid, 2022). Coordination between the respective construction contractors of Snowy 2.0 Transmission Connection Project and HumeLink regarding the use of Maragle 500 kV substation compound (C05) may be needed to ensure any required environmental management requirements are satisfied. Refer to Chapter 25 (Cumulative impacts) for further consideration of the Snowy 2.0 Transmission Connection Project.

A summary of the key features of the construction compound is included in Table 4-8. The Maragle 500 kV substation compound (C05) is shown on Figure 4-7f.

Table 4-8 Key features of Maragle 500 kV substation compound (C05)

Key feature	Summary
Site area	Approximately 11.97 ha
Ownership	Acquisition currently underway for Snowy 2.0 Transmission Connection Project
Land zoning	RU3 Forestry
Site description	Located in the Snowy Valleys LGA at the site of the future Maragle 500 kV substation at Nurenmerenmong, about 27 km west of Tumbarumba. The construction compound would be surrounded by Bago State Forest. Vegetation within the construction compound consists of a mix of shrubby open forest and woodland which will be cleared as part of connection work to the future Maragle 500 kV substation. The construction compound consists of undulating land and includes two drainage lines, an unnamed drainage line in the northern portion and New Zealand Gully located in the southern portion. Yorkers Creek is located about 190 m to the north of the construction compound. There are no nearby sensitive receivers.
Access arrangements	Access to the construction compound would be via a temporary connection with Elliott Way. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.1.5. Gregadoo Road compound (C06)

A construction compound is proposed to be established at the proposed Gugaa 500 kV substation to support transmission line construction and construction of the proposed Gugaa 500 kV substation. A summary of the key features of the construction compound is included in Table 4-9. The Gregadoo Road compound (C06) is shown on Figure 4-7a.

Table 4-9 Key features of Gregadoo Road compound (C06)

Key feature	Summary
Site area	Approximately 16.40 ha
Ownership	Private property
Land zoning	RU1 Primary Production
Site description	Located in the Wagga Wagga City LGA on private property off Livingstone Gully Road, Gregadoo, about 20 km south-east of Wagga Wagga central business district. The construction compound would be in an area of agricultural land, on sloping land. Vegetation within the construction compound is mainly limited to groundcover consisting of pasture grasses. A row of trees is located in the western portion of the construction compound. The closest sensitive receiver is a residence located about 580 m north of the construction compound. Two unnamed drainage lines are located in the western half of the construction compound and a farm dam is located adjacent to the southern boundary. Big Spring Creek is located about 630 m west of the construction compound.
Access arrangements	Access to the construction compound would be via temporary connection with Livingstone Gully Road. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.1.6. Honeysuckle Road compound (C07)

A construction compound is proposed to be established adjacent Honeysuckle Road to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-10. The Honeysuckle Road compound (C07) is shown on Figure 4-7b.

Table 4-10 Key features of Honeysuckle Road compound (C07)

Key feature	Summary
Site area	Approximately 8.20 ha
Ownership	FCNSW
Land zoning	RU3 Forestry
Site description	Located in Snowy Valleys LGA at the corner of Honeysuckle Road and Kileys Creek Road, Red Hill about 20 km north-west of Tumut. The construction compound would be in an area of forestry land within Red Hill State Forest, on moderately sloping land. Vegetation within the construction compound is limited to softwood forestry plantation. The nearest waterway to the construction compound is an unnamed drainage line located about 80 m to the west. Kiley Creek is located about 300 m south of the construction compound. There are no nearby sensitive receivers.
Access arrangements	Access to the construction compound would be via temporary connection with Honeysuckle Road. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.1.7. Red Hill Road compound (C08)

A construction compound is proposed to be established adjacent Red Hill Road to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-11. The Red Hill Road compound (C08) is shown on Figure 4-7b.

Table 4-11 Key features of Red Hill Road compound (C08)

Key feature	Summary
Site area	Approximately 2.59 ha
Ownership	FCNSW
Land zoning	RU3 Forestry
Site description	Located in the Cootamundra-Gundagai Regional LGA at the corner of Red Hill Road and Sawmill Creek Road, Adjungbilly about 22 km north-west of Tumut. The construction compound would be in an area of forestry land use within Red Hill State Forest, on relatively level land. The site is currently used to support forestry operations and the existing building located on the site would be incorporated and used as part of the construction compound. The nearest waterway to the construction compound is an unnamed drainage line located about 340 m to the west. Sawmill Creek is located about 440 m north-east of the construction compound at its closest point. A farm dam is also located adjacent the north-eastern corner of the construction compound. There are no nearby sensitive receivers.
Access arrangements	Access to the construction compound would be via the existing property accesses off Sawmill Creek Road and/or the unnamed road.

4.3.1.8. Adjungbilly Road compound (C09)

A construction compound is proposed to be established off Adjungbilly Road to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-12. The Adjungbilly Road compound (C09) is shown on Figure 4-7b.

Table 4-12 Key features of Adjungbilly Road compound (C09)

Key feature	Summary
Site area	Approximately 12.09 ha
Ownership	Private property
Land zoning	RU1 Primary Production
Site description	Located in the Cootamundra-Gundagai Regional LGA off Adjungbilly Road, Adjungbilly, about 23 km east of Gundagai. The construction compound would be on undulating land in the Black Flat forest area, which is a private plantation. Vegetation within the construction compound is limited to plantation forest. Unnamed drainage lines are located about 20 m adjacent to the northern and southern boundaries of the construction compound and the headwaters of Cotway Creek are located about 270 m to the west. The closest sensitive receiver is a residence about 780 m south-west of the construction compound.
Access arrangements	Access to the construction compound would be via the existing Black Flat forest area access from Adjungbilly Road.

4.3.1.9. Yass substation compound (C10)

A construction compound is proposed to be established at the existing Yass substation to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-13. The Yass substation compound (C10) is shown on Figure 4-7c.

Table 4-13 Key features of Yass substation compound (C10)

Key feature	Summary
Site area	Approximately 21.44 ha
Ownership	Transgrid
Land zoning	SP2 Infrastructure
Site description	Located in the Yass Valley LGA at the site of the existing Yass substation at Perry Street, Yass. The construction compound would be in an operational Transgrid substation, and the project would only utilise available land and existing hardstand areas and facilities for the purposes of the project. The construction compound would be surrounded by residential and farm infrastructure land. Several unnamed drainage lines are located immediately north of the construction compound, with the closest being about 10 m. These drainage lines flow into Booroo Ponds which is located about 620 m west of the construction compound. The closest sensitive receiver is a residence about 640 m north-east of the construction compound.
Access arrangements	Access to the construction compound would be via the existing Perry Street access to the Yass substation.

4.3.1.10. Woodhouselee Road compound (C11)

A construction compound is proposed to be established off Woodhouselee Road to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-14. The Woodhouselee Road compound (C11) is shown on Figure 4-7d.

Table 4-14 Key features of Woodhouselee Road compound (C11)

Key feature	Summary
Site area	Approximately 5.00 ha
Ownership	Private property
Land zoning	E3 Environmental Management
Site description	Located in Upper Lachlan Shire LGA on private property off Woodhouselee Road, Woodhouselee. The construction compound would be in an area of agricultural land, on sloping land. Vegetation within the construction compound is limited to groundcover consisting of pasture grasses. The closest sensitive receiver is a residence about 1.1 km east of the construction compound. Several unnamed drainage lines and farm dams are located south of the construction compound, with the closest being about 80 m. These drainage lines flow into Pejar Creek and the Wollondilly River about 1.3 km to the south-west of the construction compound.
Access arrangements	Access to the construction compound would be via the existing property access on Woodhouselee Road. An additional access track would also be constructed to the site.

4.3.1.11. Bannaby 500 kV substation compound (C12)

A construction compound is proposed to be established at the existing Bannaby 500 kV substation to support transmission line construction and modification of the existing Bannaby 500 kV substation. A summary of the key features of the construction compound is included in Table 4-15. The Bannaby 500 kV substation compound (C12) is shown on Figure 4-7d.

Table 4-15 Key features of Bannaby 500 kV substation compound (C12)

Key feature	Summary
Site area	Approximately 2.75 ha
Ownership	Transgrid
Land zoning	RU2 Rural Landscape
Site description	Located in Upper Lachlan Shire LGA at the site of the existing Bannaby 500 kV substation at Hanworth Road, Bannaby. The construction compound would be in an operational Transgrid substation, and the project would utilise available cleared land and existing hardstand areas for the purposes of the project. The construction compound is surrounded by agricultural land and several unnamed drainage lines. The closest drainage line is about 20 m to the south of the construction compound. Farm dams are also located surrounding the construction compound. The closest sensitive receiver is a residence about 480 m south-east of the construction compound.
Access arrangements	Access to the construction compound would be via the existing Hanworth Road access to the Bannaby 500 kV substation. The existing access would be upgraded as part of the project as discussed in Section 4.2.1.6.

4.3.1.12. Memorial Avenue compound (C14)

A construction compound is proposed to be established adjacent Memorial Avenue to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-16. The Memorial Avenue compound (C14) is shown on Figure 4-7e.

Table 4-16 Key features of Memorial Avenue compound (C14)

Key feature	Summary
Site area	Approximately 2.03 hectares
Ownership	Private
Land zoning	IN1 General Industrial
Site description	Located in the Snowy Valleys LGA at the corner of Memorial Avenue and Mill Road, Batlow. The construction compound would be in an area that is used for commercial services and surrounded by mixed use, recreational and residential land uses. The construction compound would be located on relatively level land and consists of an existing administration building, various sheds and maintenance facilities, and a hardstand area. The existing building and facilities would be used as part of the construction compound as required. Amenity and street trees are predominantly located along the property boundary. Residential areas and other sensitive land uses surround the construction compound including Batlow Community Pool, Memorial Park, Railway Yard Rotary Park and Batlow Ambulance Station. The closet residence is about 35 m north of the construction compound on Wakehurst Avenue. The nearest waterway to the construction compound is an unnamed drainage line located within 10 m of the southern boundary.
Access arrangements	Access to the construction compound would be via the existing property access at the corner of Memorial Avenue and Mill Road.

4.3.1.13. Bowmans Lane compound (C15)

A construction compound is proposed to be established adjacent Keenans Road/Bowmans Lane to support transmission line construction. A summary of the key features of the construction compound is included in Table 4-17. The Bowmans Lane compound (C15) is shown on Figure 4-7e.

Table 4-17 Key features of Bowmans Lane compound (C15)

Key feature	Summary
Site area	Approximately 5.74 ha
Ownership	Snowy Valleys Council
Land zoning	RU1 Primary Production
Site description	Located in the Snowy Valleys LGA adjacent the Batlow waste depot along Keenans Road/Bowmans Lane, Batlow. The construction compound would be surrounded by an area of residential and farm infrastructure land use, on undulating land. The construction compound is cleared and has previously been used to store green waste following the 2019-2020 bushfires. The closest sensitive receiver is a residence about 50 m south of the construction compound. Other nearby dwellings are located along Keenans Road and Bowmans Lane. An unnamed drainage line is located in the northern portion of the construction compound which flows into Little Gilmore Creek about 170 m to the west of the construction compound. A farm dam is located about 20 m west of construction compound.
Access arrangements	Access to the construction compound would be via the existing property access on Keenans Road.

4.3.1.14. Snubba Road compound (C16)

A construction compound is proposed to be established adjacent Snubba Road to support transmission line construction. Snubba Road compound (C16) is located about 10 kilometres south of Snubba Road compound (C03). A summary of the key features of the construction compound is included in Table 4-18. The Snubba Road compound (C16) is shown on Figure 4-7f.

Table 4-18 Key features of Snubba Road compound (C16)

Key feature	Summary
Site area	Approximately 2.64 ha
Ownership	Crown land (managed by FCNSW)
Land zoning	RU3 Forestry
Site description	Located in the Snowy Valleys LGA along Snubba Road, Batlow, about nine km south of Batlow town centre. The construction compound would be in an area of forestry land within Bago State Forest, on moderately undulating land. The location is currently cleared of vegetation but has previously supported softwood forestry plantation. Unnamed drainage lines of Gilmore Creek are the closest waterway to the construction compound and are located about 20 m to the west. The drainage lines flow into Gilmore Creek about 380 m west of the construction compound. There are no nearby sensitive receivers.
Access arrangements	Access to the construction compound would be via a temporary connection with Snubba Road. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

4.3.2. Other ancillary facilities and support sites

4.3.2.1. Work areas along transmission lines

A number of minor storage and laydown areas would be required along the project footprint for the temporary storage of materials, plant and equipment required to construct the various elements of the project (in particular transmission line structures).

These sites would be in place for shorter periods at locations suitable to support the construction work as they move along the transmission line route. Establishment of these sites would include appropriate water quality and erosion and sediment controls as required. Upon completion of work, these ancillary sites would be cleared of any temporary infrastructure and equipment and rehabilitated as detailed in Section 4.2.3.

These sites would be in place for shorter periods at locations suitable to support the construction work as they move along the transmission line route.

Before work begins at these sites, temporary lease agreements would be established with property owners for use of their land, where required.

4.3.2.2. Helipad/helicopter facilities

Helicopters may be used to deliver materials and equipment and to transfer personnel to construction areas, particularly within high alpine regions. Helicopters may also be used for stringing of the transmission lines (to be determined during detailed design). To enable helicopters to operate safely and allow easy access to the site, a helicopter landing pad (helipad) would be required. The helipad is expected to occupy an area of around 30 metres by 30 metres, and would be remediated after construction. These areas would typically be located on existing disturbed land not subject to inundation and a reasonable distance from waterways, sensitive receivers and drainage lines.

The following locations have been identified and assessed as potential helipad locations:

- options for southern area of construction:
  - Maragle 500 kV substation compound (C05), Bowmans Lane compound (C15), Snubba Road compound (C16) or Snubba Road compound (C03)
- options for central area of construction:
  - Honeysuckle Road compound (C07), Red Hill Road compound (C08), or Adjungbilly Road compound (C09)
- options for north-east area of construction:
  - Woodhouselee Road compound (C11) or Bannaby 500 kV substation compound (C12).

Only one of these options in each area is likely to be required during construction. The exact locations to be used would be confirmed during detailed design by the construction contractors. In addition, the existing facilities at Wagga Wagga Airport and Tumut Airport may be used.

4.3.2.3. Additional ancillary facilities

The following factors, in general order of priority, would be considered when selecting sites for other ancillary facilities, helicopter landing pads, support sites and/or construction compounds, should any of these be required:

- located in areas which have previously been disturbed, or would already require disturbance as part of the construction of the project
- no impacts to threatened species (or their habitats) or threatened ecological communities (within the meaning of the *Biodiversity Conservation Act 2016* (BC Act) or the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act))
- located in areas of identified lower ecological and heritage value
- located an appropriate distance from waterways (refer to Chapter 17 (Surface water and groundwater quality))
- located an appropriate distance from sensitive receivers to minimise potential impacts (ie enabling adequate separation from residential buildings) with consideration of matters such as compliance with the *Interim Construction Noise Guideline* (DECC, 2009), traffic and access impacts, dust impacts, and visual (including light spill) impacts

- located on relatively level ground to minimise earthwork requirements and offsite drainage and flooding risks
- proximity to key construction activities to minimise duration of travel for workers and transport of materials and equipment
- easily accessible for heavy vehicle construction traffic (including deliveries).

Appropriate mitigation measures may be required at sites where factors cannot be adequately addressed. The selected sites would also be subject to additional environmental assessment or consistency review, as relevant. This would include considering consistency with the assessment contained in this environmental impact statement including relevant mitigation measures, environmental performance outcomes and any future conditions of approval.

4.3.3. Worker accommodation facility

Existing accommodation facilities within towns adjacent to the project (eg Goulburn, Yass, Tumut, and Wagga Wagga) would provide temporary accommodation for the majority of the construction workers. However, a potential shortfall in available accommodation has been identified close to the project footprint.

A temporary worker accommodation facility on the corner of Courabyra Road and Alfred Street, Tumbarumba (Tumbarumba accommodation facility (AC1)) has been identified as a potential option to accommodate about 200 construction workers. The worker accommodation facility would include temporary fencing, lighting, fire protection and appropriate water quality and erosion and sediment controls.

However, the ultimate delivery of the project may include multiple temporary worker accommodation facilities in various forms, which would be outlined in the Worker Accommodation Strategy for the project. Transgrid and other stakeholders would be consulted to identify additional potential options in the Worker Accommodation Strategy for the project. Any new or changed worker accommodation facility would be subject to additional environmental assessment in accordance with the process described in Chapter 26 (Environmental management), as required.

A summary of the key features of the worker accommodation facility is included in Table 4-19 and the location is shown on Figure 4-8.

Table 4-19 Key features of Tumbarumba accommodation facility (AC1)

Key feature	Summary
Site area	Approximately 21.44 ha
Ownership	Snowy Valleys Council
Land zoning	RU1 Primary Production
Site description	Located in the Snowy Valleys LGA at the corner of Courabyra Road and Alfred Street, Tumbarumba, about 2 km north-west of the Tumbarumba town centre. The worker accommodation facility would be in an area of agricultural land, on gently sloping land. This area has been largely cleared of vegetation. Groundcover consists of pasture grasses. Two unnamed drainage lines run north to south through the worker accommodation facility area. The closest sensitive receiver is a residence about 50 m west of the worker accommodation facility. An additional four dwellings are located between 80 to 200 m north and south of the worker accommodation facility site.

Key feature	Summary
Facilities and use	The facilities would include: • provision to accommodate about 200 construction workers including 20 15 m long demountable accommodation cabins and a mess hall • new connections to water, power and wastewater services, which may require some work to be carried out outside of the project footprint to ensure appropriate connections and minimal disruption to existing services • parking for about 100 light vehicles, 12 mini-buses and 12 heavy vehicles.
Access arrangements	Temporary access to the worker accommodation facility would be provided via Courabyra Road and Alfred Street. Road improvement work would be required to facilitate access (refer to Section 4.2.1.6).

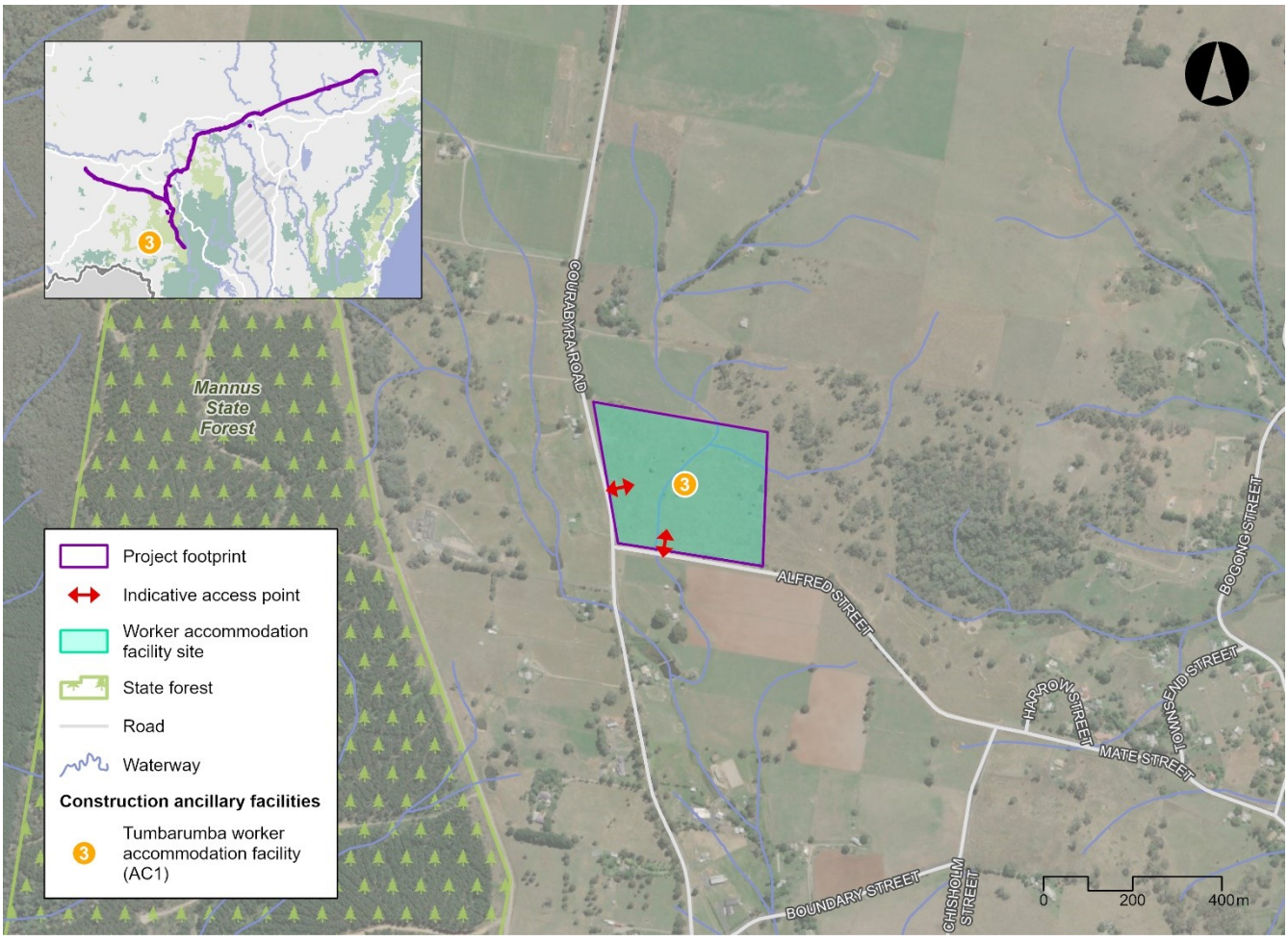


Figure 4-8 Location of Tumbarumba accommodation facility (AC1)

4.4. Plant and equipment

An indicative list of construction plant and equipment likely to be required during construction is provided below. Not all the equipment identified below would be required for all phases of construction. The final list of plant and equipment required for construction would depend on the detailed construction methodology developed by the construction contractors.

- air compressor
- backhoe
- bobcat
- bulldozers
- concrete agitator
- concrete pump
- cranes (various sizes up to 400 tonnes)
- crawler crane with grab attachments
- drill and blast units and associated support plant/equipment
- drones
- dumper trucks
- elevated working platforms
- excavators (various sizes)
- flatbed hiab trucks
- fuel trucks
- generators
- graders
- helicopters and associated support plant/equipment
- mulchers
- piling rig
- pneumatic jackhammers
- rigid tippers
- rollers (10 to 15 and 12 to 15 tonnes)
- semi-trailers
- tilt tray trucks
- trenchers
- transport trucks
- watercarts
- winches.

4.5. Resources and materials

4.5.1. Earthwork

Earthwork, including excavations and filling, would be required for activities such as construction of the transmission line structures and the new substation site, modification of the existing substation sites, drainage, earthing, installation of electrical conduits, and construction of access tracks.

Excess spoil from excavations would be managed using the following hierarchy:

- reuse onsite wherever possible so that it would not substantially alter landform or drainage in the vicinity of the transmission line structures or substations
- reuse on other projects in accordance with the requirements of any applicable resource recovery order and exemption (this could include but may not be limited to rehabilitation of local quarries, or provided to councils, private property owners and/or local businesses)
- removal from site and disposal at an appropriately licensed facility.

Indicative earthwork volumes for the project, based on the current concept design, are provided in Table 4-20. No earthwork is anticipated for the connection to the future Maragle 500 kV substation.

Table 4-20 Indicative earthwork volumes

Site	Indicative cut volume (m^3)	Indicative fill volume (m^3)
Proposed Gugaa 500 kV substation	339,430	280,110
Wagga 330 kV substation	5,020	410
Bannaby 500 kV substation	37,990	22,060
Transmission line – construction of structures, telecommunications hut and associated construction compound establishment	60,000	Nil
Transmission line – construction of access tracks	223,590	115,690
Total	**666,030**	**418,270**

Where spoil is determined not to be appropriate for reuse onsite, it may be necessary to import additional material to site to make up any deficit. Where this is required, material would be sourced locally and transported by road to the substation or transmission line sites.

Topsoil would be separated and stockpiled within or adjacent to (where appropriate) the work site and reused for revegetation and rehabilitation where required. Topsoil stockpiles would be managed throughout construction in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom, 2004) or other comparable guidelines.

There would also be a requirement to maintain safe working clearances under the existing transmission lines where the project would be located in or adjacent to existing lines or existing substations. Accordingly, excavation work would generally commence where clearances from natural ground level to the above transmission lines exceed the safe working requirements. Benching and spoil removal would progress using rock breakers, excavators, and trucks. This methodology would ensure that safe clearances are maintained, and excavation work can proceed without the requirement to disconnect electrical transmission along these lines during construction.

4.5.2. Water supply and management

Water would be typically required during construction for:

- dust suppression at substation and transmission line construction sites and on access tracks
- civil work and earthwork compaction
- concrete batching activities
- equipment and vehicle washdown
- general worker facilities at the construction compounds and the worker accommodation facility.

It is estimated that about 564 ML of water would be required during construction of the project. Indicative water volumes for construction of the transmission lines and substations are provided in Table 4-21.

Table 4-21 Indicative water quantities for construction of transmission lines and substations

Activity	Proposed Gugaa 500 kV substation	Wagga 330 kV substation	Bannaby 500 kV substation	Transmission line work[1]
Dust suppression and civil work	19.8 ML	12.1 ML	14.6 ML	450.0 ML
Concrete batching	2.7 ML	0.6 ML	0.9 ML	19.2 ML
Equipment and vehicle washdown	-	-	-	1.1 ML
General worker facilities	1.4 ML	0.7 ML	0.7 ML	40.2 ML
Total	**23.9 ML**	**13.4 ML**	**16.2 ML**	**510.5 ML**

Note:
1. Indicative water quantities required for the connection to the future Maragle 500 kV substation are included as part of transmission line work.

The water source to be used would depend on the location and nature of the construction activity and whether potable or non-potable water is required. Water sources would include:

- construction sedimentation basins
- farm dams
- rainwater tanks
- council standpipes or connection to council water supply systems
- groundwater bores
- purchase of water allocations from existing water users.

Where possible, non-potable water would be sourced from construction sedimentation basins and farm dams in agreement with the relevant landowners. However, these sources of water would not meet all the non-potable requirements in all locations. A more predictable and likely source of non-potable water would be the temporary purchase of water allocations from other water users. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for further discussion on the temporary purchase of existing water user allocations.

Potable water would be sourced from council standpipes via water carts and taken to the construction compounds, or from council water supply systems, as required.

Measures to avoid and minimise water consumption, particularly of potable water, would be considered during detailed design and construction planning.

4.5.2.1. Onsite wastewater treatment

The total annual volume of wastewater generated during construction is expected to be about 8.81 ML. The majority of this would be generated from the Tumbarumba accommodation facility (AC1) with about 7.52 ML expected per year. As discussed in Section 4.3.3, the Tumbarumba accommodation facility (AC1) is proposed to be connected to the local sewer network.

Wastewater treatment facilities may be used to treat wastewater from amenities at Gregadoo Road compound (C06) and Bannaby 500 kV substation (C12) in lieu of transporting it offsite for processing. The wastewater treatment facilities would be designed for the following staff numbers:

- Gregadoo Road compound (C06) – 190 construction workers at peak
- Bannaby 500 kV substation compound (C12) – 110 construction workers at peak.

Any onsite systems would be designed, installed and maintained to the requirement of the relevant council standards. Typically, such a system takes the wastewater into one tank (or a section of the tank for smaller systems) where solids and liquids are separated. The liquid in this tank (or section) is then discharged into a second tank (or section). The first tank (or section) continually processes the solids for more treatment until it eventually breaks down and ends up in the second tank (or section).

Each tank is typically 2.4 metres in diameter (with a similar height) and buried. For multiple tank systems, the tanks are placed side by side (possibly with a one metre gap between tanks). If the load for the system is large, there may be a need for a third tank to ensure adequate digestion occurs. Investigations would be carried out on the loading expectation for the system to size the tank arrangement. The volume of wastewater to be processed would depend on the number of workers at the construction compound and associated water use at any one time throughout the construction period.

In is anticipated that some servicing of the first tank (or section) would be required (eg once a year, depending on system load) as not all solids are expected to break down and would be required to be collected. Any waste would be taken to an appropriately licensed facility for disposal.

The method for discharging treated wastewater would be confirmed during detailed design but could involve discharge via sprinklers over a grassed area. A large system may require an area of grass, about 50 by 50 metres. Treated wastewater would not be discharged to waterways and it is not expected the treated wastewater would be used for construction activities.

The final design and requirements for onsite wastewater treatment facilities would be confirmed by the construction contractors during detailed designed in accordance with any relevant council standards.

For all other construction compounds, wastewater would be stored in a suitably sized tank and taken to an appropriately licensed facility for disposal at regular intervals.

4.5.3. Hazardous materials and chemicals

During construction, various hazardous materials and chemicals would likely be required to be used and/or stored onsite. Hazardous materials and chemicals would typically include (but not be limited to):

- acetylene, oxygen, liquid petroleum gas
- adhesives, glues and epoxies
- concrete and other mortar products
- contact cleaners
- cold-galvanising spray
- fuels, oils and lubricants (eg diesel and transformer mineral oil)
- pesticides, herbicides and other chemicals associated with biosecurity measures
- paints and other paint markers
- sulfur hexafluoride (SF_6) gas.

4.5.4. Other resources and materials

A range of other materials and resources would be required during construction of the project. Key additional materials and resources, including likely quantities, are listed in Table 4-22.

Table 4-22 Key additional materials and resources and indicative quantities

Site	Steel (t)	Aluminium (t)	Copper (t)	Concrete (m^3)
Proposed Gugaa 500 kV substation	1,880	170	60	14,840
Wagga 330 kV substation	400	70	40	3,390
Bannaby 500 kV substation	620	40	30	4,840
Transmission line work[1]	40,000	8,000	120	48,000
Total	**42,900**	**8,280**	**250**	**71,070**

Note:
1. Key additional materials and indicative quantities required for connection to the future Maragle 500 kV substation are included as part of transmission line work.

Around 3,800 kilometres of conductor and earth wire cables would also be required to construct the transmission lines.

4.6. Construction workers and working hours

4.6.1. Construction workers

Construction worker numbers would vary depending on the phase of construction and associated activities. During peak construction activities, the project is expected to employ up to 1,200 full-time equivalent workers. Table 4-23 provides an overview of the anticipated workforce for the key construction activities.

Table 4-23 Anticipated construction workers for the project

Construction activities	Anticipated construction workers (estimate)
Substation work	
Construction of proposed Gugaa 500 kV substation	Total: 510, Monthly peak[1]: 190
Modification of existing Wagga 330 kV substation	Total: 270, Monthly peak: 80
Modification of existing Bannaby 500 kV substation	Total: 320, Monthly peak: 110
Transmission line work[2]	
Site establishment, environmental controls and vegetation clearing	12 to 24
Establishment of access points and tracks for construction of towers	14 to 22
Installation of structure foundations	60 to 80
Assembly and erection of structure	100
Stringing of conductors	120
Testing and commissioning	30
Administrative and management staff	50 to 100
Accommodation camp and laydown support staff	20 to 50

Note:
2. Monthly peak represents the estimated maximum monthly construction workforce number at any given month.
3. Anticipated construction workers for the connection to the future Maragle 500 kV substation are included as part of transmission line work.

4.6.2. Construction work hours

The standard construction hours would be as per the *Interim Construction Noise Guideline* (DECC, 2009):

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturday
- no construction work on Sundays or public holidays.

In addition, as detailed in Section 4.6.3, some activities would be required outside these standard construction hours for safety, technical or public infrastructure operational reasons (eg to minimise utility or traffic disruptions).

Extension of the standard construction hours may be investigated to assist in the delivery of the project. Any proposed extension of standard construction hours would be subject to additional environmental assessment as required.

Blasting may be required depending on geotechnical conditions. Where blasting is required, it would be undertaken in accordance with the recommended standard hours for blasting from the *Interim Construction Noise Guideline* (DECC, 2009):

- 9am to 5pm Monday to Friday
- 9am to 1pm Saturday
- no blasting on Sundays or public holidays.

4.6.3. Out-of-hours work

Work outside the standard construction hours is anticipated to include (but not be limited to):

- transmission line construction at crossings of a main road or railway as these locations are expected to have restricted construction hours requiring some night work for activities such as conductor stringing over the crossing(s)
- work where a road occupancy licence (or similar) is required, depending on licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- limited substation assembly work (eg oil filling of the transformers)
- connection of the new assets to existing assets under outage conditions (eg modification and/or connection work at Bannaby 500 kV substation, Wagga 330 kV substation and future Maragle 500 kV substation), which is likely to require longer working hours
- operation of the Tumbarumba accommodation facility (AC1)
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected sensitive receivers
- activities that do not generate noise that exceeds the applicable noise management level at any sensitive receiver.

During detailed design and further construction planning, a program would be determined to identify the required night work periods (including dates and durations).

Except for emergencies, construction work would be carried out in accordance with an out-of-hours work protocol and would not take place outside standard construction hours without prior notification to

stakeholders in accordance with the protocol, which would be documented within the CEMP. Additional measures would also be implemented where work would potentially exceed noise management levels in proximity to sensitive receivers, which would be included as part of Noise and Vibration Management Plan (NVMP).

4.7. Construction parking, access and vehicle movements

4.7.1. Construction vehicle movements

Construction vehicles would transport equipment, waste, materials and spoil, as well as workers:

- Larger volumes of heavy vehicles would occur during the main construction work associated with the substations and transmission lines and would mainly be associated with the delivery of materials to work sites and construction compounds.
- Most of the light vehicle movements would be limited to construction staff travelling to and from individual sites.
- Non-standard or oversized and/or overmass (OSOM) loads would be required for the substation work (eg for transformer transport).

Indicative daily vehicle movements are outlined in Table 4-24. These vehicle movements are based on the expected typical and peak construction period. The vehicle movements stated in Table 4-24 would be confirmed during detailed design and further construction planning and included in the Traffic and Transport Management Plan (TTMP).

Table 4-24 Indicative vehicle movements during construction

Site	Light vehicles		Heavy vehicles	
	Typical daily movements	Maximum daily movements	Typical daily movements	Maximum daily movements
Proposed Gugaa 500 kV substation	86	190	36	102
Wagga 330 kV substation	52	106	26	92
Bannaby 500 kV substation	52	106	26	92
Transmission line work	346	656	99	155

Note - the following assumption apply to the indicative vehicle movements:

- vehicle movements are each way (ie a heavy/light vehicle arriving and leaving a site, either within a day or separate days counts as two movements)
- typical and maximum daily movements are based on the current program of work
- vehicle movements associated with the connection to the future Maragle 500 kV substation and the telecommunications hut are included in transmission line work.

The timing of OSOM vehicle movements would be subject to further traffic studies during detailed design and the requirements of the local road authorities. The indicative total OSOM vehicle movements for the duration of the project are likely to include:

- proposed Gugaa 500 kV substation – 20 movements
- Bannaby 500 kV substation – four movements.

Standard traffic management measures would be implemented to minimise short-term traffic impacts during construction. These measures would be identified in the TTMP.

Vehicle movements would be scheduled outside peak periods wherever possible. However, there would be a need for some vehicle movements during peak periods. Worker vehicle movements would also be required during both the morning and afternoon peak periods. Refer to Chapter 20 (Traffic, transport and access) and *Technical Report 16 – Traffic and Transport Impact Assessment* for further detail.

4.7.2. Construction access routes

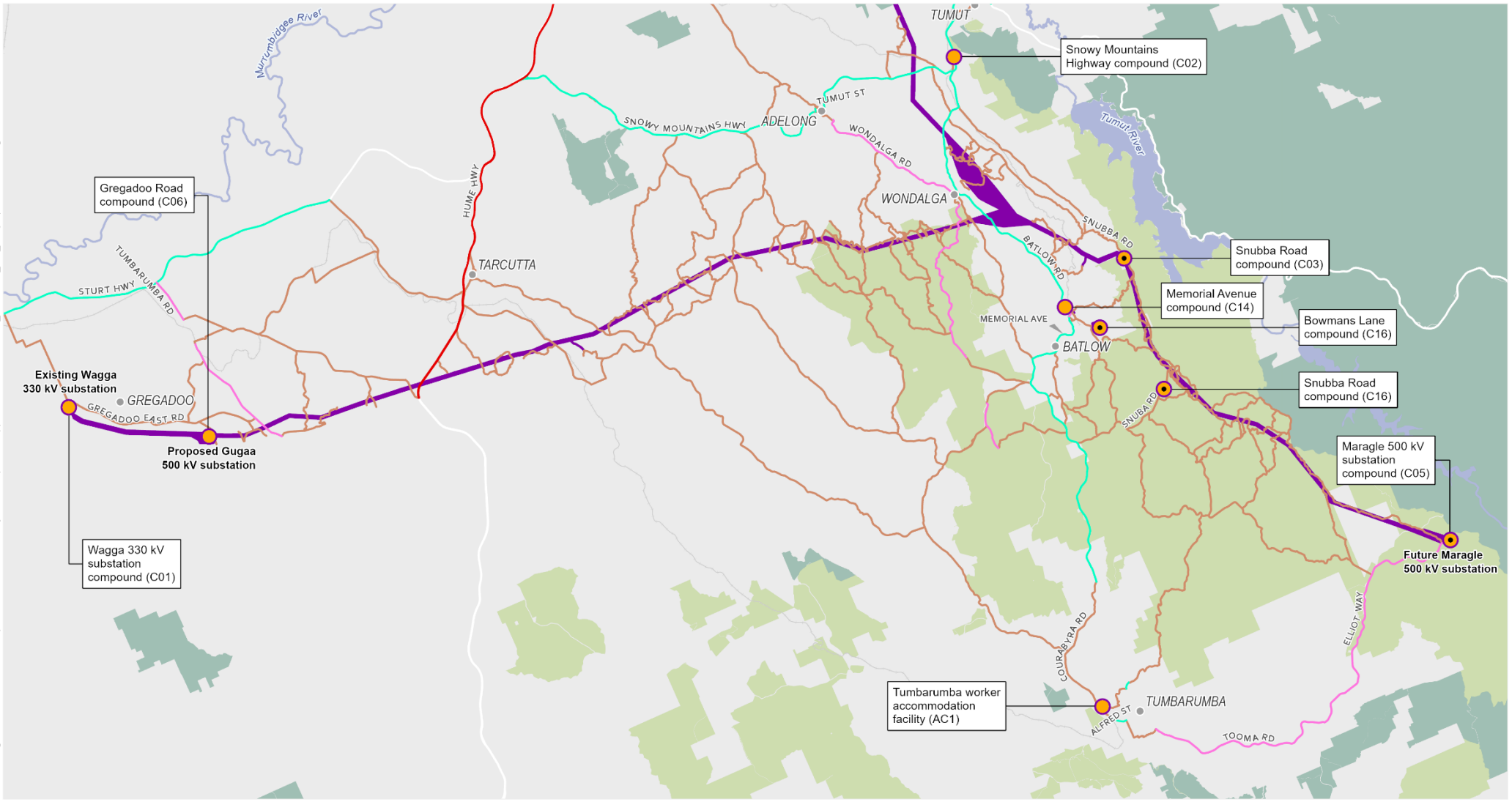
Construction materials and equipment would be transported from multiple locations using national, state, regional and local road networks, as well as new and upgraded access tracks.

Table 4-25 summarises the national, state, and regional roads, which are expected to provide access to the project footprint, with an overview provided on Figure 4-9. Local roads, which would provide access to construction compounds and the worker accommodation facility, are also included. The construction compound and worker accommodation facility reference numbers have been provided after the road name as relevant to indicate the road provides access to these facilities. Further detail and discussion regarding construction access routes is provided in Chapter 20 (Traffic, transport and access) and *Technical Report 16 – Traffic and Transport Impact Assessment*.

Table 4-25 Summary of proposed construction access routes

Road	LGA	Type
Adjungbilly Road (C09)	Cootamundra-Gundagai Regional	Local
Alfred Street (AC1)	Snowy Valleys	Local
Ashfords Road (C01)	Wagga Wagga City	Local
Batlow Road	Snowy Valleys	State
Barton Highway	Yass Valley	State
Binda Road	Upper Lachlan Shire	Regional
Boorowa Road	Upper Lachlan Shire	Regional
Brookland Street	Upper Lachlan Shire	Regional
Bunnaby Street	Upper Lachlan Shire	Regional
Burrinjuck Road	Yass Valley	Regional
Collector Road	Upper Lachlan Shire	Regional
Courabyra Road (AC1)	Snowy Valleys	Local
Crookwell Road/Goulburn Road	Upper Lachlan Shire	State
Dalton Road	Upper Lachlan Shire	Regional
Elliott Way (C05)	Snowy Valleys	Regional
Grabben Gullen Road	Upper Lachlan Shire	Regional
Gregadoo East Road (C06)	Wagga Wagga City	Local
Gocup Road	Snowy Valleys Cootamundra-Gundagai Regional	State
Gundaroo Road	Upper Lachlan Shire	Regional
Gundaroo Street	Upper Lachlan Shire	Regional
Gunning Street	Upper Lachlan Shire	Regional
Hanworth Road (C12)	Upper Lachlan Shire	Local
Honeysuckle Road (C07)	Cootamundra-Gundagai Regional	Local

Road	LGA	Type
Hume Highway	Wagga Wagga City Cootamundra-Gundagai Regional Yass Valley Upper Lachlan Shire	National
Hume Street	Upper Lachlan Shire	Regional
Keenans Road (C15)	Snowy Valleys	Local
Laggan Road	Upper Lachlan Shire	Regional
Laggan-Taralga Road	Upper Lachlan Shire	Regional
Laidlaw Street	Yass Valley	Regional
Livingstone Gully Road (C06)	Wagga Wagga City	Local
Memorial Avenue (C14)	Snowy Valleys	Local
Mill Road (C14)	Snowy Valleys	Local
Mitchell Road (C01)	Wagga Wagga City	Local
Northcott Street	Upper Lachlan Shire	Regional
Orchard Street	Upper Lachlan Shire	Regional
Perry Street (C10)	Yass Valley	Local
Red Hill Road (C08)	Snowy Valleys Cootamundra-Gundagai Regional	Local
Rye Park Road	Upper Lachlan Shire	Regional
Selwyn Street	Snowy Valleys	Regional
Snowy Mountains Highway (C03)	Snowy Valleys Cootamundra-Gundagai Regional	State
Snubba Road (C03 and C16)	Snowy Valleys	Local
Sturt Highway	Wagga Wagga City	State
Taralga Road	Upper Lachlan Shire	Regional
Tooma Road	Snowy Valleys	Regional
Tumbarumba Road	Wagga Wagga City	Regional
Tumut Street	Snowy Valleys	Regional
Warrataw Street	Upper Lachlan Shire	Regional
Wee Jasper Road (including Grand Junction Road)	Snowy Valleys	Regional
West Street	Cootamundra-Gundagai Regional	Regional
Willis Street	Upper Lachlan Shire	Regional
Wondalga Road	Snowy Valleys	Regional
Woodhouselee Road (C11)	Upper Lachlan Shire	Regional
Yass Street	Upper Lachlan Shire	Regional
Yass Valley Way	Yass Valley	Regional



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

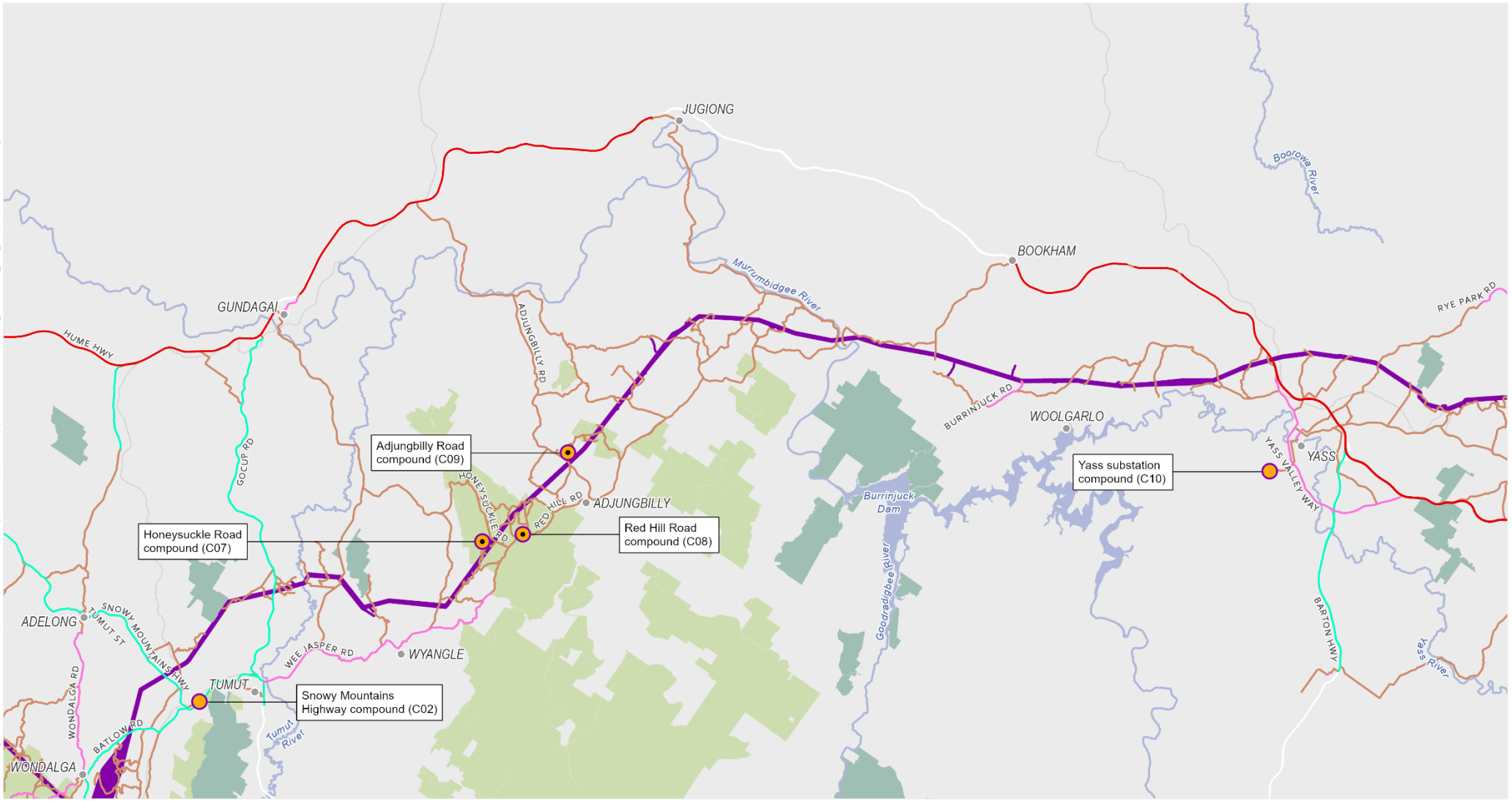
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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 4-9a: Overview of proposed construction traffic haulage routes



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

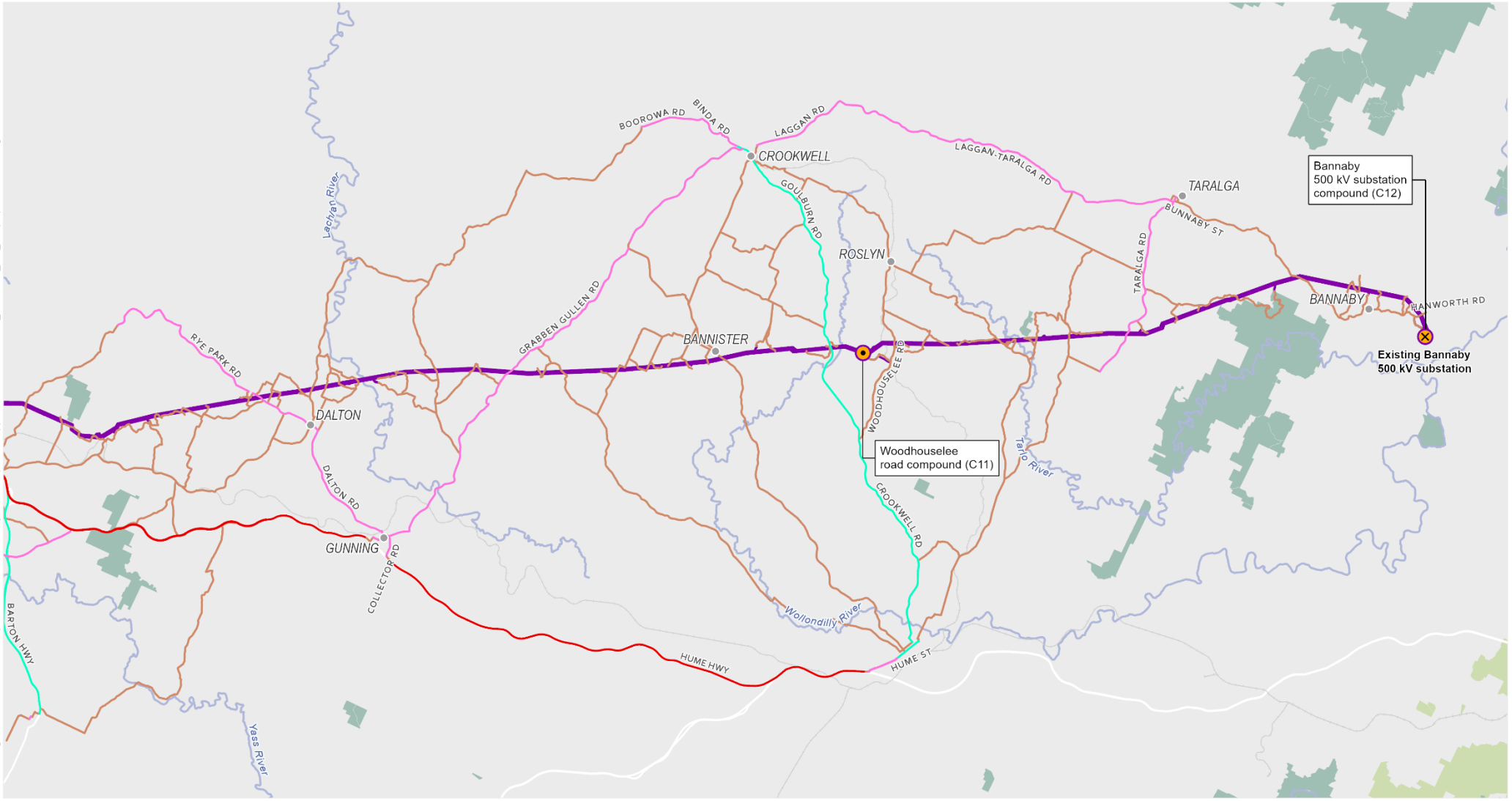
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Projection: GDA 1994 MGA Zone 55

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FIGURE 4-9b: Overview of proposed construction traffic haulage routes



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

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0 7 14 km

Projection: GDA 1994 MGA Zone 55

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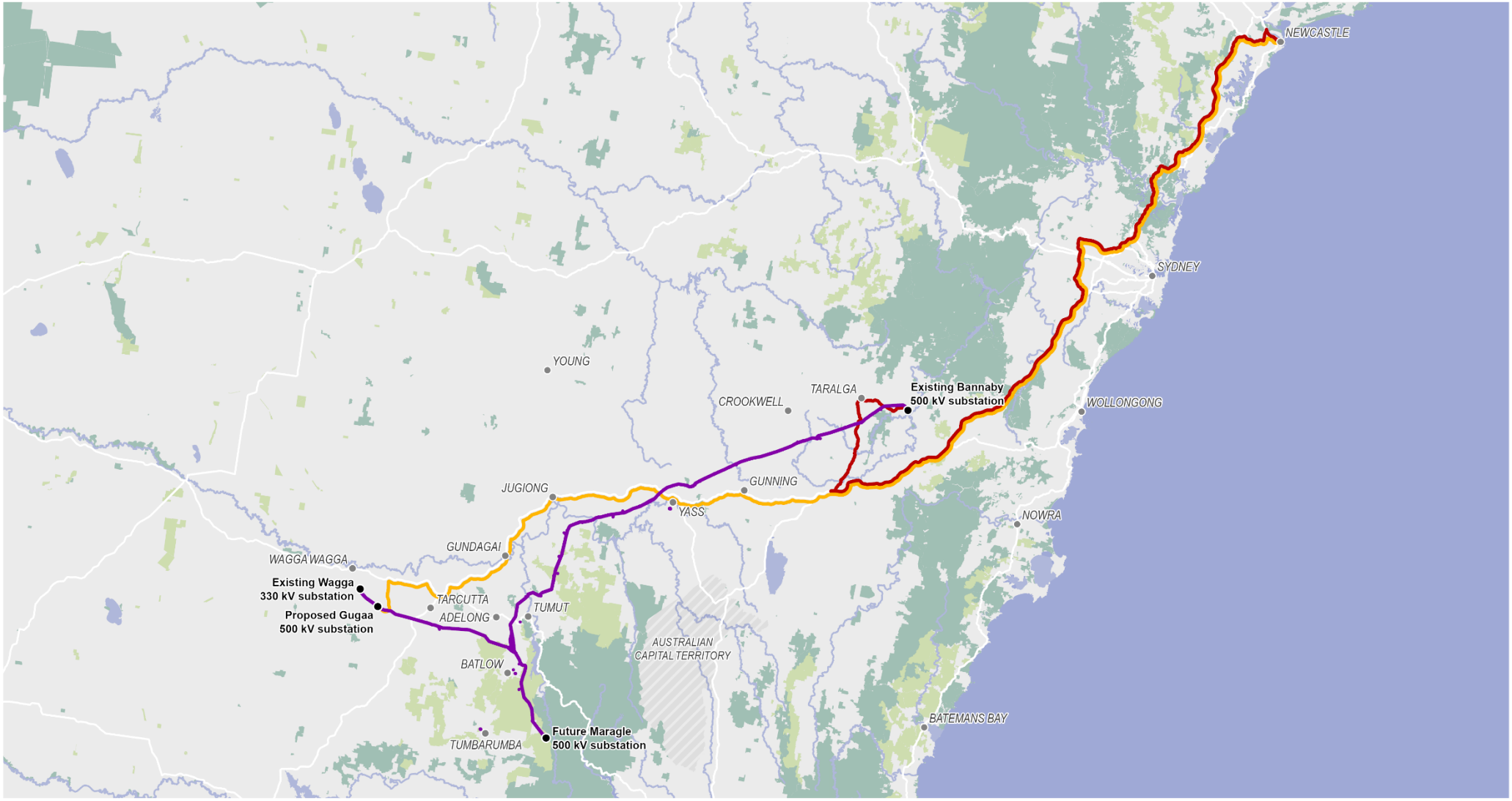
FIGURE 4-9c: Overview of proposed construction traffic haulage routes

4.7.2.1. Oversized and overmass vehicle routes

As stated in Section 4.7.1, OSOM vehicle movements would be required to transport transformers and other large substation infrastructure and equipment to the proposed Gugaa 500 kV substation and Bannaby 500 kV substation. A preliminary route study has been carried out based on transporting the loads from Port of Newcastle to each substation. The proposed OSOM routes are provided in Table 4-26 and on Figure 4-10.

Table 4-26 Proposed OSOM routes

OSOM route	Transport summary
Port of Newcastle to the proposed Gugaa 500 kV substation	Selwyn Street, George Street, Industrial Drive, Maitland Road, Newcastle Inner City Bypass, Newcastle Road, Thomas Street, Newcastle Link Road, M1 Motorway, Pennant Hills Road, M2 Motorway, M7 Motorway, M5 Motorway, Hume Highway, Sturt Highway, Elizabeth Avenue, Inglewood Road, Mitchell Road, Gregadoo East Road, Livingstone Gully Road. An alternative to above route includes using Tumbarumba Road instead of Elizabeth Avenue, Inglewood Road and Mitchell Road to reach Gregadoo East Road.
Port of Newcastle to Bannaby 500 kV substation	Selwyn Street, George Street, Industrial Drive, Maitland Road, Maitland Road, Newcastle Inner City Bypass, Newcastle Road, Thomas Street, Newcastle Link Road, M1 Motorway, Pennant Hills Road, M2 Motorway, M7 Motorway, M5 Motorway, Hume Highway, Hume Street, Garroorigang Road, Sloane Street, Grafton Street, Reynolds Street, Union Street, Wilmot Street, Chantry Street, Tarlo Street, Taralga Road, Orchard Street, Bunnaby Street, Macarthur Street, Walsh Street, Bannaby Road, Hanworth Road.



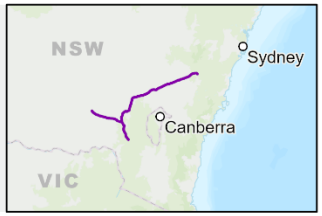
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Project footprint
State forest
National park and reserve
Waterbody
Waterway

Major road
Substation

OSOM routes

Port of Newcastle to Bannaby 500 kV substation
Port of Newcastle to proposed Gugaa 500 kV substation



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

1:1,750,000
0 30 60 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 4-10: Proposed OSOM routes

As discussed in Section 4.2.1, it is anticipated that the intersection of Gregadoo East Road and Livingstone Gully Road would be widened and modified to facilitate OSOM vehicle movements to the proposed Gugaa 500 kV substation. In addition, OSOM vehicle movements to the Bannaby 500 kV substation, based on the proposed route included in Table 4-26, could potentially require the temporary removal of several road signs and an isolated tree on Bannaby Road.

The final routes for the OSOM vehicle movements would be determined by the construction contractors during detailed design and further construction planning in accordance with the relevant NSW heavy vehicle haulage guidelines and in consultation with the relevant road authority.

4.7.3. Construction worker parking

Construction worker parking would primarily be provided within the construction compounds and the worker accommodation facility as described in Section 4.3.

The number of construction workers requiring parking would vary over the duration of the construction program. Table 4-27 provides indicative construction worker parking requirements for the construction compounds associated with each substation site and the worker accommodation facility.

Table 4-27 Indicative construction worker parking requirements

Construction compound	Indicative number of light vehicles requiring parking	Indicative number of heavy vehicles requiring parking
Wagga 330 kV substation (C01)	17	3
Maragle 500 kV substation compound (C05)	28	4
Gregadoo Road compound (C06)	34	4
Bannaby 500 kV substation compound (C12)	20	3
Tumbarumba accommodation facility (AC1)	100 (and 12 mini-buses)	12

Given the transient nature of the transmission line work, and potentially long distances, it is expected that workers would be transported by bus to site from nearby towns and the Tumbarumba accommodation facility (AC1). Where other vehicles are used to access these sites, parking spaces for construction personnel would generally be within 30 metres of each transmission line structure.

4.8. Indicative construction program

The HumeLink EIS has been prepared on the basis of a concept design with the assumption that construction would commence in 2024 and be fully operational by late 2026. It is anticipated that overall construction would take about 2.5 years, subject to weather conditions. The indicative construction program is shown in Figure 4-11. The construction compounds and worker accommodation facility at Tumbarumba would be in place throughout the entire construction period.

However, the Australian Energy Market Operator's (AEMO) *2022 Integrated System Plan* (ISP) identifies a target date for completion by mid-2026, ahead of the previously projected date of late-2026. Transgrid recognises the benefits of the transition to renewable energy for energy consumers and is committed to working with our delivery partners, landowners and key stakeholders to meet this timeline.

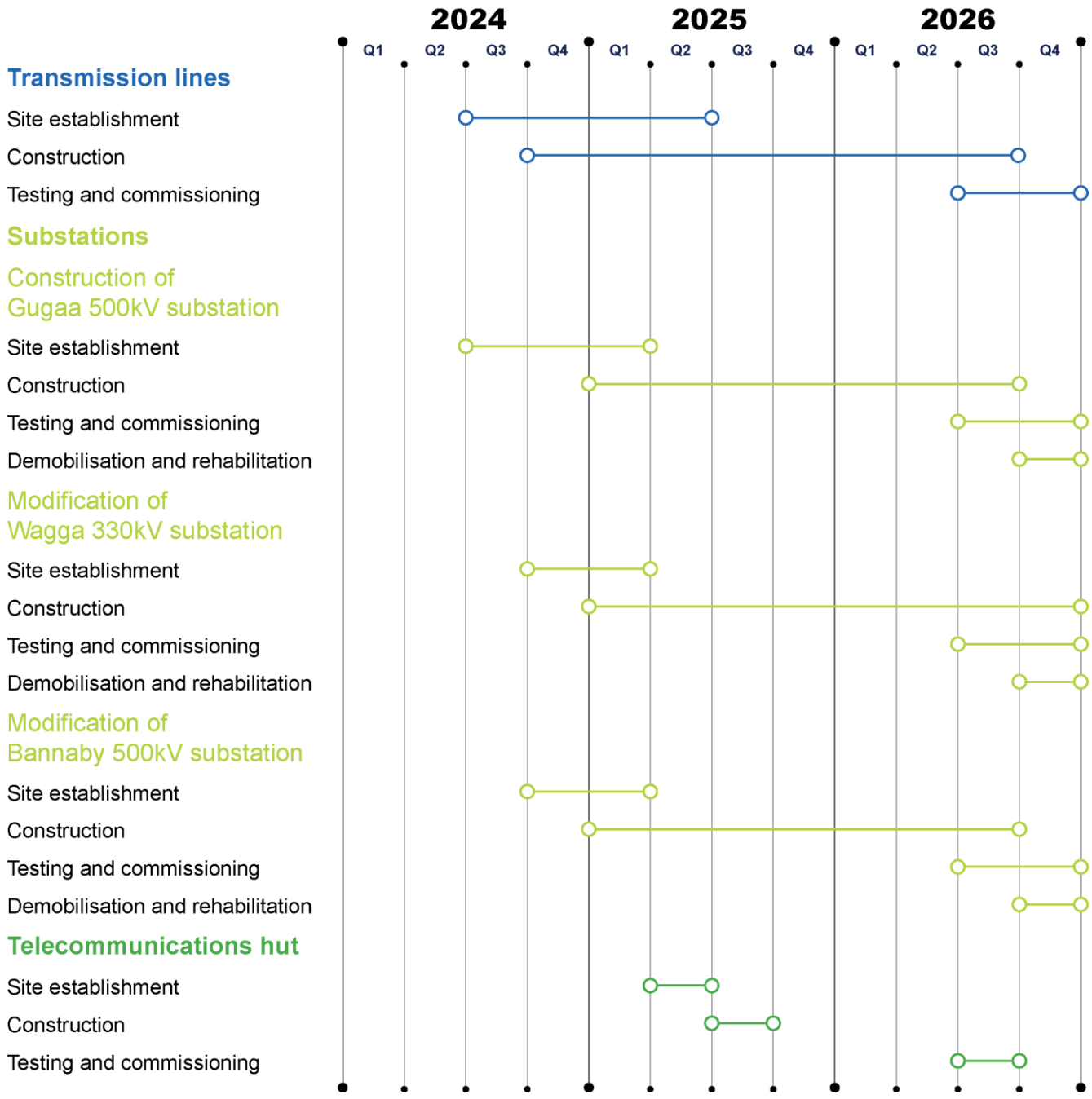


Figure 4-11 HumeLink indicative construction program

Construction at each transmission line structure would be transient and intermittent and construction activities would not occur at each structure location for the full duration for each phase of construction. However, following construction of the foundation, each transmission line structure would typically take one to three weeks to erect. Figure 4-12 presents an indicative duration of construction activities associated with an individual transmission line structure.

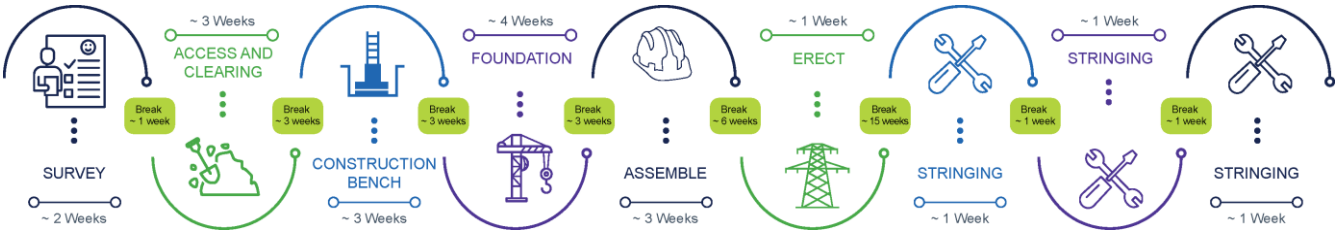


Figure 4-12 Indicative duration and sequence of construction activities for transmission line structures

The duration of any construction activity associated with an individual transmission line structure, and inactive/respite periods, may vary for a number of reasons including (but not limited to):

- multiple work fronts
- resource and engineering constraints
- environmental constraints
- work sequencing and location.

There would also be multiple work fronts. For example, foundation works, or structure erection, would occur in several locations along the transmission line route at the same time.

Timeframes for some activities, such as the telecommunications hut construction, have only been shown as indicative in Figure 4-11 and would be confirmed by the construction contractors during detailed design and further construction planning. Site establishment, construction and testing, and commissioning of the telecommunications hut could occur at any time during the construction timeframe for transmission lines.

5. Statutory context

This chapter identifies and addresses the relevant statutory requirements for the project including those identified in the Planning Secretary's Environmental Assessment Requirements (SEARs) and in a format consistent with the *State significant infrastructure guidelines – preparing an environmental impact statement* (DPE, 2022d) (the Guidelines). The SEARs for the project were issued on 14 March 2022 (refer to Appendix A (SEARs compliance table)). A statutory compliance table, which provides further details on all the relevant statutory requirements for the project and indicates where they have been addressed in the EIS, is provided in Appendix B (Statutory compliance table).

The NSW Minister for Planning has declared the project to be CSSI under section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). As CSSI, the project requires approval from the NSW Minister for Planning under Part 5, Division 5.2 of the EP&A Act.

A referral under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was made to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and it was determined that the project was a controlled action and will require approval from the Commonwealth Minister for the Environment and Water under Part 9 of the EPBC Act. The project would be subject to the assessment bilateral agreement between the Commonwealth of Australia and the State of NSW.

The NSW planning approval process under Part 5, Division 5.2 of the EP&A Act and the Commonwealth process pursuant to the EPBC Act is shown in Figure 1-2 in Chapter 1 (Introduction). The relevant key statutory planning requirements are summarised in Table 5-1. Further details regarding statutory requirements are provided in Appendix B (Statutory compliance table).

Table 5-1 Statutory requirements for the project

Matter	Statutory requirements
Power to grant approval	On 7 March 2018, the NSW Minister for Planning declared Snowy 2.0 and the project to be State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (CSSI). On 1 November 2022, the NSW Minister for Planning amended the declaration by way of order, which commenced on 4 November 2022. The project is declared SSI and CSSI under sections 5.12 and 5.13 of the EP&A Act by virtue of section 2.15 and Schedule 5, paragraph 9 "Snowy 2.0 and Transmission Project" of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). The project requires approval from the NSW Minister for Planning under Division 5.2 of the EP&A Act. As the project has been determined to be a controlled action (refer to 'Other approvals – EPBC Act' below), the project also requires approval by the Commonwealth Minister for the Environment and Water under section 130(1) and section 133(1) of the EPBC Act.
Permissibility	In accordance with section 2.15 of the Planning Systems SEPP, the declaration of the project as CSSI has the effect that the project may be carried out without development consent under Part 4 of the EP&A Act. On this basis, the project would be assessed as a CSSI project and this EIS has been prepared to support the application under Division 5.2 of the EP&A Act.

Matter	Statutory requirements
Other approvals - approvals that should be substantially consistent with approved SSI (deemed CSSI)	In accordance with section 5.24 of the EP&A Act, certain approvals cannot be refused and are required to be granted in a form substantially consistent with any approval to carry out an SSI (deemed CSSI) project. In the context of this project, the following approval would be required: • a consent (road occupancy licence) under section 138 of the *Roads Act 1993* from the relevant roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road. The project would require the carrying out of work on a number of roads. Subject to detailed design requirements the following approval may also be required: • an Environment Protection Licence (EPL) under Chapter 3 of the Protection of the *Environment Operations Act 1997* (POEO Act) for scheduled activities. Appendix B (Statutory compliance table) provides a more detailed overview of how the above statutory requirements have been considered for the project.
Other approvals - approvals that are not required for approved SSI (deemed CSSI)	Under section 5.23(1) of the EP&A Act, the following approvals, which may otherwise be required, are not required for declared SSI: • a permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act) • an approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* (Heritage Act) • an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974* (NP&W Act) • a bushfire safety authority under section 100B of the *Rural Fires Act 1997* • a water use approval under section 89, a water management work approval under section 90, or an activity approvals (other than aquifer interference approvals) under section 91 of the *Water Management Act 2000.* In addition, under section 5.23(2) of the EP&A Act, Division 8 of Part 6 of Heritage Act does not apply to prevent or interfere with the carrying out of approved SSI. Under section 5.23(3), the following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI: • an interim protection order (within the meaning of the NP&W Act) • an order under Division 1 (Stop work orders) of Part 6A of the NP&W Act or Division 7 (Stop work orders) of Part 7A of the FM Act • a remediation direction under Division 3 (Remediation directions) of Part 6A of the NP&W Act • an order or direction under Part 11 (Regulatory compliance mechanisms) of the BC Act • an environment protection notice under Chapter 4 of the POEO Act • an order under section 124 of the *Local Government Act 1993*.
Other approvals – EPBC Act approval	In accordance with the EPBC Act, proposed actions that will have or are likely to have a significant impact on matters of national environmental significance (MNES) protected by the EPBC Act or the environment on Commonwealth land, or is an action by the Commonwealth, must be referred to the Commonwealth DCCEEW. An EPBC Act referral was submitted in December 2021 to the then Commonwealth Department of Agriculture, Water and the Environment (now DCCEEW) under Section 68 of the EPBC Act for the Minister's decision whether or not the action is a controlled action for the purposes of the EPBC Act, requiring further assessment and approval. On 13 April 2022, the project was determined to be a controlled action under Section 75 of the EPBC Act due to the potential for the project to impact on: • two national heritage places, being the Australian Alps National Parks and Reserves and Snowy Mountains Scheme National Heritage • six listed threatened ecological communities • 82 listed threatened species and communities • 13 listed migratory species. In May 2022, the DPE issued Supplementary SEARs confirming the action would be subject to the Assessment Bilateral Agreement between the Commonwealth of Australia and the State of NSW dated 26 February 2015 and amended on 24 March 2020 (entered into pursuant to s45 of the EPBC Act). Appendix A (SEARs compliance table) and Appendix B (Statutory compliance table) outline how the MNES and Commonwealth assessment requirements have been considered for the project.

Matter	Statutory requirements
Other approvals – Other NSW and/or Commonwealth legislation	The project may require other approvals or to meet requirements under other NSW and Commonwealth legislation regardless of being declared CSSI. This includes: • acquisition in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* • establishment of easements in accordance with *Crown Land Management Act 2016* and *Forestry Act 2012* • management of contaminated land and notification to NSW Environment Protection Authority (EPA) in accordance with the *Contaminated Land Management Act 1997* • a water access licence (WAL) and/or aquifer interference approval in accordance with the *Water Management Act 2000* • notifications to local councils in accordance with the *Electricity Supply Act 1995* regarding work associated with the electricity network • notifications to the relevant control authority in accordance with the *Biosecurity Act 2015* and Biosecurity Regulation 2017 in the event of weed infestations during construction or operation. Appendix B (Statutory compliance table) provides a more detailed overview of how the above statutory requirements have been considered for the project.
Pre-conditions to exercising the power to grant approval	The following statutory pre-conditions are relevant to the application for approval of the project: • Section 1.3 of EP&A Act provides the objects, which are guiding principles that need to be considered by planning authorities when making decisions under the EP&A Act. Consideration of the objects of the EP&A Act is provided in Appendix B (Statutory compliance table). • Section 5.16 of the EP&A Act requires the Planning Secretary to prepare and notify the proponent of environmental assessment requirements that require the preparation of an EIS in the form prescribed by the EP&A Regulation. Appendix A (SEARs compliance table) and Appendix B (Statutory compliance table) demonstrates how the Planning Secretary's Environmental Assessment Requirements and requirements included in sections 190 and 192 of the EP&A Regulation have been addressed. • Section 5.17 of the EP&A Act provides that the proponent must submit an EIS for approval to carry out the State Significant Infrastructure and may require the proponent to submit a response to any issues raised in submissions and a preferred infrastructure report. This EIS has been prepared to satisfy the requirements of section 5.17 of the EP&A Act. • Section 5.18 of the EP&A Act requires the Planning Secretary to provide a report for the Minister's consideration, which is to include the EIS and any preferred infrastructure report, and advice provided by public authorities, any report or advice of the Independent Planning Commission and any environmental assessment undertaken by the Planning Secretary or any other matter the Planning Secretary considers appropriate. • Section 7.9 of the BC Act requires that an application under Division 5.2 of the EP&A Act must be accompanied by a Biodiversity Development Assessment Report unless the proposed development is not likely to have any significant impact on biodiversity values. Section 7.14 of the BC Act provides that, when determining an application in accordance with the EP&A Act, the Minister must take into account the likely impact of a proposed development on biodiversity values as assessed in the Biodiversity Development Assessment Report. A Biodiversity Development Assessment Report has been prepared for the project and is provided in *Technical Report 1 – Biodiversity Development Assessment Report*. Potential biodiversity impacts are summarised in Chapter 8 (Biodiversity).

Matter	Statutory requirements
Mandatory matters for consideration	Mandatory matters that the NSW Minister for Planning is required to consider in deciding whether to grant approval of the project include the preparation of an EIS and a submissions report (on the EIS and Amendment Report (if required)) and consideration of any recommendations from the Planning Secretary's Environmental Assessment Report. Relevant environmental planning instruments have been reviewed to determine their applicability to the project (refer to Appendix B). The detailed environmental assessment of the potential impacts of the project included in Chapters 8 to 23 and 25 has considered relevant objectives, criteria and assessment requirements. With regards to the approval by the Commonwealth Minister for the Environment and Water under the EPBC Act, DPE will ensure that there is sufficient information in the Assessment Report on the impacts of a controlled action on each relevant MNES so that the Commonwealth Minister may consider those impacts when determining whether to approve the action and if so, on what conditions. DPE will also provide to the Commonwealth an Assessment Report that contains a statement setting out a recommendation to the Commonwealth Minister about whether the action should be approved and, if so, what conditions (if any) should be attached to manage the impacts on MNES and reasons for the recommended decision and conditions.

6. Engagement

This chapter outlines how Transgrid has engaged with stakeholders and the community prior to and during the preparation of the HumeLink EIS. It describes the activities that were completed, the feedback received, how that feedback has been incorporated into the EIS and how Transgrid plans to engage during subsequent stages of the project.

Targeted consultation was also carried out for specific EIS specialist reports, as outlined in *Technical Report 2 – Aboriginal Cultural Heritage Assessment*, *Technical Report 4 – Agricultural Impact Assessment* and *Technical Report 7 – Social Impact Assessment*.

Further to this chapter, a detailed Engagement Outcomes Report is provided in Appendix C.

6.1. Engagement approach

6.1.1. Strategy

Transgrid developed *The HumeLink Engagement Strategy*, a project-specific engagement strategy (refer to Appendix C) based on *Undertaking Engagement Guidelines for State Significant Projects* (Department of Planning and Environment (DPE), 2022c) and the International Association of Public Participation's (IAP2) public participation spectrum. The strategy includes a five-step process that facilitates continuous evolution of the project's engagement practices (refer to Figure 6-1).



Figure 6-1 Five-step process of engagement

Supporting the engagement strategy is the *EIS Engagement Plan,* which addresses specific engagement and consultation activity to support the Planning Secretary's Environmental Assessment Requirements (SEARs).

Transgrid is committed to engaging with landowners, communities and other stakeholders through the life of the project. The HumeLink community and stakeholder engagement strategy and plans developed and implemented across the project lifecycle are outlined in Figure 6-2.

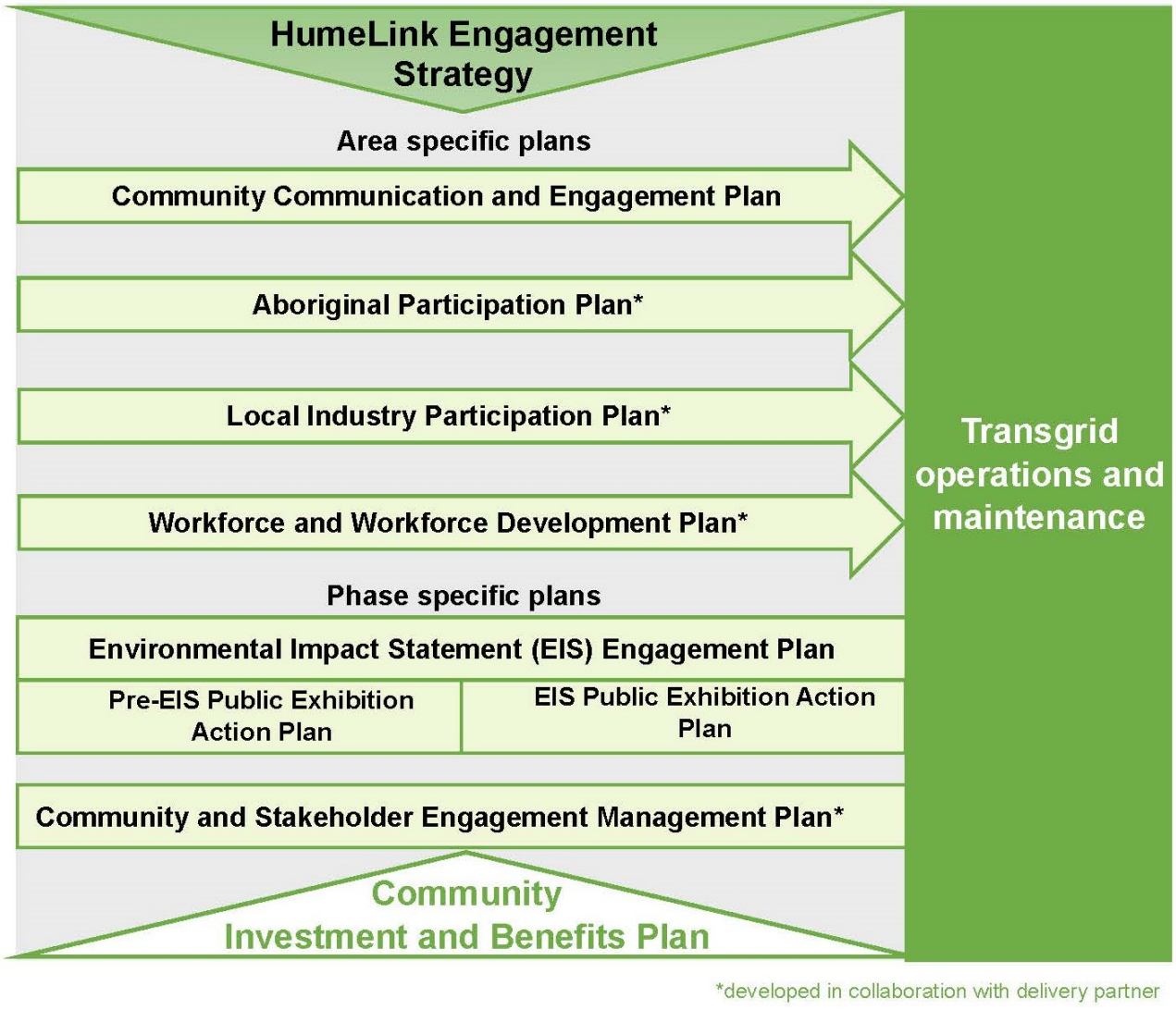


Figure 6-2 HumeLink Community and Stakeholder Engagement strategy and plans

6.1.2. Objectives

Table 6-1 outlines the HumeLink Engagement Strategy engagement strategy objectives – which reflect Transgrid's commitment to ensure accountability and genuine engagement as the project progresses – as well as the current status of the strategy.

Table 6-1 HumeLink Engagement Strategy objectives

Objective	Success looks like	Status / performance
Work in partnership with local communities and businesses	Quality of partnerships between local communities and Transgrid established as a win-win within the context of the HumeLink project.	In progress. Transgrid is working with the shortlisted contractors to co-design the scope of the construction contract in relation to workforce and workforce development, local industry participation, Aboriginal participation and community investment and benefits. The following plans are required to be developed by the construction contractors to identify opportunities to work in partnership with local communities and businesses during delivery of the project: • Community and Stakeholder Engagement Management Plan • Workforce and Workforce Development Plan • Local Industry Participation Plan • Aboriginal Participation Plan • Community Investment and Benefits Plan.
Listen to feedback, understand community views, and consider how these can deliver a better project	Transgrid proactively seeks and, where feasible and reasonable, incorporates community feedback into all aspects of the project. Queries and feedback are captured and responded to within a reasonable timeframe (target 10 business days).	Ongoing. Throughout route selection and refinement, Transgrid has worked with impacted landowners, stakeholders and community members to identify and, where feasible and reasonable, mitigate impacts. Examples have included Community Consultative Group (CCG) meetings, changes to route alignment, the undergrounding feasibility steering committee and independent assessment. Transgrid will continue to offer information and feedback channels throughout the development of the EIS, and the construction stage of the project.
Be accessible and provide engagement that works for communities and considers audiences	A suite of different engagement channels that are accessible to community members, landowners and organisations who seek it, are provided on an ongoing basis throughout the development of the project. Opportunities for feedback are provided to allow two-way communication with the project team.	Ongoing. Transgrid has provided a range of engagement materials, channels and direct engagement activities to provide for a variety of stakeholders. Collateral and materials (Table 6-3), communication channels (Table 6-4), and direct engagement and consultation activity (Table 6-5) continues to be reviewed and adjusted based on feedback and quality of engagement.
Deliver long-term social, economic, and environmental legacies for communities and regions	HumeLink contributes to Australia's transition to renewable energy supporting the nations emissions reduction targets and leaving a sustainably stronger social, economic and environmental regional NSW.	In progress. Transgrid, through its Community Investment and Benefits Plan has been investigating opportunities to leave positive legacy outcomes for the communities in proximity to the project, and considers all phases of the project (design, construction and operation).
Build awareness of HumeLink's role in providing reliable, clean energy and affordable electricity to consumers	Community given opportunity to acknowledge and accept that HumeLink is a key enabler in Australia's transition to renewable energy.	Ongoing. Community awareness will continue throughout the EIS assessment process and into the construction and operation stages of the project. Ongoing opportunities are provided for community members to learn more about the project at engagement events (in person and online), direct landowner engagement and via the project website.

Objective	Success looks like	Status / performance
Build on Transgrid's positive reputation and social licence to operate	Align with Transgrid's Social Licence Program based on gaining community and stakeholder acceptance to develop and operate Transgrid's electricity network: • fair, reasonable and timely consultation processes • fair, robust and transparent route selection process • fair and equitable compensation for landowners • provide benefits to regional communities • clearly communicate why HumeLink is needed and how the project contributes to cheaper and more reliable energy, and support delivering a sustainable clean energy future.	Ongoing. Transgrid, through its Community Investment and Benefits Plan has investigated opportunities to leave positive legacy outcomes for the communities in proximity to the project. Opportunities are considered in four broad theme areas: • care for Country • connectivity • opportunities for all • access to accommodation. Examples include a multi-year partnership with Regional Development Australia Riverina.

These objectives are guided by eight engagement principles:

- respect and empathy
- fairness and equity
- openness and transparency
- clarity and detail
- inclusivity and accessibility
- working together
- safety
- legacy.

6.1.3. Background

Landowner, community and stakeholder engagement began in early 2020 as per the *HumeLink Engagement Strategy* (refer to Appendix C). Within a couple of months of engagement starting, a group of landowners and stakeholders began voicing concern to the media about the engagement and the route selection process. Ongoing concerns led Transgrid to request a review and report on the HumeLink engagement process by independent community advocate, Rod Stowe. His report, referred to as 'the Stowe Report', was made public in July 2021, prior to the completion of the Scoping Report.

The Stowe Report made 20 recommendations. Transgrid has implemented all recommendations and, on the basis of the recommendations, the project entered a 'reset' on its approach to community engagement. (The report recommendations, and how they have been addressed, are documented in the *Implementation of the Landowner Advocate's Recommendations on HumeLink* (Transgrid, 2022a), provided in the link below).

The reset involved addressing engagement challenges by establishing three CCGs as a consultation mechanism to be rolled out throughout the development of the project. Since then, the project has had ongoing consultation with Upper Lachlan and Yass Valley CCG, Snowy Valleys CCG and Cootamundra Gundagai and Wagga Wagga CCG. Transgrid continues efforts to involve communities meaningfully and effectively to deliver a project that the community values, sees the benefits of, and feels they have the opportunity to be involved in.

The *HumeLink Engagement Strategy* (identified in Section 6.1.1) was updated in February 2022 to reflect the adjusted approach to consultation. The improvements to the engagement approach focused on:

- gaining an increased understanding of stakeholders and their needs
- regular and meaningful engagement
- assessing potential impacts to stakeholders and appropriate mitigations
- embedding Place Managers local to the area and ensuring there is an appropriately sized team to deliver engagement effectively
- establishing the CCGs
- alignment with the Landowner and Community Advocate Report and its recommendations
- achieving regulatory requirements, industry standards and best practice.

The *HumeLink Engagement Strategy* (outlined in Section 6.1.1) has also been developed in line with the Stowe Report recommendations.

To ensure engagement is fair and robust for stakeholders, the community, and the future of the project, plans would be developed and tailored towards specific stakeholder groups, including consideration of:

- directly impacted landowners
- local communities along the project footprint
- Aboriginal communities
- government agencies and relevant approval authorities
- local councils across the project footprint
- local and Indigenous businesses
- community investment applicants and recipients.

The following documents are available to view on the HumeLink webpage:

- *Review of HumeLink engagement process – Findings of the Review* (Landowner and Community Advocate, 2021) – the Stowe Report
- *Implementation of the Landowner Advocate's Recommendations on HumeLink* (Transgrid, 2022d)
- *Report on Transgrid's implementation of the Stowe recommendations* (Landowner and Community Advocate, 2022).

6.1.4. IAP2 public participation planning

The *HumeLink Engagement Strategy* outlined in Section 6.1.1 is underpinned by the IAP2 public participation spectrum (refer to Figure 6-3). The level of engagement for activities is also based on the IAP2 spectrum and will vary as the project progresses.

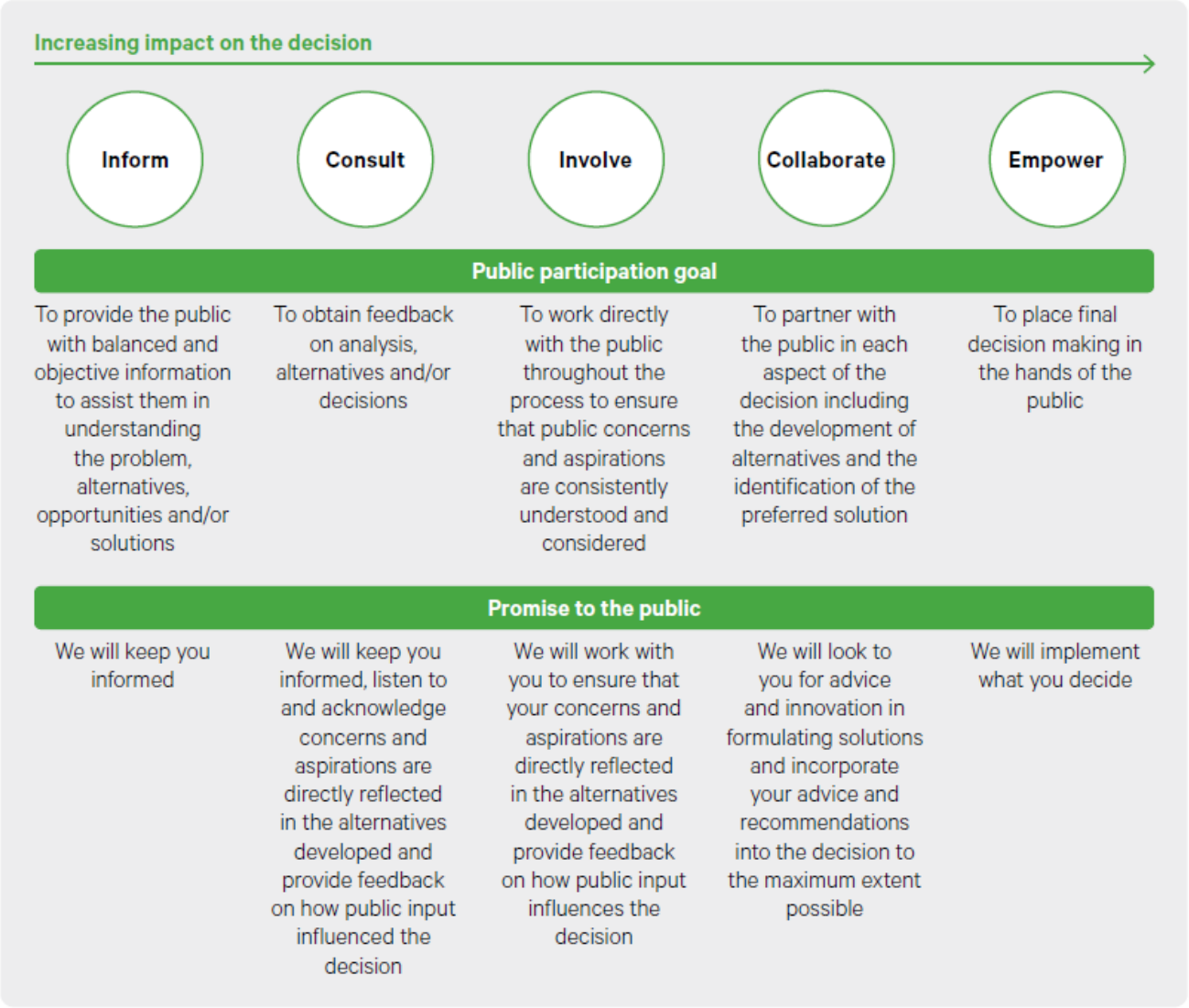


Figure 6-3 IAP2 Spectrum of Public Participation

The EIS engagement approach has been informed by the early engagement with stakeholders, landowners, Indigenous communities and the local communities within and surrounding the HumeLink project footprint.

Engagement activities have been planned and delivered based on an analysis of stakeholder interest and impact in relation to the project. Most of the engagement during the project's planning stage has been planned and designed across the inform, consult and involve levels of IAP2 public participation spectrum. Figure 6-4 outlines HumeLink's key milestones and the approach to ongoing community and stakeholder engagement.

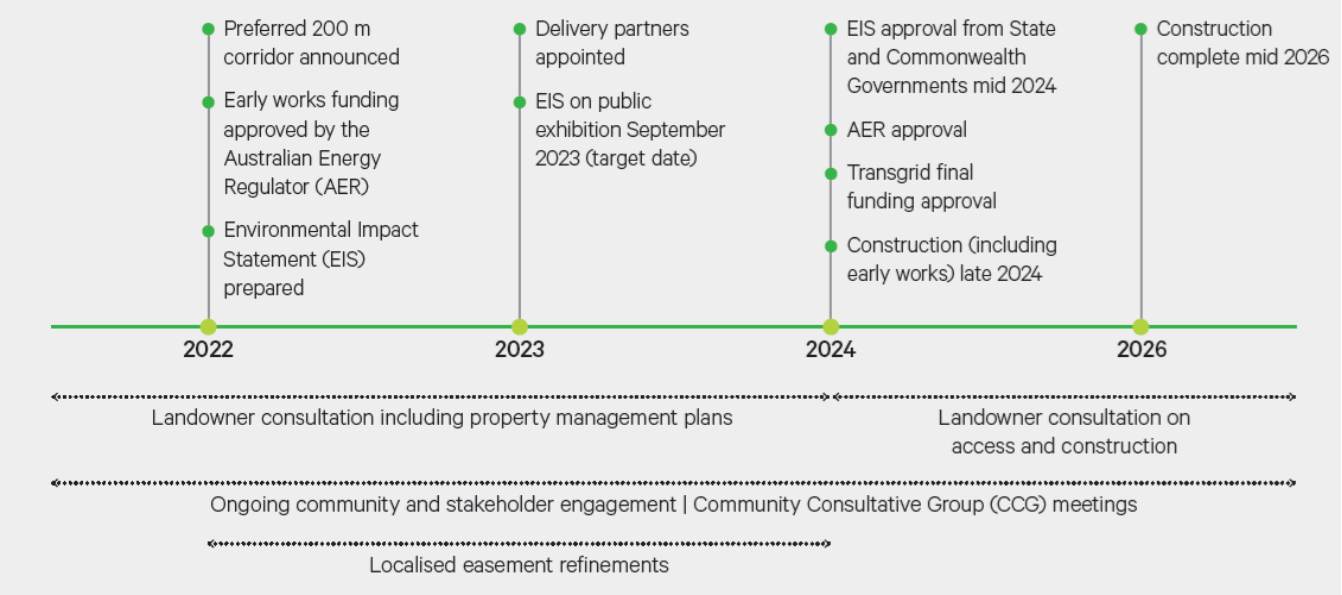


Figure 6-4 HumeLink key milestones and engagement activities

6.2. Key stakeholders

The *HumeLink Engagement Strategy* extensively mapped stakeholder groups and identified appropriate methods and levels of engagement for various stakeholders, justified by their interests in the project and project objectives. Key stakeholder groups and individuals that have been identified and engaged throughout the development of the project are outlined in Table 6-2.

Table 6-2 HumeLink key stakeholder groups

Stakeholder group	Stakeholders
Government – Political representatives	• Commonwealth Minister for Climate Change and Energy – Hon. Chris Bowen MP • Commonwealth Minister for the Environment and Water – Hon Tanya Plibersek MP • Commonwealth Shadow Minister for Energy – Ted O'Brien MP • NSW Minister for Environment and Minister for Heritage – Penny Sharpe MLC • NSW Minister for Planning – Paul Scully MP • Former NSW Minister for Energy and Environment – Matthew Kean MP Former NSW Minister for Planning – Anthony Roberts MP
Energy Regulator / Operator	• Australian Energy Market Operator (AEMO) • Australian Energy Regulator (AER) • Australian Energy Market Commission • Energy Security Board
NSW Members of Parliament (and others where appropriate)	*Commonwealth* • Angus Taylor, Hume • Kristy McBain, Eden-Monaro and Minister for Regional Development, Local Government and Territories • Michael McCormack, Riverina *State Members* • Joe McGirr, Wagga Wagga • Wendy Tuckerman, Goulburn • Stephanie Cooke, Cootamundra • Justin Clancy, Albury

Stakeholder group	Stakeholders
Local government	• Wagga Wagga City Council • Snowy Valleys Council • Upper Lachlan Shire Council • Cootamundra–Gundagai Regional Council • Yass Valley Council • Goulburn–Mulwaree Council Hilltops Council
Government agencies	**Commonwealth Government** • DCCEEW, formerly Department of Agriculture, Water and Environment • Department of Industry, Science and Resources • Crown Lands • Civil Aviation Safety Authority (CASA) • Department of Defence • Murray Darling Basin Authority (MDBA) • Australian Rail Track Corporation (ARTC) **NSW Government** • NSW DPE - NSW EPA - WaterNSW • Biodiversity and Conservation Division (BCD) • Heritage NSW • Department of Regional NSW - NSW Forestry Corporation • Department of Primary Industries (DPI) Agriculture • DPI Fisheries • NSW Treasury - Office of Energy and Climate Change - Energy Corporation of NSW (EnergyCo) • NSW Department of Education • Transport for NSW • Centre for Property Acquisition (NSW) • NSW Rural Fire Service • Fire and Rescue NSW • Health NSW • SafeWork NSW • Local police, ambulance, and fire services
Directly impacted landowners (within the project footprint)	• Landowners who will be impacted by the project infrastructure (temporary or permanent).
Indirectly impacted landowners or 'Near Neighbours' (outside the project footprint)	• Landowners who are not easement affected and outside of the project footprint who might experience construction or operation impacts as a result of the project.
Traditional Owners and other Aboriginal groups	• Brungle Tumut Local Aboriginal Land Council (LALC) • Wagga Wagga LALC • Onerwal LALC (Yass) • Pejar LALC (Goulburn) • Wagonga LALC (Narooma) Registered Aboriginal parties (RAPs) • Thunderstone Aboriginal Cultural Services Pty Ltd • Buru Ngunnawal Aboriginal Corporation • Bidya Marra Consultancy • Gunjeewong Cultural Heritage Aboriginal Corporation • Murrabidgee Mullaangari

Stakeholder group	Stakeholders
	• Muragadi Heritage Indigenous Corporation • PD Ngunawal Consultancy • Konanggo Aboriginal Cultural Heritage Services • Yurwang Gundana Cultural Heritage Services • Ngurambang • Bundyi Aboriginal Cultural Knowledge • Ngunnawal Elders Corporation • Gulgunya Ngunawal Heritage Aboriginal Consultancy (GNHAC) • Ngunawal Heritage Aboriginal Corporation • Bangerang Aboriginal Corporation • Didge Ngunawal clan • Corroboree Aboriginal Corporation • 19 individual RAPs
Community Consultative Groups (CCGs)	• Yass and Upper Lachlan • Snowy Valleys • Wagga Wagga and Cootamundra-Gundagai
Community / special interest groups	• Special interest groups - HumeLink Action Group - Bannaby Residents Action Group - Kyeamba Valley Concerned Landowners Group - Yass Valley Group - HumeLink Alliance • Progress associations • Service groups • Local business chambers
Local community	Communities within local government areas listed below: • Wagga Wagga City Council • Snowy Valleys Council • Upper Lachlan Shire Council • Cootamundra–Gundagai Regional Council • Yass Valley Council • Goulburn–Mulwaree Council • Hilltops Council
Local suppliers	• Suppliers within project footprint and local government areas listed above
Other suppliers	• Greater-NSW and Australian suppliers
Industry groups	• Energy Networks Australia • Infrastructure Partnerships Australia • Clean Energy Council • Business Council of Australia
Unions	• Electrical Trade Union • Construction, Forestry Maritime, Mining and Energy Union
Service providers / utilities	• Existing utility and service providers in the region including Telstra, WaterNSW, local water utilities and other communications providers
Exploration licence holders Quarry operators Mineral title holders	• New South Resources Pty Ltd • Cullarin Metals Pty Ltd • Godolphin Tenements Pty Ltd • Legacy Minerals Pty Ltd • Rox 1 Pty Ltd • Carbozorb Pty Ltd • Aurum Metals Pty Ltd • Trk Resources Pty Ltd • New Base Metals Pty Ltd • Right Resources Pty Ltd • Wildcat Gold Pty Ltd

Stakeholder group	Stakeholders
	• Right Resources Pty Ltd • Gilmore Metals Pty Ltd
Media	• Local, State and national print, radio and television
General public	• Members of the public outside the project footprint who may take an interest in the project
Energy customer groups	• Public Interest Advocacy Centre (PIAC) • Energy Users' Association of Australia • Energy Consumers Australia • St Vincent de Paul • Tesla • AiGroup • Australian Energy Infrastructure Commissioner • Transgrid Advisory Council (TAC) • Landowner Advocate
Education and training facilities	• Charles Sturt University • TAFE NSW

6.3. Engagement tools and activities

The *EIS Engagement Plan* was developed to identify and demonstrate how engagement activities planned for HumeLink will meet the consultation requirements outlined in the SEARs. The plan aligns with the *HumeLink Engagement Strategy* identified in Section 6.1.1. This plan includes identification of engagement opportunities for communities and stakeholders along the project footprint as well as targeted consultation with government agencies, business associations and Aboriginal communities.

Transgrid established three independently facilitated CCGs, which include a wide range of stakeholders including local government authorities, impacted landowners, and interested community members. The aim of the CCGs is to inform, seek input from key community representatives on key issues, and work directly with stakeholders to address concerns as they are identified throughout all stages of the project.

Transgrid also implemented a targeted approach for landowner engagement. Every easement affected landowner within the project footprint was allocated a dedicated Place Manager and a Land Access Officer who worked with them throughout early engagement, route refinement and continuing easement negotiations. Through ongoing engagement at times and locations convenient to the landowners, the Place Managers and Land Access Officers have developed the local knowledge to facilitate understanding and obtain feedback from landowners throughout the planning and development stages of the project.

All engagement activities undertaken for the project have taken into consideration the stage of the project as well as the interests, needs, accessibility and availability of stakeholders and the community. Transgrid's commitment is to make sure relevant activity and communications are reinforced by the relationships held with the Place Managers, HumeLink CCGs and Transgrid Landowner Advocates. Place Managers, HumeLink CCG members and Landowner Advocates have been regularly consulted for feedback on engagement activities. This has informed Transgrid's approach to engagement opportunities.

The *HumeLink Engagement Strategy* and *EIS Engagement Plan* guided the communication and engagement prior to and during the preparation of the EIS for HumeLink. The documents are reviewed periodically and allow for adaptability of scheduling, delivery, and messaging based on the feedback received from stakeholders, the community, and the CCGs.

The *EIS Engagement Plan* was developed to:

- outline how community and stakeholder feedback is sought and considered as part of the corridor refinement process, the environmental assessment process, design development and construction planning
- ensure that the project planning, design and project approval processes are transparent, and that it is clear how community and stakeholder feedback is considered in these processes
- align the engagement and communications process with regulatory requirements for the project's assessment and approval, and provides community and stakeholders with just and fair opportunities to participate meaningfully in this process
- honour commitments to the community, landowners, and stakeholders.

The *EIS Engagement Plan* considers the use of collateral and materials (shown in Table 6-3), communication channels (shown in Table 6-4), and direct engagement and consultation activity (shown in Table 6-5) to:

- raise awareness of the project
- educate on the project process
- align objectives with the community, where possible
- build trust with the community and stakeholders
- seek feedback from the community
- understand community sentiment and concerns related to local and regional issues
- gain insight into the local area.

The activity and data presented in Table 6-3, Table 6-4 and Table 6-5 are current as at 30 June (June) 2023. However, engagement and consultation with stakeholders and the community has and will continue prior to, during and after the EIS public exhibition period. An *Engagement Outcomes Report* (included as Appendix C) was developed in line with the abovementioned strategy and plan and outlines in detail all communication and engagement activities undertaken as part of HumeLink up to June 2023.

Table 6-3 Collateral and materials used

Collateral / materials	Purpose	Method	Delivery output (to June 2023)
Project newsletter	Provide comprehensive information about the project and EIS engagement process. Ensure key information and updates about the project and EIS process is received by those most impacted, delivered straight to their letterbox.	Electronic distribution via direct email to project subscribers list and available on project website. Hard copy distribution via letterbox drops to impacted and neighbouring landowners as well as general communities along the HumeLink project footprint.	11 project newsletter editions were published between 2021 and to June 2023. Project newsletters distributed to over 6,500 people via email. Project newsletters distributed to over 77,700 people via letterbox drop. Over 250 clicks in total on project newsletters on the HumeLink project webpage.
Guides and fact sheets	Provide high-level information regarding each of the EIS topics or technical reports. Make relevant information available to all interested parties in an easy-to-understand format.	Digital copies available on the HumeLink webpage. Hard copies made available at in-person engagement and consultation activities.	29 guides and factsheets produced and made available online and at community events.
What we heard reports	Share back with stakeholders and the community what we have heard at engagement activities and any relevant next steps to be taken to address feedback received. Provide public-facing accountability and transparency for genuine feedback, questions, and comments.	Publication on the HumeLink website. Link announced and shared within relevant project engagement collateral and emailed to stakeholders who engaged with the activity featured in the report.	What we Heard reports produced after each round of Community Information Sessions (CIS) and Community Information Webinars. As of June 2023 the following What we Heard reports were produced: • September 2022 CIS • October 2022 CIS • November/December 2022 Webinars • March 2023 CIS • March 2023 Webinars • May 2023 CIS • May 2023 Webinars.
Feedback forms	Feedback forms made available at the conclusion of all engagement activities to share thoughts on the experience and provide any additional comments or queries regarding the HumeLink project.	QR code provided at in person events for a digital feedback form. Feedback forms emailed to attendees of webinar events.	All face-to-face community engagement activities have made a digital feedback form available for attendees to fill in.
Icons/images and infographics	Visual and communication collateral developed to support engagement activities. Examples include visual information of transmission line structures construction process, EIS planning approvals flowchart, icons for each EIS specialist study and visual fact sheets for each of the EIS topics.	Icons and infographic to support in-person and online engagement activities.	-

Table 6-4 Communication channels

Channel	Purpose	Delivery output
Project hotline	Dedicated project freephone number – 1800 317 367 – featured on all collateral and digital channels for stakeholders and the community to easily call with enquiries, complaints and feedback.	280 total incoming calls received to June 2023.
Project email	Dedicated project email address – humelink@transgrid.com.au – featured on all collateral and digital channels for stakeholders and the community to easily contact Transgrid with enquiries, complaints and feedback.	2,349 emails received to June 2023. 2,269 classified as enquiries. 80 classified as complaints.
Project webpage	Dedicated webpage for the HumeLink project on Transgrid's website – HumeLink: Connecting Wagga Wagga, Bannaby and Maragle | Transgrid – featured on all collateral and digital channels for stakeholders and the community to easily access up-to-date information about the project.	25,558 page views with over 50,000 clicks to the HumeLink website. Over 15,800 total unique visitors to the webpage to June 2023.
Direct person to person engagement (via Place Managers and Land Access Officers)	Dedicated Place Managers and Land Access Officers for each of the project's impacted landowners to work throughout early engagement, route refinement and ongoing easement negotiations.	Route sections: • Bannaby to Pejar • Bannister to Bango • Wagga Wagga (Gregadoo) to Wondalga • Maragle (Nurenmerenmong) to Wondalga • Wondalga to Adjungbilly • Bowning to Adjungbilly.
Digital EIS webpage	Interactive web-based summary report of the key findings of the project's EIS. The report provides summary text alongside multimedia and interactive maps demonstrating key project information.	Digital EIS to be live during EIS public exhibition stage.
Project webpage – HumeLink interactive map	An interactive feature for the public to see where the project is located, and to place landmarks, comments and feedback tagged to a specific location on the map.	2,175 comments on the map to date.
Social media	Facebook used as output channel to reach those stakeholders and community members that were not able to be reached via formal project channels (website, emails, letterbox drops, phone calls). Facebook provided a timely and engaging platform to post updates and events regarding the HumeLink project – this channel has been particularly used via the paid advertisement option to reach Facebook users geotargeted areas.	23,091 clicks on paid Facebook posts regarding the HumeLink project. 3,018,493 total impressions on Facebook posts regarding the HumeLink project.
Electronic direct mail (EdM)	Emails sent to subscribed stakeholders raising awareness of EIS engagement activities, the process, and where to find more information.	95 EdM campaigns sent to June 2023, with 852 subscribers. Distribution segments: • CCGs • directly impacted landowners • project subscribers.
Letterbox drops	Delivering key information directly to the letterboxes of landowners within the project footprint via post. Reaching community members with activity notifications directly delivered to their letterbox via a letterbox drop to raise awareness of the project and EIS process.	77,780 project newsletters letterbox dropped across the project alignment and surrounding regional towns.

Channel	Purpose	Delivery output
Advertisements in local media	Develop awareness of the HumeLink project and EIS process, including upcoming engagement opportunities. Reach the broader community and attract interest from a wider audience.	31 print advertisements placed across 10 local newspapers. 4 local radio stations featured ads about the HumeLink community information sessions.
Media release, media events, and broadcast	Media coverage on information provided by Transgrid to relevant media outlet that will ensure timely and correct information is shared with the community.	12 media releases shared by Transgrid between February 2022 and June 2023.
Info distributors group	Identify groups and stakeholders within the community that might act as project info distributors and contribute to sharing information about upcoming EIS engagement activities, EIS engagement channels and opportunities for feedback.	Over 120 info distributors in the network including: • local business chamber • local progress associations • local community groups.

Table 6-5 Direct engagement and consultation activities

Activity	Purpose	Delivery output
Stakeholder briefings	Regular briefings offered to key stakeholder groups to inform on the approach to community engagement and the EIS development. Used as an opportunity to receive informal feedback and to understand sentiment.	Ongoing stakeholder briefings offered to key project stakeholders.
Regulatory stakeholder and governmental agency meetings	Formal opportunities, with the presence of technical experts, to receive feedback on EIS topics from regulatory stakeholders and governmental agencies.	Ongoing meetings held with government agencies.
Local Aboriginal Land Councils (LALCs) and Aboriginal Stakeholders meetings	Regular meetings offered to address the project status, potential impacts and the progress of EIS engagement. Provides a mechanism for feedback and collaboration.	Ongoing meetings held with LALCs and Aboriginal Stakeholders as part of Transgrid's First Nations engagement including consultation on Aboriginal objects and places within the project footprint and contribute to the identification and development of options to manage potential cultural heritage impacts. Predictive model included in the Aboriginal Cultural Heritage Assessment Report (ACHAR) methodology was presented to the HumeLink RAPs. Further information of the submissions and feedback received can be found in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.
Community information sessions (face-to-face)	Hosted at a range of locations near the project footprint. The sessions provide an opportunity for the community to engage with Transgrid, learn more about the project, ask questions, and provide feedback. Events program includes a general project introduction followed by specific sessions that address the EIS topics and the EIS public exhibition. Access to technical specialists is provided at each session.	44 community information sessions held across 11 regional towns. Over 200 people have attended in person. Locations that have hosted information sessions to date: Adelong, Batlow, Crookwell, Gundagai, Gunning, Taralga, Tarcutta, Tumbarumba, Tumut, Wagga Wagga and Yass.

Activity	Purpose	Delivery output
Community information webinars	Online project update sessions for interested community members and stakeholders who were unable to attend the face-to-face sessions.	9 webinars held to date. Webinar topics: • project introduction • project update • introduction to Environmental Impact Statement • EIS specialist studies - Landscape Character and Visual Amenity - Land Use and Property - Agricultural Land - Traffic and Transport - Noise and Vibration - Air Quality. Webinars will continue to be held during the public exhibition of the EIS.
Community/special interest group briefings	Updates to community/special interest groups on the project status and progress on the EIS engagement plan, providing a mechanism for feedback and collaboration.	Ongoing briefings to community/special interest groups as required and requested.
CCG meetings	A forum for discussion and feedback between HumeLink, local councils and representatives of the community on matters relating to the project and EIS. Scheduled CCG meetings are leveraged to present proposed engagement activity and relevant topics related to EIS assessment.	CCG meetings were held with each CCG monthly up to February 2023. From March 2023 onwards, CCGs have been held on a combined basis as a result of consultation with the three groups. 27 CCG meetings to date.
Mobile community engagement hub – Remote Access Community Hub (RACH)	As part of the overall Community engagement strategy, RACH is a critical tool for the CSE team to deliver meaningful and productive interactions with communities. RACH is a mobile engagement hub solution, a custom-built tool that enables community engagement in an agile and responsive way with the capacity for remote and off-road travel.	From May 2023 engagement has been undertaken in towns within the following LGAs • Wagga Wagga City • Snowy Valleys • Cootamundra-Gundagai Regional • Yass Valley • Upper Lachlan Shire Goulburn Mulwaree.
One-on-one landowner meetings (on property)	Discuss individual landowner impacts or queries.	Over 1,100 one-on-one meetings held with impacted landowners. Over 10,500 interactions (including phone calls, emails and text messages).
Facilitated landowner Q&A webinars	Opportunity for landowners to ask specialists questions on selected topics in a group forum.	38 attendees across 6 webinars in 2022.

An overview of the consultation activity (up to June 2023) by geographical area is presented in Figure 6-5.

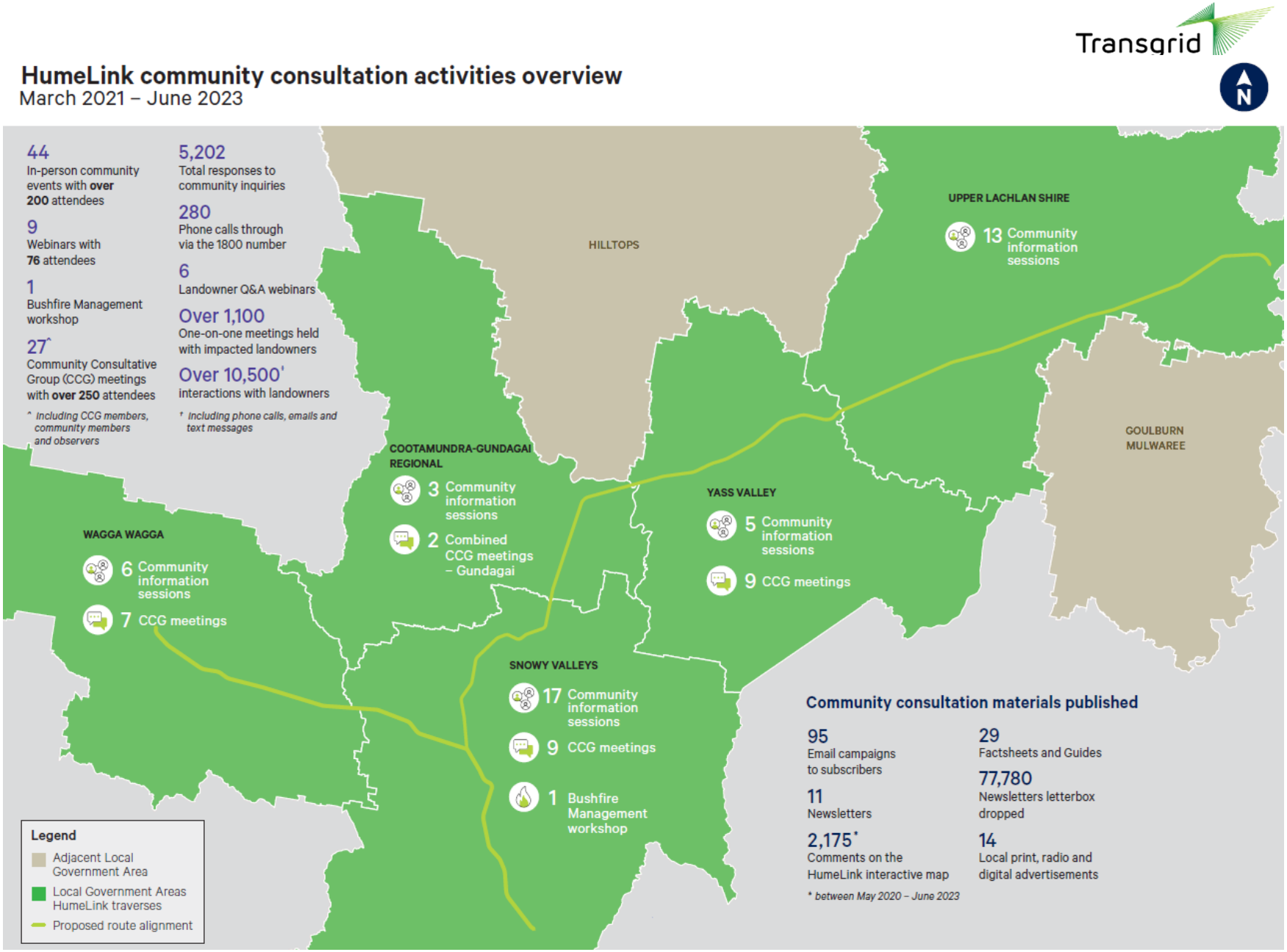


Figure 6-5 Overview of consultation activity by geographical area

6.4. Stakeholder feedback and topics raised

Transgrid has engaged with a range of key stakeholders and communities within and surrounding the project footprint. The following sections provide information on stakeholder engagement and feedback received to date.

6.4.1. Government agency feedback

The HumeLink project team has undertaken extensive consultation with a range of government departments and agencies to confirm regulatory requirements for the environmental assessment, gather knowledge on key issues and opportunities, and facilitate information sharing during preparation of the EIS.

Consultation that has occurred thus far has resulted in the topics listed in Table 6-6.

Table 6-6 Topics raised from consultation with government agencies and departments

Agency / government department	Topics raised	Addressed in EIS
Commonwealth Government		
DCCEEW – formerly Department of Agriculture, Water and Environment	• potential impacts on Matters of National Environmental Significance including threatened species and communities, migratory species and the Australian Alps National Parks and Reserves and Snowy Mountains Scheme National Heritage places • compliance with Commonwealth assessment and approval process.	Chapter 5 (Statutory context) Chapter 8 (Biodiversity) Chapter 10 (Non-Aboriginal heritage)
Department of Industry, Science and Resources	• Australian *Jobs Act 2013* obligation and the implication on local business and local workforce involvement.	Chapter 12 (Economic) Chapter 13 (Social)
Crown Lands	• potential impacts on Crown Land and associated land acquisition requirements • potential impacts on Crown roads and process for access requirements through Councils.	Chapter 11 (Land use and property)
CASA	• potential impacts on existing Obstacle Limitation Surface (OLS) across the project footprint.	Chapter 19 (Hazards and risks) *Technical Report 14 – Aviation Impact Statement*
Department of Defence	• potential impacts of new transmission lines on existing Defence Royal Australian Air Force (RAAF) base in Wagga Wagga.	Chapter 19 (Hazards and risks)
Murray Darling Basin Authority (MDBA)	• potential impacts on water quality, the riparian zone and threatened species and management under relevant regional, State and Commonwealth planning guidelines/legislation.	Chapter 17 (Surface water and groundwater quality)
ARTC	• potential impacts on any ARTC works including the Main South Railway Line • compliance with ARTC and Australian Standards, ARTC network rules and procedures.	Chapter 20 (Traffic, transport and access)

Agency / government department	Topics raised	Addressed in EIS
NSW Government		
NSW DPE	• HumeLink's Biodiversity Offset Strategy and potential Biodiversity Stewardship Agreements • interest in potential visual impacts, biodiversity impacts (including vegetation clearance methodology), heritage impacts and other impacts on local communities from the project • early engagement with government agencies and other stakeholders such as councils • EIS assessment and approval process, timeframes and opportunities.	Chapter 2 (Strategic context and project need) Chapter 5 (Statutory context) Chapter 8 (Biodiversity) Chapter 11 (Land use and property)
Department of Planning and Environment – BCD	• interest in understanding local biodiversity values • assessment methodology for biodiversity impacts including vegetation clearance approach, areas previously affected by bushfires, and assumed presence of threatened species • biodiversity management and potential offset strategies • ecology surveys and fieldwork to support the development of the Biodiversity Development Assessment Report • management of inaccessible areas and land access prioritisation.	Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report*
Heritage NSW	• cultural heritage (Aboriginal and non-Aboriginal) assessment requirements, impacts and management strategies • need for appropriate consultation with Aboriginal stakeholders including LALCs and RAPs • Cultural Values Assessment.	Chapter 9 (Aboriginal heritage) *Technical Report 2– Aboriginal Cultural Heritage Assessment Report* Chapter 10 (Non-Aboriginal heritage) *Technical Report 3 – Historic Heritage Impact Assessment* A Cultural Values Assessment is being prepared and would be provided to Heritage NSW.
NSW DPI Agriculture	• potential impacts on land use and compatibility issues on agricultural land and farm businesses hosting transmission line infrastructure • impacts of project construction and operation on current and future farming and rural land use practices • definition of prime agricultural land • economic impacts – impact on farm production and potential loss of productivity as a result of hosting transmission lines on farming properties • landowner influence on route refinement • easement land allocations.	Chapter 11 (Land use and property) Chapter 12 (Economic) *Technical Report 4 – Agricultural Impact Assessment* *Technical Report 5 – Land Use and Property Impact Assessment*
NSW DPI Fisheries	• impacts on waterway crossings, aquatic ecology and riparian vegetation • details of construction methodology for water quality monitoring and sourcing.	Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report* Chapter 17 (Surface water and groundwater quality) *Technical Report 12 – Surface Water and Groundwater Impact Assessment*

Agency / government department	Topics raised	Addressed in EIS
DPE – Water (previously Natural Resources Access Regulator)	• impact assessment to include identification of an adequate and secure water supply for the life of the project • potential impacts on surface and ground water sources.	Chapter 17 (Surface water and groundwater quality) *Technical Report 12 – Surface Water and Groundwater Impact Assessment*
Department of Regional NSW	• workforce availability and skills – opportunities for collaboration • workforce accommodation and potential impacts on housing.	Chapter 13 (Social) *Technical Report 7 – Social Impact Assessment*
Transport for NSW (TfNSW)	• potential impacts of transmission lines crossing over state roads • impacts on TfNSW assets affected by construction • potential impacts on road safety and capacity of current road network • transportation of large materials and oversize loads • traffic management during construction	Chapter 20 (Traffic, transport and access) *Technical Report 16 – Traffic and Transport Impact Assessment*
Forestry Corporation of NSW	• details of route options including access tracks • cultural heritage significance of Red Hill State Forest • Aboriginal cultural heritage site (Kiley's Run – Banjo Patterson cottage, Brungle) • Transgrid land ownership structure • need to minimise impact on the plantation estate – suitable compensation • salvage harvest – once complete, locals with heavy machinery and vehicle experience available • early access agreement for future Maragle 500 kV substation • transmission line structure locations • construction schedule • bushfire risk and site access post fires • biodiversity offsets strategy • environmental surveys – flora and fauna survey data, hunting exclusion zones.	Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report* Chapter 11 (Land use and property) *Technical Report 4 – Agricultural Impact Assessment* *Technical Report 5 – Land Use and Property Impact Assessment* Chapter 9 (Aboriginal heritage) *Technical Report 2– Aboriginal Cultural Heritage Assessment Report* Chapter 10 (Non-Aboriginal heritage) *Technical Report 3 – Historic Heritage Impact Assessment*
NSW Rural Fire Service	• development of a bushfire assessment report to address potential risks associated with bushfires including: - ignition sources during construction and operation - operational access for firefighting appliance to the site and - proposed bush fire protection measures, including vegetation management and fire suppression capabilities.	Chapter 19 (Hazards and risks) *Technical Report 13 – Bushfire Risk Assessment Report*
Fire and Rescue NSW	• requested to be consulted and given the opportunity to review and provide comment on the proposed fire and life safety systems and their configuration at the project's preliminary and final design phases.	Chapter 19 (Hazards and risks) *Technical Report 13 – Bushfire Risk Assessment Report*

Agency / government department	Topics raised	Addressed in EIS
SafeWork NSW	• worker accommodation strategy for the project – particularly interested in worker influx in Wagga Wagga (considering other major projects happening in the area) • Worker safety during construction including workers health and wellbeing, commuting times and length, temporary accommodation conditions.	Chapter 13 (Social) Chapter 20 (Traffic, transport and access)
WaterNSW	• potential impacts on water supply infrastructure and water quality.	Chapter 17 (Surface water and groundwater quality)

6.4.2. Local council feedback

Transgrid has been in consultation with local councils across the project footprint and surrounding areas throughout the HumeLink planning and development stages to address unique concerns, needs and opportunities. Consultation that has occurred thus far has resulted in the topics listed in Table 6-7.

Table 6-7 Topics raised from consultation with local councils

Local council	Topics raised	Addressed in EIS
Wagga Wagga City Council	• Proposed Gugaa 500 kV substation location and associated construction work • Potential impacts on the Gregadoo waste facility • Renewable energy opportunities in the Wagga Wagga area and potential link with HumeLink • Worker accommodation and construction compounds • Community consultation fatigue – particularly due to other major projects happening in the Wagga Wagga area • Local university / student engagement • Building social licence	Chapter 2 (Strategic context and project need) Chapter 13 (Social) Chapter 25 (Cumulative impacts)
Snowy Valleys Council	• Route selection process including detail on approach to Kosciuszko National Park and Blowering route options • Easement maintenance • Aviation safety and access and potential impacts on Tumut Airport OLS • Bushfire risk and management of fire hazard and ability to fight fires in areas under and around transmission lines • Benefits to Snowy Valleys region and potential legacy and community investment projects • Impacts on visual amenity	Chapter 2 (Strategic context and project need) Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 19 (Hazards and risks) *Technical Report 13 – Bushfire Risk Assessment Report* *Technical Report 14 – Aviation Impact Statement*
Upper Lachlan Shire Council	• Potential cumulative impacts on existing infrastructure • Impacts on visual amenity and potential impacts on tourism as a result of decreased visual amenity • Impacts on the local road network • Landowner compensation process • Community engagement and communication • Community investment, legacy and benefits to the region	Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 25 (Cumulative impacts) Chapter 20 (Traffic, transport and access) *Technical Report 16 – Traffic and Transport Impact Assessment* Chapter 12 (Economic) *Technical Report 6 – Economic Impact Assessment*

Local council	Topics raised	Addressed in EIS
Yass Valley Council	• Impact on visual amenity due to positioning and proximity of transmission line structures and lines to existing residences • Employment opportunities for the Yass Valley area • Population influx in LGA and impacts on housing and availability of accommodation • Water and soil management during construction (spoil transport and management) • Detail on bushfire hazard assessment for HumeLink • Impacts on Aboriginal heritage • Community investment and community enhancement opportunities	Chapter 12 (Economic) *Technical Report 6 – Economic Impact Assessment* Chapter 13 (Social) *Technical Report 7 – Social Impact Assessment* Chapter 14 (Landscape character and visual amenity) *Technical Report 8 – Landscape Character and Visual Impact Assessment* Chapter 16 (Soils, geology and contamination) *Technical Report 10 Phase 1 Contamination Assessment* Chapter 17 (Surface water and groundwater quality) *Technical Report 12 – Surface Water and Groundwater Impact Assessment* Chapter 19 (Hazards and risks) *Technical Report 13 – Bushfire Risk Assessment* Chapter 25 (Cumulative impacts)
Cootamundra-Gundagai Regional Council	• Impacts from electric and magnetic fields (EMF) • Community consultation fatigue from other projects in the area • Impact on visual amenity due to positioning and proximity of transmission line structures and lines to existing residences • Compulsory acquisition process • Details on route selection process • Flooding • Project timeline	Chapter 2 (Strategic context and project need) Chapter 11 (Land use and property) Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 25 (Cumulative impacts)
Goulburn-Mulwaree Council	• Assessment on presence of Golden Sun Moth • Route selection process • Potential impacts on tourism impacts at Pejar Dam	Chapter 2 (Strategic context and project need) Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report*
Hilltops Council	• Socio-economic impacts and community investment opportunities	Chapter 12 (Economic) Chapter 13 (Social)

6.4.3. Impacted landowners

Transgrid has implemented a targeted approach for landowner engagement, including the deployment of dedicated Place Managers and Land Access Officers local to the area. A key focus for Transgrid has been to meet with easement-impacted landowners prior to and during the preparation of the EIS. There have been over 1,100 on-property meetings and over 13,000 interactions (including emails, phone calls and text messages) with the impacted landowners across the project footprint to June 2023.

The initial purpose of these meetings was to understand landowner sentiment and any concerns or opportunities, seek input and receive local information on such matters as local farming operations, logistics, land use and environmental and cultural considerations.

As the project progressed, targeted engagement with impacted landowners has related to the property acquisition process, easement requirements, potential environmental and social impacts, route alignment, biosecurity and property access management.

Engagement with landowners has been an integral part of the route refinement process and has been ongoing since the start of the project. To reduce and minimise impacts on landowners, a number of factors were considered when consulting with landowners on route alignment and options assessment. These included proximity to residences, number of landowners affected, land use and operational requirements and other local land use constraints.

Changes to the route alignment have been progressed in close consultation with impacted landowners. Route options including (but not limited to) options through Green Hills State Forest, Pejar Dam, Bannaby and Tumut have been assessed through involvement and consultation with directly impacted landowners. This approach to ongoing engagement with landowners through the route refinement process has contributed to a reduced number of impacted landowners as the project footprint has been refined. Further information on how landowner feedback has been considered as part of the route refinement process is outlined in Appendix E (Options Report) and also in Chapter 2 (Strategic context and project need).

Landowners will continue to be consulted on the exact locations of transmission line structures and other design and construction aspects of the project as detailed design progresses.

6.4.4. General community feedback

Feedback from a range of stakeholders has been captured and responded to prior to and during the preparation of the EIS. The feedback has been received through HumeLink's communication channels (identified in Table 6-4) and direct consultation activities (Table 6-5) including the project hotline, email address, webpage form, and in-person and online events.

After each community event (in-person or virtual), a 'What we heard' report has been prepared and made available on the HumeLink webpage. The objectives of these reports are:

- for all stakeholders (whether in attendance or not) to reflect on the conversation and feedback that was raised, and review the response from the project team
- for the HumeLink engagement team to capture, respond to and monitor themes of conversation that are occurring within the community in order to adapt engagement activity and communications accordingly
- to ensure Transgrid and the HumeLink engagement team have captured and interpreted their feedback as it was intended.

Key topics raised across the communication channels and activity have been grouped into relevant themes and are listed in Table 6-8 and outlined in Figure 6-6. These themes are:

- **Design and construction:** This relates to topics that have a design component including the project footprint, changes to route alignment, transmission line structures, and traffic management.
- **Environment and heritage:** This relates to topics impacting the environment and heritage including biodiversity, air quality, and heritage.
- **Project processes:** This relates to topics associated with project delivery, including community and stakeholder engagement activities and the need for the project.

- **Property:** This relates to access, compensation, maintenance and any other requirements that relating to properties and easements within the scope of the HumeLink project.
- **Socio-economic:** This relates to topics that have a socio-economic impact within the scope of the HumeLink project, including local employment and suppliers.

These themes and their stakeholder relationships are broken down further in the *Engagement Outcomes Report* (Appendix C).

Table 6-8 Topics raised through general community and stakeholder engagement

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
Design and construction	Potential option to underground transmission lines: • Undergrounding assessment outcomes • Technical assessment process • Financial feasibility • Visual impact of overhead transmission lines • Environmental impacts	HumeLink interactive map CCG meetings Undergrounding Feasibility Steering Committee Yass Community Information Session 13/09/2022 Batlow Community Information Session 15/09/2022 Community information webinars: November - December 2022 Tumut Community Information Session 21/02/2023 Adelong Community Information Session 22/02/2023 Wagga Wagga Community Information Session 23/02/2023 Batlow Community Information Session 01/03/2023 Wagga Wagga Community Information Session 22/05/2023 Gundagai Community Information Session 24/05/2023 Tumbarumba Community Information Session 25/05/2023 Yass Community Information Session 29/05/2023 Crookwell Community Information Session 30/05/2023 Gunning Community Information Session 30/05/2023 Taralga Community Information Session 31/05/2023 Project inbox Project hotline number	Chapter 2 (Strategic context and project need) Chapter 19 (Hazards and risks)
Design and construction Environment and heritage	EMF: • EMF impacts on grazing and stock under transmission lines • EMF related health impacts	HumeLink interactive map CCG meetings Yass Community Information Session: 13/09/2022 Taralga Community Information Session 20/09/2022 Gundagai Community Information Session 21/09/2022 Community information webinars: November - December 2022 Tumut Community Information Session 21/02/2023	Chapter 19 (Hazards and risks)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
		Wagga Wagga Community Information Session 23/02/2023 Batlow Community Information Session 01/03/2023 Taralga Community Information Session 09/03/2023 Wagga Wagga Community Information Session 22/05/2023 Tumut Community Information Session 23/05/2023 Project inbox	
Design and construction	Transmission line route and structure locations: • Transmission line structure and route location need to consider topography to reduce visual impact • Need confirmation of the transmission line structure locations • Requirements and regulations around distances between the transmission lines and residential properties • Why the project is not located in the big cities where the power is going	HumeLink interactive map CCG meetings Yass Community Information Session 13/09/2022 Tumut Community Information Session 14/09/2022 Taralga Community Information Session 20/09/2022 Community information webinars: November - December 2022 Tumut Community Information Session 21/02/2023 Batlow Community Information Session 01/03/2023 Yass Community Information Session 29/05/2023 Taralga Community Information Session 31/05/2023 Community information webinars: March 2023 Project inbox	Chapter 2 (Strategic context and project need) Chapter 3 (Project description – infrastructure and operation) Chapter 14 (Landscape character and visual amenity)
Design and construction	Alignment / route selection: • Decision around Blowering option, and through Kosciuszko National Park. • Route alignment option in Bannaby • General “why” around route selection process – aligning line wherever possible to the existing lines • How HumeLink would connect with surrounding projects (Victoria to NSW Interconnector West (VNI West) and EnergyConnect) • Western Route option (Green Hills)	HumeLink interactive map Tumut Community Information Session 14/09/2022 Taralga Community Information Session 20/09/2022 Gundagai Community Information Session 21/09/2022 Tumut Community Information Session 21/02/2023 Wagga Wagga Community Information Session 23/02/2023 Tumbarumba Community Information Session 28/02/2023 Gundagai Community Information Session 02/03/2023 Crookwell Community Information Session 07/03/2023 Tumbarumba Community Information Session 25/05/2023 Yass Community Information Session 08/03/2023 Taralga Community Information Session 31/05/2023 Project inbox	Chapter 2 (Strategic context and project need)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
Design and construction Environment and heritage Property	Visual amenity and impact: • Visual impact on neighbouring landowners • Potential compensation options to mitigate visual impact on neighbouring properties • General visual amenity concerns	HumeLink interactive map CCG meetings Yass Community Information Session 13/09/2022 Batlow Community Information Session 15/09/2022 Wagga Wagga Community Information Session 16/09/2022 Taralga Community Information Session 20/09/2022 Gundagai Community Information Session 21/09/2022 Community information webinars: November - December 2022 Tumut Community Information Session 21/02/2023 Adelong Community Information Session 22/02/2023 Tumbarumba Community Information Session 28/02/2023 Crookwell Community Information Session 07/03/2023 Gunning Community Information Session 07/03/2023 Wagga Wagga Community Information Session 22/05/2023 Taralga Community Information Session 31/05/2023 Community information webinars: March 2023 Project inbox Project hotline number	Chapter 14 (Landscape character and visual amenity)
Property Environment and heritage	Biosecurity: • Adherence to biosecurity measures when accessing property • Biosecurity measures within properties that have contained weeds and pests on certain areas. Concerns about project team moving around property and spreading weeds around different locations within a property • General biosecurity concerns • Impact on aerial spraying and weed control	HumeLink interactive map CCG meetings Yass Community Information Session 13/09/2022 Gundagai Community Information Session 21/09/2022 Batlow Community Information Session 01/03/2023 Gundagai Community Information Session 02/03/2023 Project inbox	Chapter 8 (Biodiversity) Chapter 11 (Land use and property)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
	• Minimise cross-contamination during soil remediation and weed control		
Environment and heritage Design and construction	Vegetation: • Transgrid strategies to minimise vegetation clearance	HumeLink interactive map Yass Community Information Session 13/09/2022 Batlow Community Information Session 15/09/2022 Crookwell Community Information Session 07/03/2023	Chapter 4 (Project description – construction) Chapter 8 (Biodiversity)
Environment and heritage	Aboriginal heritage: • Aboriginal heritage sites located on directly impacted land • Assessment process for EIS	HumeLink interactive map CCG meetings Yass Community Information Session 13/09/2022 Yass Community Information Session 08/03/2023	Chapter 9 (Aboriginal heritage)
Environment and heritage	Historic heritage: • Historic properties around the Bannaby area	HumeLink interactive map CCG meetings Project inbox Project hotline number	Chapter 10 (Non-Aboriginal heritage)
Environment and heritage	Ecology: • Response to ecology report Bannaby Residents Action Group submitted to Transgrid • Threatened species – location and species identified on interactive map • Native lilies and orchids • Ecological sensitivity around Bannaby Creek, part of the Sydney catchment • Plant species identified on Tomneys Plains • Impacts on national parks and State forests • Impacts to koala population	HumeLink interactive map Taralga Community Information Session 20/09/2022 Adelong Community Information Session 22/02/2023 Yass Community Information Session 08/03/2023 Taralga Community Information Session 09/03/2023 Taralga Community Information Session 31/05/2023	Chapter 8 (Biodiversity)
Environment and heritage	Bushfire: • Bushfire risk and management of fire hazard and ability to fight fires under and around transmission lines • Potential changes to bushfire risk from transmission lines being undergrounded	HumeLink interactive map CCG meetings Undergrounding Feasibility Steering Committee Yass Community Information Session 13/09/2022 Batlow Community Information Session 15/09/2022 Taralga Community Information Session 20/09/2022 Community information webinars: November - December 2022	Chapter 19 (Hazards and risks)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
	• Transgrid engagement with RFS for bushfire risk management matters • Sensitivities arising from the 2019-2020 bushfires – particularly around the Tumut area.	Tumut Community Information Session 21/02/2023 Adelong Community Information Session 22/02/2023 Wagga Wagga Community Information Session 23/02/2023 Batlow Community Information Session 01/03/2023 Yass Community Information Session 08/03/2023 Taralga Community Information Session 09/03/2023 Gundagai Community Information Session 24/05/2023 Tumbarumba Community Information Session 25/05/2023 Yass Community Information Session 29/05/2023 Project inbox Project hotline number	
Design and construction	Renewable energy: • Potential interactions with local wind farms	Taralga Community Information Session 20/09/2022 Taralga Community Information Session 31/05/2023	Chapter 25 (Cumulative impacts)
Design and construction	Traffic and transport: • Impact on local roads and road maintenance • Use of private access tracks • Potential increase in traffic and impacts on public safety	CCG meetings Wagga Wagga Community Information Session 23/02/2023 Gunning Community Information Session 07/03/2023 Yass Community Information Session 08/03/2023 Taralga Community Information Session 09/03/2023	Chapter 20 (Traffic, transport and access)
Project process	Corporate interest: • Project funding	Yass Community Information Session 13/09/2022 Tumut Community Information Session 21/02/2023 Adelong Community Information Session 25/05/2023 Taralga Community Information Session 31/05/2023	Chapter 2 (Strategic context and project need)
Project process Design and construction	Project status: • Confirmation that HumeLink construction had not started. Work on existing transmission lines is not related • Project timeline • Consultation prior to EIS public exhibition and timing of EIS exhibition	HumeLink interactive map CCG meetings Batlow Community Information Session 15/09/2022 Wagga Wagga Community Information Session 23/02/2023 Batlow Community Information Session 01/03/2023 Gunning Community Information Session 07/03/2023 Taralga Community Information Session 09/03/2023 Yass Community Information Session 29/05/2023 Crookwell Community Information Session 30/05/2023	Chapter 4 (Project description – construction) Chapter 6 (Engagement) Chapter 25 (Cumulative impacts)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
		Gunning Community Information Session 30/05/2023 Taralga Community Information Session 31/05/2023 Community information webinars: March 2023	
Project process	Construction contractor: • Contractor worker safety protocols • Safe Works to be engaged ahead of start of construction to discuss worker safety matters • Announcement of HumeLink delivery partners	Wagga Wagga Community Information Session 16/09/2022 Tumbarumba Community Information Session 25/05/2023 Taralga Community Information Session 31/05/2023	Chapter 26 (Environmental management)
Project process	Regulatory: • Consideration of the weighting of impacts to private landowners in comparison to other aspects of the EIS such as Aboriginal heritage • NSW legislative framework for EIS and property acquisition and compensation process	Tumut Community Information Session 17/09/2022	Chapter 2 (Strategic context and project need) Chapter 5 (Statutory context)
Project process Property Socio-economic	Landowner consultation: • Not enough contact and communication with Land Access Officer and Place Manager • Perceived lack of genuine consultation with landowners • Open forum with Transgrid Executives requested • Strategic Benefits payment • Dissatisfaction with property valuation • Visual impact on neighbouring landowners • Public availability of photomontages and project visualisations	HumeLink interactive map CCG meetings Yass Community Information Session: 13/09/2022 Tumut Community Information Session 14/09/2022 Taralga Community Information Session 20/09/2022 Gundagai Community Information Session 21/09/2022 Gundagai Community Information Session 02/03/2023 Crookwell Community Information Session 07/03/2023 Adelong Community Information Session 25/05/2023 Taralga Community Information Session 31/05/2023 Community information webinars: March 2023	Chapter 6 (Engagement) Appendix C (Engagement Outcomes Report)
Environment and Heritage Socio-economic	Tourism property: • Impact on future tourism opportunities for properties whose visual amenity is affected by the project	HumeLink interactive map Yass Community Information Session: 13/09/2022 Batlow Community Information Session 15/09/2022	Chapter 13 (Social)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
		Community information webinars: November - December 2022	
Property Environment and Heritage Socio-economic Project process	Property impacts: • Compensation for neighbouring properties (not in project footprint) • Compensation information provided to some property owners but not others • Request to evaluate options for ongoing (annual) compensation due to ongoing impact on land value and productivity of land • Impact on land values • Impact on land use during construction • Impact and management of livestock during construction • Impact on existing irrigation infrastructure • Impact on aerial spraying from hosting transmission lines on property • Impact on timber industry due to vegetation clearing • Strategic Benefits Payment	HumeLink interactive map CCG meetings Yass Community Information Session 13/09/2022 Tumut Community Information Session 14/09/2022 Wagga Wagga Community Information Session 16/09/2022 Tumut Community Information Session 17/09/2022 Wagga Wagga Community Information Session 23/02/2023 Tumbarumba Community Information Session 28/02/2023 Gundagai Community Information Session 24/05/2023 Adelong Community Information Session 25/05/2023 Taralga Community Information Session 31/05/2023 Community information webinars: March 2023 Project inbox	Chapter 11 (Land use and property) Chapter 12 (Economic)
Socio-economic	Workforce: • Workforce management issues including worker shortage due to scale of major projects in the area • Worker accommodation during construction in/near the town to support the economy • Increased demand for social infrastructure and social services from non-local workers supporting the project during construction	Wagga Wagga Community Information Session 16/09/2022 Taralga Community Information Session 20/09/2022 Tumbarumba Community Information Session 28/02/2023 Wagga Wagga Community Information Session 22/05/2023 Tumut Community Information Session 23/05/2023 Batlow Community Information Session 24/05/2023 Adelong Community Information Session 25/05/2023 Tumbarumba Community Information Session 25/05/2023	Chapter 13 (Social) Chapter 25 (Cumulative impacts)

Themes	Topic raised	Engagement activity where feedback was received	Addressed in EIS
Socio-economic	Local partnerships: • Opportunities to partner with local Taralga/Bannaby initiatives, including the local showground refurbishment • Opportunities for communities and community groups to partner with the project for community investment and social legacy opportunities • Local business opportunities • Community Partnerships Program	Taralga Community Information Session 20/09/2022 Community information webinars: November - December 2022 Tumbarumba Community Information Session 28/02/2023 Gunning Community Information Session 07/03/2023 Yass Community Information Session 08/03/2023 Taralga Community Information Session 09/03/2023 Tumut Community Information Session 23/05/2023 Batlow Community Information Session 24/05/2023 Yass Community Information Session 29/05/2023 Crookwell Community Information Session 30/05/2023 Community information webinars: March 2023	Chapter 13 (Social)
Socio-economic	• Impacts on mental health particularly from the property acquisition process	CCG meetings Tumut Community Information Session 21/02/2023 Adelong Community Information Session 22/02/2023 Batlow Community Information Session 01/03/2023 Gundagai Community Information Session 02/03/2023 Crookwell Community Information Session 07/03/2023	Chapter 13 (Social)

6.4.4.1. EIS community information webinars

During the EIS Introduction webinars held in November and December 2022, a live poll was made available for attendees to select the EIS topics they wished to learn more about to ensure engagement would continue to be meaningful to community stakeholders. Webinars and other engagement activities prior to the public exhibition of the EIS have been guided by the results of this poll. The results of the poll are shown in Figure 6-6.

EIS topic-specific webinars started to be held from early 2023. The first round of sessions focused on landscape character and visual amenity, land use and property, and agricultural land. During 2023 the team continued to hold community information webinars focused on different EIS specialist studies.

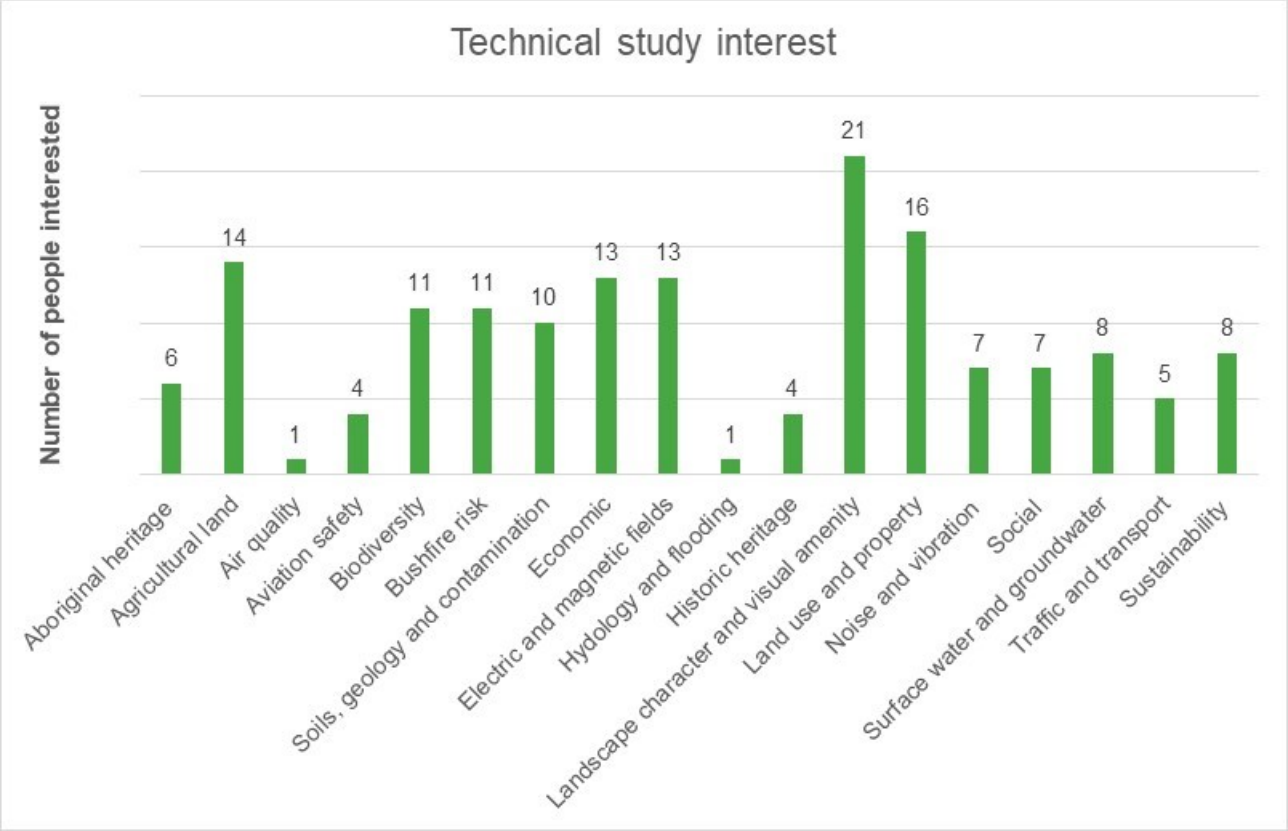


Figure 6-6 EIS Specialist studies webinar poll results

6.4.5. Consultation with Aboriginal communities for the ACHAR

This section provides a summary on the consultation undertaken with Aboriginal communities as part of the Aboriginal Cultural Heritage Assessment Report (ACHAR). Detailed information on this consultation can be found in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

The *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water (DECCW), 2010a) establish the requirements for consultation with Aboriginal people as part of the heritage assessment process and is referenced in the SEARs for the project. The aim of undertaking this consultation is to understand the cultural heritage values present within the project footprint, and the views and concerns of Aboriginal people about the project.

The requirements specify four stages of consultation:

- Stage 1 – notification of project proposal and registration of interest
- Stage 2 – presentation of information about the proposed project
- Stage 3 – gathering information about cultural significance
- Stage 4 – review of draft cultural heritage assessment report.

In accordance with these requirements, consultation was undertaken with the project RAPs that registered their interest during the Stage 1 of the consultation process (refer to Table 6-2 for a full list of HumeLink's RAPs).

During Stage 2, information about the scope of the project and the methodology for the ACHAR, including the predictive model, was presented to the RAPs.

During Stage 3 and Stage 4, RAPs were invited to provide feedback on Aboriginal objects and places within the project footprint and contribute to the identification and development of options to manage potential cultural heritage impacts. The RAPs have also had the opportunity to provide feedback on the predictive model as part of the required 28-day RAPs consultation on the ACHAR. Further information on the submissions and feedback received are in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

Transgrid is also progressing a Cultural Values Assessment that would be provided separately to Heritage NSW. Further consultation with Aboriginal stakeholders across the project footprint will be undertaken as part of this assessment and will be documented separately.

6.4.6. Other consultation undertaken for the EIS

Additional targeted consultation for the EIS has been completed as part of the Agricultural Impact Assessment and the Social Impact Assessment. Information sourced from targeted consultation on these assessments is outlined in *Technical Report 4 – Agricultural Impact Assessment* and *Technical Report 7 – Social Impact Assessment*.

6.5. Public exhibition of the EIS

The HumeLink EIS will be on public exhibition in 2023. During this time, stakeholders and the community have the opportunity to review and comment on the EIS via submission to DPE.

Electronic copies of the EIS are available to be viewed at:

- the DPE Major Projects website (planningportal.nsw.gov.au/major-projects)
- the HumeLink webpage (transgrid.com.au/humelink).

Hard copies of the EIS will also be made available including at the council libraries listed in Table 6-9.

Table 6-9 Libraries where the EIS will be on public display

LGA	Library
Wagga Wagga City	Wagga Wagga City Library
Snowy Valleys	Batlow Library
	Tumbarumba Library
	Tumut Library
	Adelong Library
Cootamundra-Gundagai Regional	Gundagai Library
Yass Valley	Yass Valley Library
Upper Lachlan Shire	Crookwell Library
	Gunning Library

6.5.1. Project notifications and updates

Throughout the public exhibition of the EIS, Transgrid will continue to inform stakeholders of the opportunities to have their say on the project. During this time, Transgrid will continue to use the following engagement channels:

- digital EIS portal
- stakeholder briefings
- community information sessions
- HumeLink webpage
- traditional media and advertisements
- social media.

In addition, directly affected landowners will be contacted via email and post to inform them of the EIS public exhibition. This will allow the community and other stakeholders to be informed about the project and the opportunity to provide a submission.

6.5.2. Considerations of stakeholder and community feedback

Once the EIS public exhibition period has concluded, Transgrid will receive a copy of all community and stakeholder submissions from DPE.

Transgrid will prepare a submissions report that responds to comments and feedback on the EIS, which will then be made available on the DPE website. If changes to the project are required following the EIS public exhibition period, an amendment report (or a preferred infrastructure report if the Planning Secretary requests changes to the project) may also be prepared.

6.6. Engagement during the HumeLink construction stage

Engagement with the community and stakeholders will continue throughout the EIS process and during the construction of HumeLink. The purpose of the ongoing engagement is to:

- ensure a high level of process awareness remains for the community as construction progresses
- provide opportunities for ongoing community feedback
- ensure feedback or concerns are addressed in a timely manner with accurate information.

Transgrid is working closely with shortlisted contractors to co-design the scope of the construction contract in relation to community and stakeholder engagement and management, workforce and workforce development, local industry participation, Aboriginal participation and community investment and benefits.

Following the co-design process, the following documents will be finalised before construction begins:

- Community and Stakeholder Engagement Management Plan
- Workforce and Workforce Development Plan
- Workforce Accommodation Strategy
- Local Industry Participation Plan
- Australian Industry Participation Plan
- Aboriginal Participation Plan
- Community Investment and Benefits Plan.

Transgrid will evaluate and endorse the plans in consideration of any relevant Minister's conditions of approval. The community and stakeholder engagement approach during construction will also include a feedback management procedure to manage communications with the community such as enquiries, complaints or disputes. Any feedback provided by the community will be managed with respect and be responded to efficiently and in a timely manner, with each stakeholder interaction being treated as an opportunity for a positive experience.

The HumeLink project hotline, email address and webpage will continue to be available, monitored and updated throughout the construction stage. Impacted landowners within the HumeLink footprint and other key stakeholders will receive important information directly via the channels and materials outlined in Table 6-3, Table 6-4 and Table 6-5, and other channels as agreed and outlined as part of the CEMP.

Further, individual Property Management Plans (PMPs) will be developed during the property acquisition and compensation process and implemented after determination of the project. PMPs will be developed in consultation with directly impacted landowners. These plans will address individual property requirements during the construction stage of the project, including adjustments to property infrastructure, biosecurity protocols, as well as agreed timing and location of works to limit disruption of landowner activities. Land Access Officers would continue to liaise with landowners throughout construction to assist with the implementation of biosecurity and access protocols and the interaction between agricultural activities and construction work to minimise and manage impacts.

6.7. Engagement during the HumeLink operation stage

The transmission line and substations would be inspected by Transgrid operational staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Transgrid's asset management team would largely manage direct relationships and engagement with landowners for infrastructure maintenance purposes during operation of the project.

Access onto private landowner properties for infrastructure maintenance purposes, including private access tracks, opening and closing of gates and biosecurity protocols, would be done in accordance with the relevant Easement Agreement between Transgrid and the landowner.

Any communications that would need to go beyond direct landowner engagement (ie helicopter maintenance surveying) would be done in line with Transgrid operational procedures and guidelines. Further information on operation and maintenance can be found in Chapter 3 (Project description – infrastructure and operation).

7. Approach to assessment of impacts

This chapter provides a summary of the approach to the assessment of impacts adopted in this EIS. This approach has been developed in response to the need for the ongoing refinement of design and construction methodology to improve environmental and performance outcomes whilst maintaining a robust assessment of potential environmental impacts for the project.

Further details on the methodology for individual specialist assessments (including details on surveys carried out and any key assumptions or limitations of the approach) are provided in each relevant environmental assessment chapter (refer to Chapter 8 to Chapter 25).

7.1. Overview of study areas used in the assessment of impacts

The assessment of impacts in this EIS has been based on several different geographic areas, which have been adopted where most appropriate to assess the extent and nature of impacts from the project, as follows:

- Various study areas have been defined for the assessment of impacts for specific environmental aspects. These study areas have been defined by technical specialists and are generally larger than the project footprint to assist with understanding the context of the project and assessment of impacts. The study areas and their use are explained in each relevant environmental assessment chapter (refer to Chapter 8 to Chapter 25).
- The project footprint has been adopted in this EIS as a conservative area that has the potential to be directly affected by the construction and operation of the project. The use of the project footprint and its justification are explained in Section 7.2.
- The indicative disturbance area has been defined to provide a more refined area for assessment of biodiversity impacts related to vegetation clearance. The indicative disturbance area is located within the project footprint and has been based on a concept design and preliminary construction methodology for the project. The use of the indicative disturbance area is explained in Section 7.3.
- An indicative area and location of individual concept design elements (such as transmission line structures and access tracks) have been adopted for some specialist assessments. These concept design elements are located within the project footprint and indicative disturbance area. Their use in the assessment of impacts for this EIS is explained in Section 7.4.

This approach to impact assessment of the project is required because, as discussed in Chapter 3 (Project description – infrastructure and operation) and Chapter 4 (Project description – construction), several aspects of the project design and construction methodology would continue to be refined and confirmed during detailed design by the construction contractors.

The detailed design process would be informed by the assessment completed for the project as well as government, landowner, community and/or other stakeholder feedback received on the project. During this stage, the mitigation and management measures identified in this EIS relevant to the detailed design would be implemented to enable the avoidance and minimisation of potential environmental impacts of the project.

These refinements would include:

- finalising the location of the proposed transmission line route
- micro-siting the transmission line structures along the proposed transmission line route
- confirming the location and number of construction compounds as well as developing construction compound layouts and final boundaries of these temporary facilities
- confirming the location of associated ancillary infrastructure (including brake and winch sites)
- confirming the final design arrangement of the proposed Gugaa 500 kV substation and the modifications to the Wagga 330 kV substation and Bannaby 500 kV substation, including any required drainage and other associated infrastructure
- confirming the requirements for utility connections and/or relocations and property adjustments
- confirming the layout of the Tumbarumba accommodation facility (AC1) and the overall worker accommodation strategy
- micro-siting and design of temporary and permanent access tracks and any road upgrades required.

Chapter 26 (Environmental management) provides details on how the mitigation and management measures would be implemented as well as the process for dealing with any future design refinements or changes to the project.

7.2. Use of project footprint in response to future design refinement

The general approach adopted for this EIS has been to conservatively assume that any area within the project footprint has the potential to be directly impacted by the project. This approach enables a level of flexibility for future design refinement while undertaking a rigorous level of impact assessment. This provides an understanding and assessment of the potential 'worst case' impacts of the project, despite the project ultimately only impacting a portion of the project footprint. For example, the proposed transmission line easement would generally be 70 metres wide, which is almost three times smaller than the 200 metre width used for the majority of the transmission line portion of the project footprint.

However, for some environmental aspects, the assessment of the project footprint is considered likely to substantially overestimate potential impacts of the project. Where this occurs, the relevant assessment of impacts has been refined within the project footprint to identify and further define the potential impacts of the project upon identified areas of environmental constraints and sensitivity (refer to Sections 7.3 and 7.4).

Environmental assessment of key issues identified for the project (summarised in Chapters 8 to 25) also includes discussion on how uncertainties resulting from this impact assessment approach would continue to be resolved and managed during the life of the project.

7.3. Use of indicative disturbance area and vegetation clearance zones

As identified in Section 7.1, the assessment of biodiversity impacts includes a more refined indicative disturbance area within the project footprint to provide a more accurate estimation of the likely magnitude of vegetation clearance required, and any associated biodiversity impacts. This approach was adopted to avoid a substantial overestimation of the likely biodiversity impacts and the associated quantity in biodiversity offsets required, which would have resulted if the whole of the project footprint was assumed to be cleared of vegetation. This is because not all the land within the project footprint is expected to be used for construction and/or operation. In addition, transmission line construction and maintenance would not require full clearance within the transmission line easement.

It is expected that the detailed design and final construction methodology for the project would result in biodiversity impacts that are similar or less than those indicated in this EIS. This is because the detailed design is unlikely to occupy a greater area of land than the concept design used in development of the indicative disturbance area and would remain within the project footprint. However, the location of final infrastructure elements and work sites within the area of the project footprint would be subject to confirmation by the construction contractors. If the final area of vegetation clearance is not consistent with what has been assessed in this EIS following design refinement, and/or would impact on areas with notably different biodiversity value, the biodiversity assessment would be revised accordingly (and, if necessary, modifications sought to the project approval).

The indicative disturbance area comprises varying degrees of physical disturbance along the transmission line route to reflect construction and operational requirements.

The indicative disturbance area is made up of three different types of vegetation clearance zones: Total Clearing Zone (TCZ), Easement Clearing Zone (ECZ) and Hazard Tree Zone (HTZ). These zones are described in Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report*. As the project does not require vegetation clearance for the entire width of the easement, the ECZ only comprises areas within the easement with potential for tall vegetation that may encroach close to transmission lines. As such, the ECZ that was assessed for potential biodiversity impacts is smaller than the full easement that was considered in the assessment of potential land use and property impacts (refer to Section 7.4).

7.4. Use of indicative concept design for specialist assessments

As discussed in Section 7.1, the impact assessment of some environmental aspects has been carried out for more refined aspects of the indicative concept design as well as the project footprint. For example, indicative transmission line structure and access track locations have been used to calculate the size of impacted areas, rather than the entirety of the project footprint where relevant.

Indicative concept design elements within the project footprint are considered in:

- *Technical Report 4 – Agricultural Impact Assessment* (Tremain Ivey Advisory, 2023) and *Technical Report 5 – Land Use and Property Impact Assessment* (HillPDA, 2023a). These reports provide refined estimates of land use areas that would be impacted by construction and operation based on the size of temporary and permanent project elements that would be situated within the project footprint.
- *Technical Report 8 – Landscape Character and Visual Assessment* (IRIS, 2023). This report provides photomontages showing a potential transmission line route and structure locations within the project footprint.

Part B – Environmental assessment

8. Biodiversity

This chapter provides a detailed summary of the assessment of potential biodiversity impacts of the project. The full assessment is provided in *Technical Report 1 – Biodiversity Development Assessment Report* (Niche Environment and Heritage, 2023).

During the development of HumeLink and the preparation of the EIS, including the biodiversity assessment, Transgrid has undertaken extensive consultation with community and stakeholders. Engagement included consultation with the Department of Planning and Environment, Biodiversity Conservation Division and Biodiversity Conservation Trust on matters such as assessment methodology, survey approach, impact avoidance and minimisation, and approach to offset calculations. This consultation has been carried out since early 2020. The summary of consultation undertaken for biodiversity is detailed Chapter 6 (Engagement) with specific feedback provided in Appendix C (Engagement Outcomes Report).

Transgrid will continue to engage with community and stakeholders on biodiversity through the detailed design, construction and operation of HumeLink.

8.1. Environmental Assessment Requirements

8.1.1. Secretary's Environmental Assessment Requirements

Table 8-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to the biodiversity impacts of the project and where these requirements are addressed in this EIS. Table 8-2 outlines the supplementary SEARs that provide relevant Commonwealth assessment requirements to address biodiversity impacts of the project.

Table 8-1 Secretary's Environmental Assessment Requirements – biodiversity

Reference	SEARs	Where principally addressed in the EIS
Biodiversity		
Key issues	The EIS must address the following matters: • an assessment of the biodiversity impacts of the project, in accordance with the NSW *Biodiversity Conservation Act 2016*, the Biodiversity Assessment Method (BAM) 2020, the Guideline for applying the Biodiversity Assessment Method at severely burnt sites 2020 and documented in a Biodiversity Development Assessment Report (BDAR);	The chapter provides a detailed summary of *Technical Report 1 – Biodiversity Development Assessment Report*, which has been prepared in accordance with the BC Act, *Biodiversity Assessment Method* (Department of Planning, Industry and Environment (DPIE), 2020c) (BAM) and *Guideline for applying the Biodiversity Assessment Method at severely burnt sites* (DPIE, 2020d).
	• the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and	Section 8.6.2 outlines how the project has applied the avoid, minimise, and offset framework. Sections 8.4, 8.5 and 8.6 provide an assessment of the direct, indirect and prescribed impacts in accordance with the BAM. Further detail is included in *Technical Report 1 – Biodiversity Development Assessment Report*.
	• an assessment of the impacts of the project on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts; and	Sections 8.4.5 and 8.5.5 summarise the assessment of impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the FM Act. Section 8.7.3 provides mitigation measures to minimise and rehabilitate impacts.

Reference	SEARs	Where principally addressed in the EIS
	• if an offset is required, details of the measures proposed to address the offset obligations.	Section 8.7.5 provides offset obligations for the project.
Water and soils		
Key issues	The EIS must address the following matters: • an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the *NSW Aquifer Interference Policy* and relevant *Water Sharing Plans*;	Sections 8.4.6 and 8.5.6 provide an assessment of potential impacts on groundwater dependent ecosystems (GDEs). Chapter 17 (Surface water and groundwater quality) provides further consideration of potential groundwater impacts of the project.
	• where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the *Controlled activities - Guidelines for riparian corridors on Waterfront Land* (DPE, 2022c), *Controlled activities - Guidelines for watercourse crossings on Waterfront Land* (DPE, 2022b) and (if necessary) *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003); and *Policy & Guidelines for Fish Habitat Conservation & Management* (DPI, 2013); and	Section 8.2.1 includes consideration of the listed guidelines for assessing impacts on aquatic habitat. Chapter 17 (Surface water and groundwater quality) provides an assessment of likely impacts on the waterfront land and how impacts are proposed to be managed.
	• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).	Section 8.7 includes detail on the erosion and sediment control measures that would be implemented for the project. Chapter 4 (Project description – construction), Chapter 16 (Soils, geology and contamination) and Chapter 17 (Surface water and groundwater) provides further discussion of erosion and sediment control measures. Further detail is also included in *Technical Report 1 – Biodiversity Development Assessment Report* and *Technical Report 12 – Surface Water and Groundwater Impact Assessment*.

Table 8-2 Supplementary SEARs relevant to biodiversity

Reference	Supplementary SEARs	Where principally addressed in the EIS
Biodiversity (threatened species and communities and migratory species)		
15.	The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	Section 8.3 identifies *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed species and communities and other relevant matters of national environmental significance (MNES) with the potential to be impacted by the project. Sections 8.4, 8.5 and 8.6 provide details on the potential impacts including a description of the nature, quantum and consequences of the impacts. Further detail is included in *Technical Report 1 – Biodiversity Development Assessment Report*.

Reference	Supplementary SEARs	Where principally addressed in the EIS
16.	Further analysis of the impacts of the 2019-2020 bushfires on EPBC Act listed threatened species and communities should be undertaken during the assessment. Further assessment will determine whether the remaining habitat within the proposed action area is of substantially greater importance to the survival of the listed threatened species following the fires and/or whether the population of the species in the area is considered an important population. This information, once obtained, can be considered when determining avoidance, mitigation and offset measures for these species.	Section 8.3.9.1 summarises the analysis of bushfire impacts on MNES and any implications for the project avoidance, mitigation and offsets. Further detail is included in *Technical Report 1 – Biodiversity Development Assessment Report*.
17.	For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: i. description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; ii. details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements; iii. description of the relevant impacts of the action having regard to the full national extent of the species or community's range; and iv. description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; v. identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; vi. a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established. vii. details of how the current published NSW Biodiversity Assessment Method (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and viii. details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the BAM and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.	Section 8.2 summarises the relevant Commonwealth guidelines and policy statements used as part of the assessment of biodiversity impacts and methodology applied, Sections 8.3 summarises the habitat of the EPBC Act listed threatened species, communities, and migratory species within the project footprint. Sections 8.4, 8.5 and 8.6 provide details on the potential impacts with Section 8.6.2 providing details of the proposed avoidance and mitigation measures. A description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established is included in Section 8-908.7.5. Further detail is included in *Technical Report 1 – Biodiversity Development Assessment Report*.

Reference	Supplementary SEARs	Where principally addressed in the EIS
	Note: For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action and deliver an overall conservation outcome that improves or maintains the viability of the MNES i.e. 'like for like'. Like-for-like includes protection of native vegetation that is the same ecological community or habitat being impacted (preferably in the same region where the impact occurs), or funding to provide a direct benefit to the matter being impacted e.g. threat abatement, breeding and propagation programs or other relevant conservation measures.	
18.	Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy	As detailed in Section 8.7.5, the proposed Biodiversity Offset Strategy for the project would be used to assess and meet offsets for significant impacts on MNES. Any significant residual impacts on MNES not addressed under the BAM would be addressed in accordance with the *EPBC Act Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Population and Communities, 2012).

8.2. Assessment approach

8.2.1. Legislative and policy context

Key Commonwealth and state legislation considered as part of the assessment of biodiversity impacts included:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – provides protection for MNES including listed threatened species and ecological communities, listed migratory species and wetlands of international importance. As stated in Chapter 5 (Statutory context), the project is a controlled action under the EPBC Act. Potential impacts on relevant MNES are included in Section 8.6.
- *Biodiversity Conservation Act 2016* (BC Act) and Biodiversity Conservation Regulation 2017 – establishes a framework for assessment and offsetting of biodiversity impacts as well as investment in biodiversity conservation. The BC Act established the Biodiversity Offsets Scheme (BOS) and BAM which have informed the preparation of *Technical Report 1 – Biodiversity Development Assessment Report*.
- *Biosecurity Act 2015* – provides a framework for the prevention, elimination, and minimisation of biosecurity risks on public and private land in NSW. Consideration of declared pests and weeds listed in Division 1 of Part 2 of Schedule 3 and Part 3 of Schedule 3 of the *Biosecurity Act 2015* and Schedule 3 of the Biosecurity Regulation 2017 recorded in project footprint is included in Sections 8.3.8, 8.4 and 8.5.
- *Fisheries Management Act 1994* (FM Act) – contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, threatened species, populations, and ecological communities. The potential impact of the project on KFH and threatened species, populations and ecological communities listed under the FM Act, is provided in Sections 8.4 and 8.5.

- *Local Land Services Act 2013* – categorises rural land which underpins the legislative framework for native vegetation clearing in rural areas. Category 1 – exempt land is defined as land that has been previously lawfully cleared, contains low conservation value grasslands, contains regrowth vegetation, or is identified as exempt land under the Local Land Services Regulation 2014. Clearing and offsetting vegetation within Category 1 – exempt land is excluded from BAM assessment and has been mapped for the project in *Technical Report 1 – Biodiversity Development Assessment Report*. However, suitable habitat for MNES within Category 1 – exempt land has been included in the calculation of potential impact areas for EPBC Act listed species and communities where relevant.

In addition to the above legislation, key policies and guidelines used as part of the assessment of biodiversity impacts included:

- Biodiversity Assessment Method (2020)
- *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of Environment, 2013)
- *Guideline for applying the Biodiversity Assessment Method at severely burnt sites* (Department of Planning, Industry, and the Environment (DPIE), 2020b)
- *Policy and guidelines for fish habitat conservation and management (2013 update)* (Department of Primary Industries (DPI), 2013)
- W*hy do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003)
- *Controlled activities - Guidelines for watercourse crossings on waterfront land* (Department of Planning and Environment (DPE), 2022b)
- *Controlled activities - Guidelines for riparian corridors on waterfront land* (DPE, 2022c).

Refer to *Technical Report 1 – Biodiversity Development Assessment Report* for a full list of legislation, policies and guidelines used as part of the assessment of biodiversity impacts.

8.2.2. Methodology

Transgrid has sought to avoid and minimise impacts on biodiversity values throughout development of the project. This has included applying biodiversity criteria during options assessment, selecting a technical option that reduced the project footprint, and adopting a partial clearing methodology for the transmission line easement. Avoiding and minimising impacts on biodiversity values would be further prioritised during detailed design and construction planning to the greatest extent practicable.

To assist in the assessment of biodiversity values, an indicative disturbance area was used to estimate the likely extent and magnitude of vegetation clearance required and associated biodiversity impacts (refer to Section 8.4.1). The indicative disturbance area is based on a concept design. The disturbance area would be refined during detailed design and construction planning to further avoid and minimise impacts on biodiversity values where practicable. Some areas could not be surveyed or were surveyed outside of the seasonal survey window due to access limitations (eg lack of landowner consent, poor weather and flooding). As a result, a precautionary approach was adopted to meet the requirements of the BAM and to assess impacts on relevant MNES. As such, the assessment presented in this chapter is considered conservative and through the implementation of the mitigation measures detailed in Section 8.7.3, the extent and magnitude of potential impacts may be reduced.

The biodiversity assessment involved:

- reviewing available data and existing reports relevant to existing vegetation, threatened flora and threatened fauna including searches of the NSW BioNet Atlas Database, BAM – Important Areas viewer and the EPBC Act Protected Matters Search Tool of the locality (ie a 10 kilometre buffer around the project footprint)
- defining the landscape assessment area (ie the project footprint with a buffer of 500 metres as required by the BAM for linear development) to describe the landscape context for the project
- determining candidate threatened flora and fauna species for the project based on the list generated by the Biodiversity Assessment Method Credit Calculator (BAM-C) as well as additional species with a moderate or higher likelihood of occurrence in the project footprint
- applying a mapping process to delineate the extent of potential habitats for candidate threatened flora and fauna species in which further assessment of species presence/absence would be required by means of targeted surveys, an expert report or assumed presence
- carrying out multiple field surveys within accessible lands, from December 2018 to September 2022, in accordance with the BAM and other relevant Commonwealth and state government guidelines to:
    - verify vegetation communities present and develop a map of vegetation zones
    - assess habitat suitability for threatened fauna including the presence/absence of known habitat constraints
    - undertake BAM plots within vegetation zones to calculate vegetation integrity
    - assess and survey bushfire affected lands
    - undertake targeted surveys for candidate threatened flora and fauna species
- assessing aquatic habitat condition and suitability for threatened aquatic biota
- assessing potential direct, indirect, prescribed, and serious and irreversible impacts (SAII) in accordance with the BAM
- assessing potential direct and indirect impacts on aquatic habitat and biota and any potential impacts on riparian corridors and GDEs
- identifying mitigation measures to address any potential impacts
- determining the need for offset requirements to address any residual impacts.

Cumulative biodiversity impacts were also considered as part of the biodiversity assessment. Chapter 25 (Cumulative impacts) details the key findings and identifies mitigation measures to address any potential cumulative impact.

The project footprint is the area that has been assessed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.

The BCD of the DPE was consulted throughout the preparation of *Technical Report 1 – Biodiversity Development Assessment Report*. This included general correspondence, meetings, species-specific workshops, discussion of issues relating to mapping, and analysis and presentation of datasets to the BCD for review and comment.

The Forestry Corporation of NSW (FCNSW) was also consulted during preparation of *Technical Report 1 – Biodiversity Development Assessment Report*. This included sharing of ecological information and spatial data relating to threatened flora and fauna within State forests and on-ground knowledge where relevant to the evaluation of severely burnt lands (refer to Section 8.3.9).

Technical Report 1 – Biodiversity Development Assessment Report provides further detail on the methodology used to assess biodiversity impacts including survey effort.

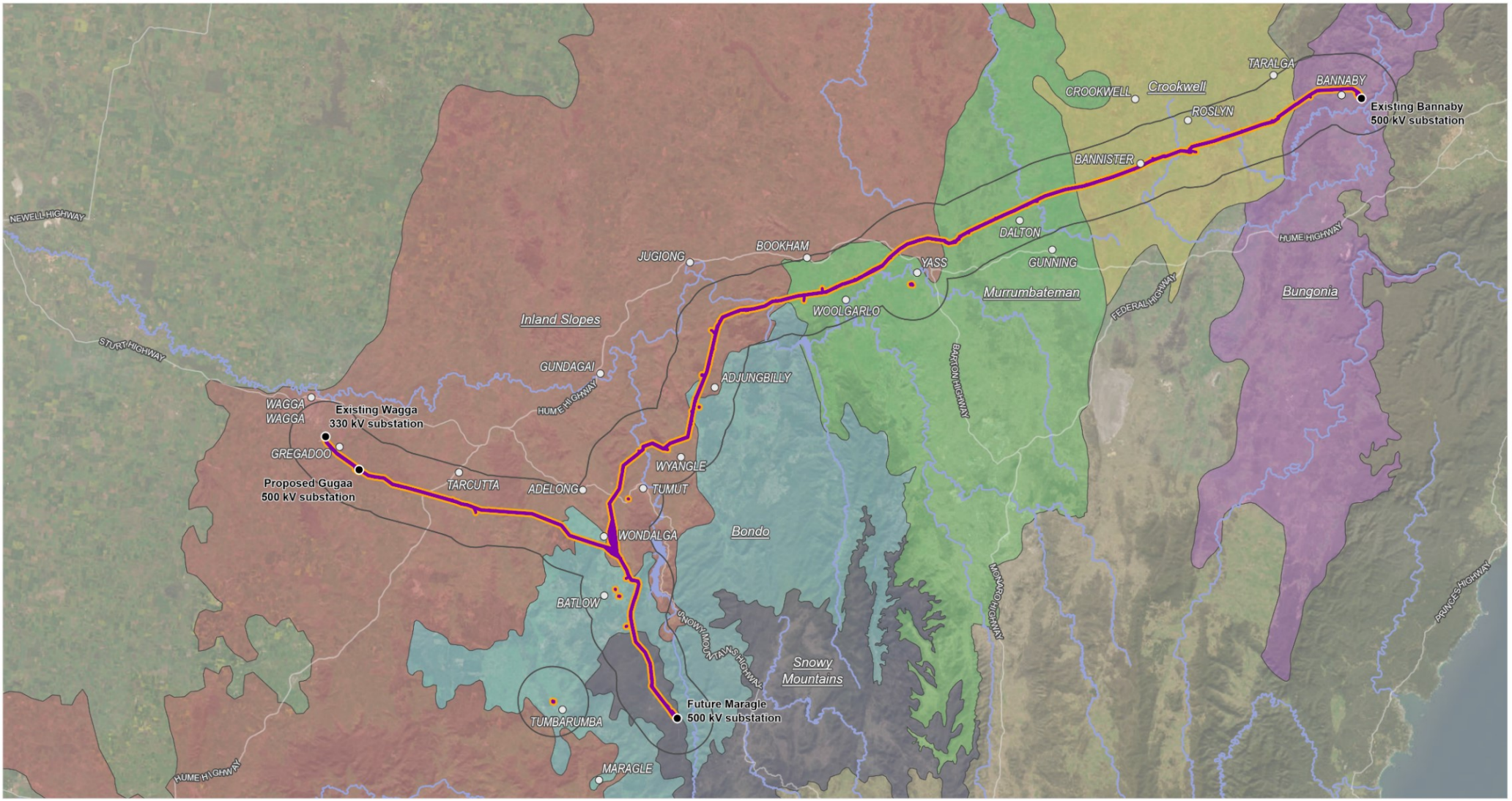
8.3. Existing environment

8.3.1. Landscape context

The landscape assessment area intersects three Interim Biogeographic Regionalisation for Australia (IBRA) regions and six IBRA subregions. Table 8-3 includes the three IBRA regions and six subregions within the landscape assessment area (ie within 500 metres of the project footprint). Figure 8-1 shows the boundaries of the IBRA regions and subregions in relation to the landscape assessment area.

Table 8-3 IBRA regions and subregions within the landscape assessment area

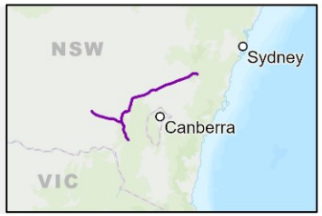
IBRA region	IBRA subregion	General location	Percentage breakdown of landscape assessment area by IBRA subregion
South-Eastern Highlands	Bondo	Located in the area from around Wondalga south to Batlow and an area around Adjungbilly	9.5%
	Bungonia	Located in the area east of Taralga to the existing Bannaby 500 kV substation	5.0%
	Crookwell	Located in the area between Bannister and Taralga	15.0%
	Murrumbateman	Located in the area between Woolgarlo and Bannister	17.6%
NSW South-Western Slopes	Inland Slopes	Located in the area from the existing Wagga 330 kV substation, including the proposed Gugaa 500 kV substation, to Woolgarlo and an area just east of Yass	45.9%
Australian Alps	Snowy Mountains	Located in the area from Batlow south to the future Maragle 500 kV substation	6.6%



Project footprint
Landscape assessment area
Locality
Waterbody
Waterway
Substation

IBRA Subregion

Bondo
Bungonia
Crookwell
Inland Slopes
Murrumbateman
Snowy Mountains



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

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0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink

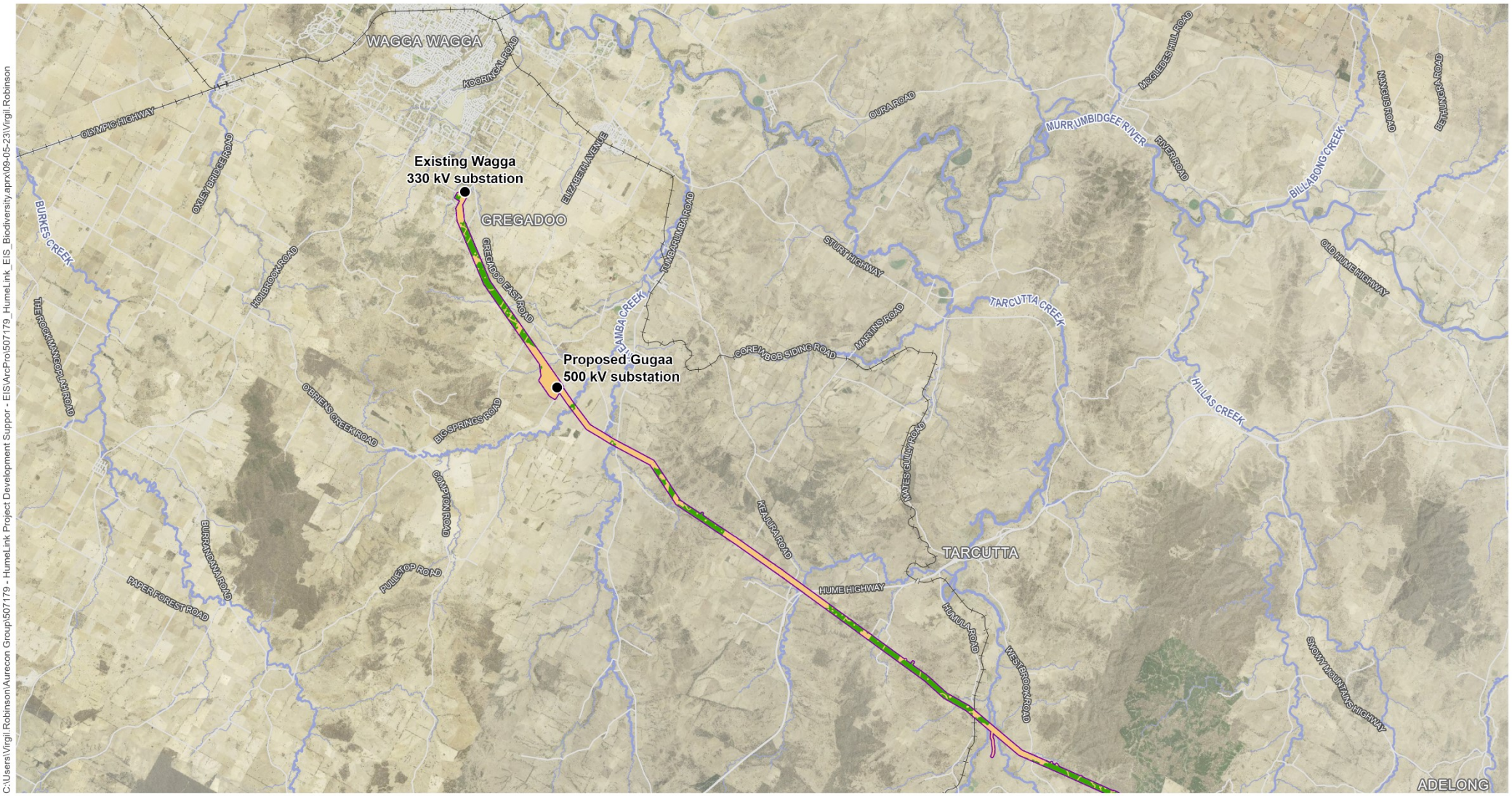
FIGURE 8-1: IBRA subregions in relation to the landscape assessment area

Based on a desktop review of available information, the key landscape features of the landscape assessment area are as follows:

- Most of the waterways are Strahler first to fourth order streams. The Bondo, Murrumbateman and Inland Slopes IBRA subregions are the only subregions to have sixth or higher order streams. Refer to Chapter 17 (Surface water and groundwater quality) for further detail on waterways in and surrounding the project footprint.
- No Ramsar wetlands intersect the landscape assessment area. The nearest Ramsar wetlands to the project are Barmah Forest and NSW Central Murray State forests sites, roughly 200 to 300 kilometres south-west of the project footprint.
- There are five bogs and/or fens mapped in the Snowy Mountains IBRA subregion within the project footprint. These bogs and/or fens are associated with Plant Community Type (PCT) 939 – Montane wet heath and bog of the eastern tablelands and are located between 10 and 18 kilometres north of the future Maragle 500 kV substation.
- The Bondo and Snowy Mountains IBRA subregions have a high level of connectivity due to the substantial areas of vegetation associated with Kosciuszko National Park, Green Hills State Forest, Bago State Forest and Maragle State Forest.
- The Bungonia and Inland Slopes IBRA subregions have some connectivity within the landscape assessment area, which is mainly associated with Minjary National Park, Mudjarn Nature Reserve, Tarlo River National Park, Red Hill State Forest and Tumut State Forest.
- The majority of Crookwell and Murrumbateman IBRA subregions have been cleared, and there are only some isolated woodland patches.
- Minor rock outcrops and areas of loose surface rock are the main geological features recorded in the six IBRA subregions. However, areas potentially supporting caves, crevices and an overhang were identified in Bondo, Bungonia and Inland Slopes IBRA subregions.
- No Areas of Outstanding Biodiversity Value listed in Part 3 of the Biodiversity Conservation Regulation 2017 were identified in the landscape assessment area.

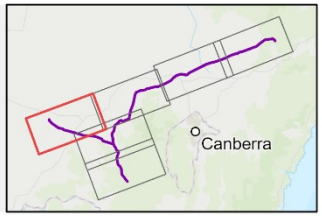
8.3.2. Native vegetation

Based on several existing spatial datasets and field validation within accessible lands, the project footprint includes about 5,692.96 hectares of native vegetation, about 810.25 hectares of non-native vegetation and about 1,983.48 ha of Category 1 – exempt land. The majority of native vegetation is within the Inland Slopes IBRA subregion due to almost half of the project footprint occurring within this subregion. Figure 8-2 provides an overview of native and non-native vegetation within the project footprint.



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Project footprint
Native vegetation
Non-native vegetation
Railway
Waterway
Substation



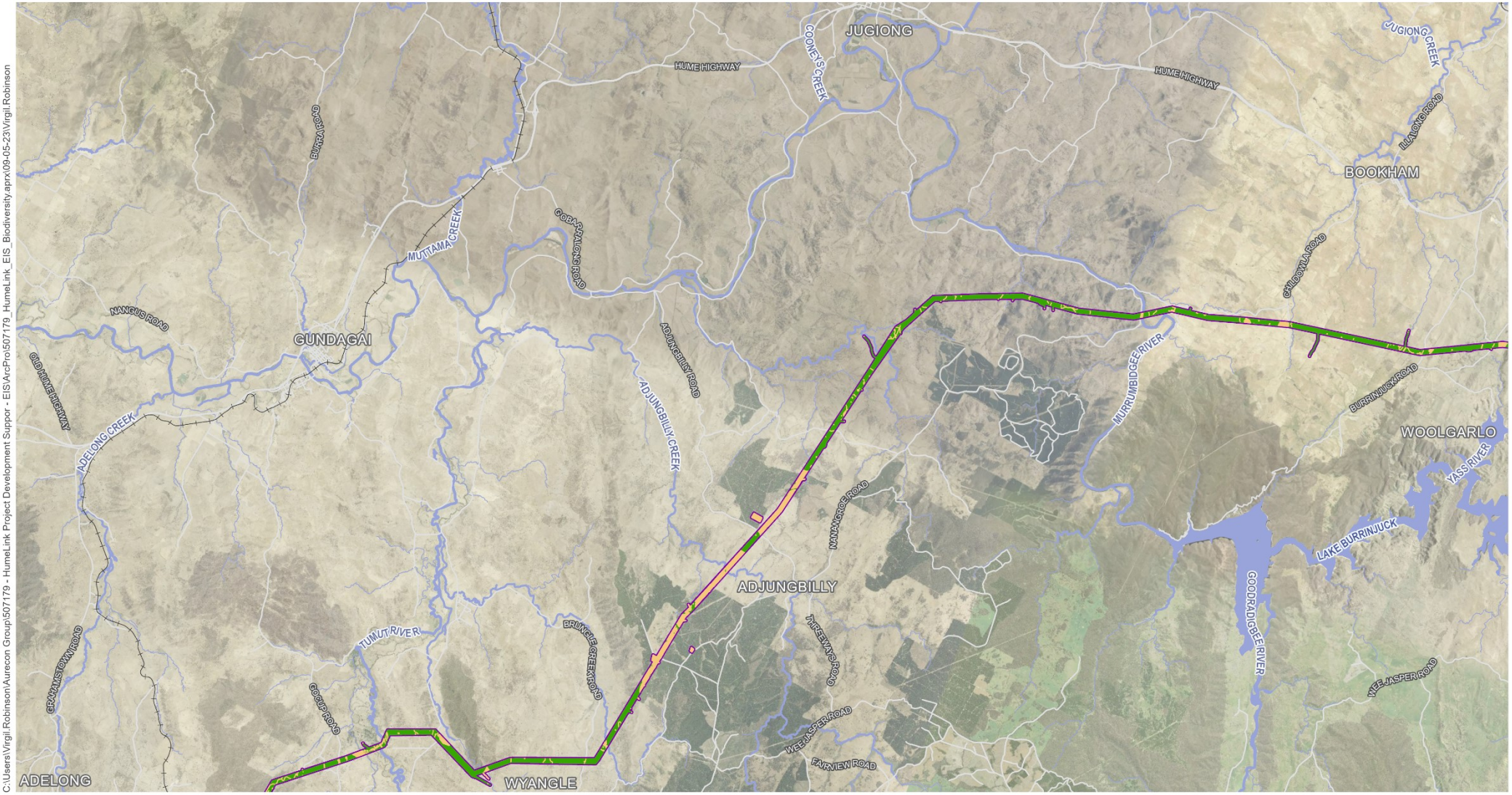
Source: *Aurecon, Transgrid, Niche, ELA, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

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Figure 8-2a: Native vegetation within the project footprint



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

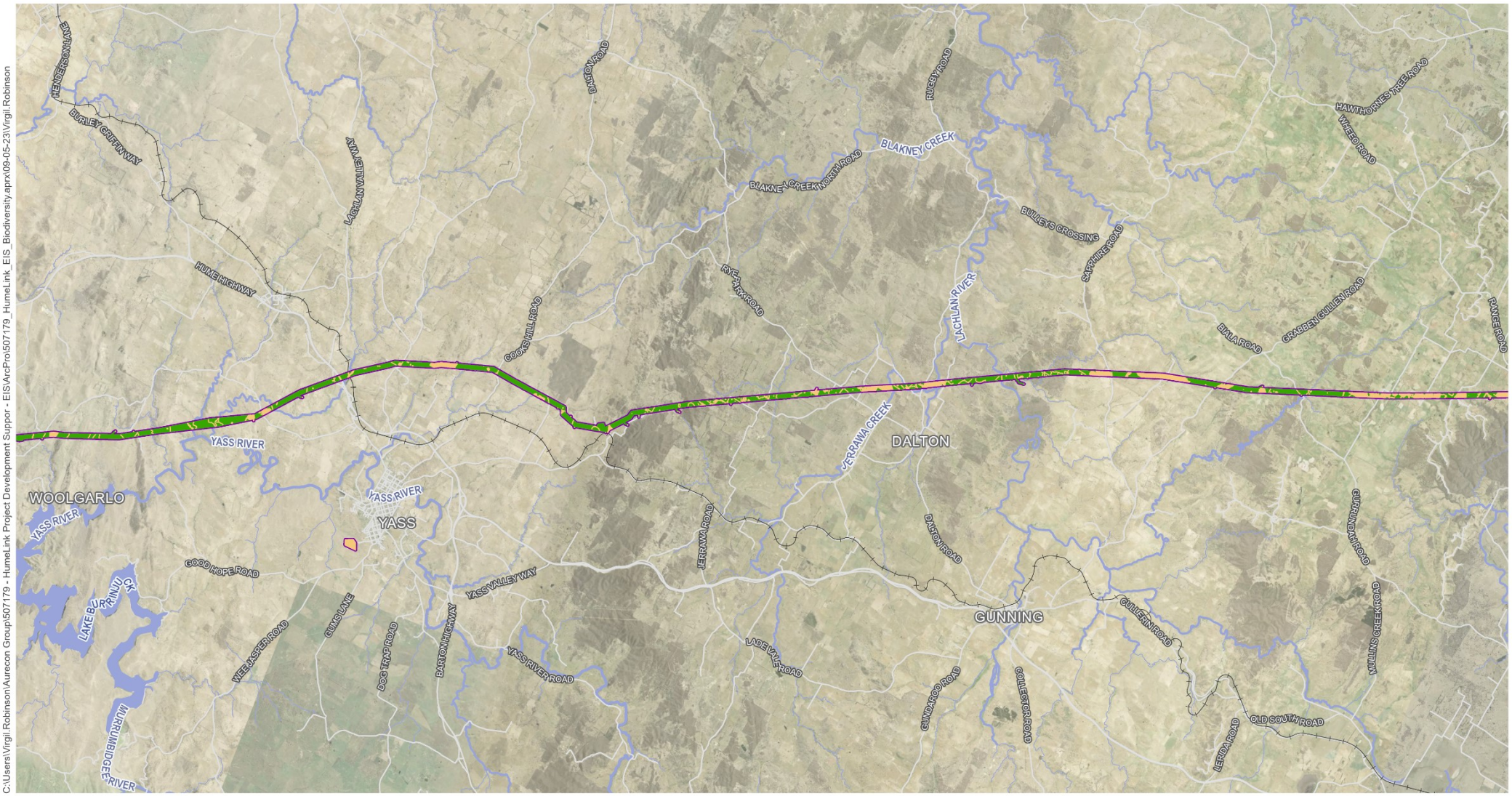
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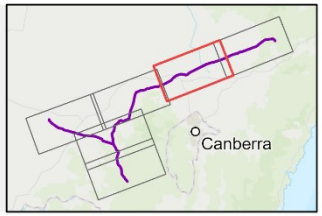
Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 8-2b: Native vegetation within the project footprint



Project footprint
Native vegetation
Non-native vegetation
Railway
Waterway
Substation



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

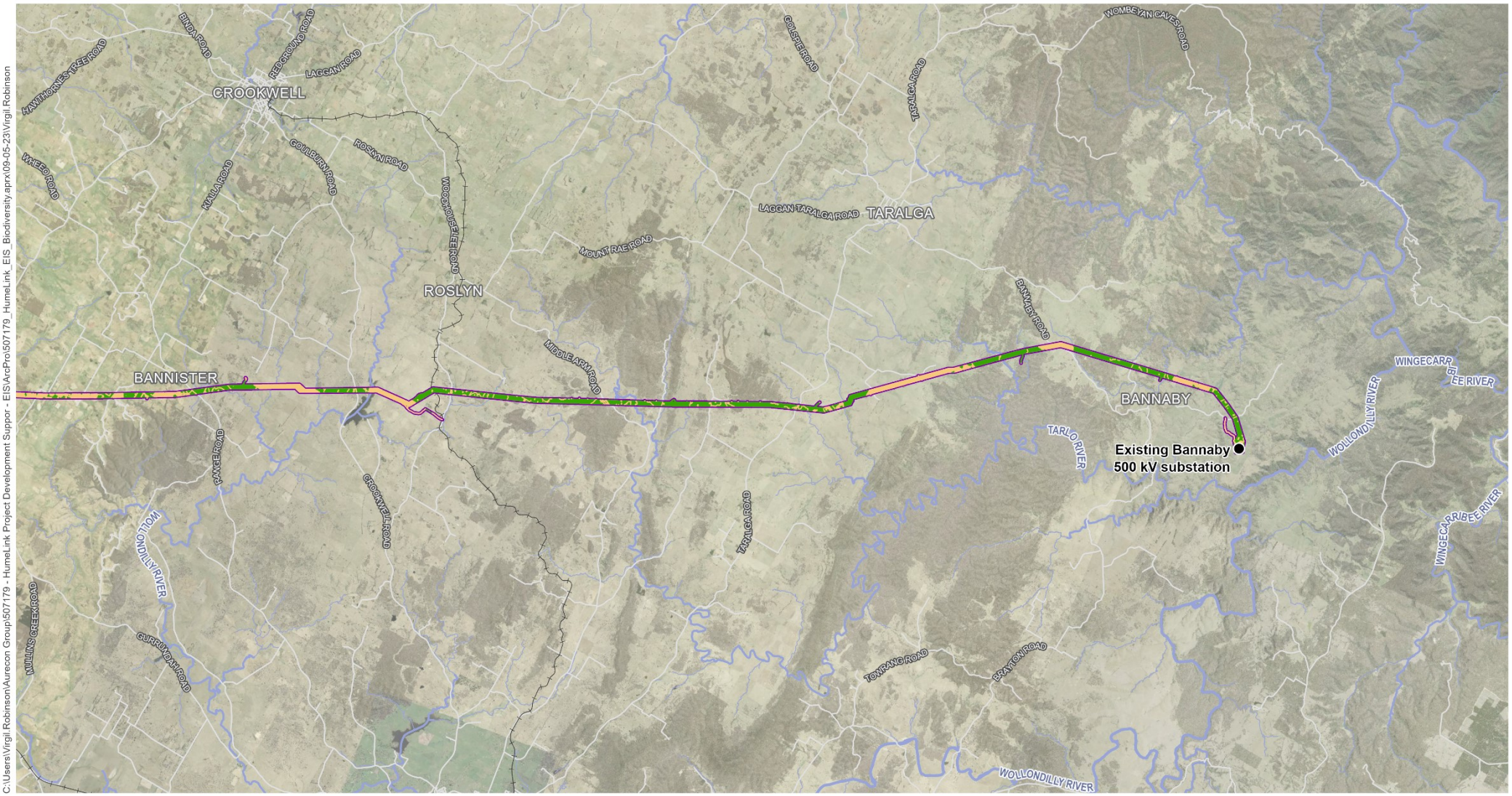
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Projection: GDA 1994 MGA Zone 55

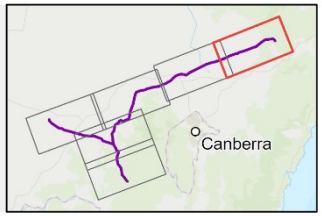
HumeLink

Figure 8-2c: Native vegetation within the project footprint

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Project footprint
Native vegetation
Non-native vegetation
Railway
Waterway
Substation



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

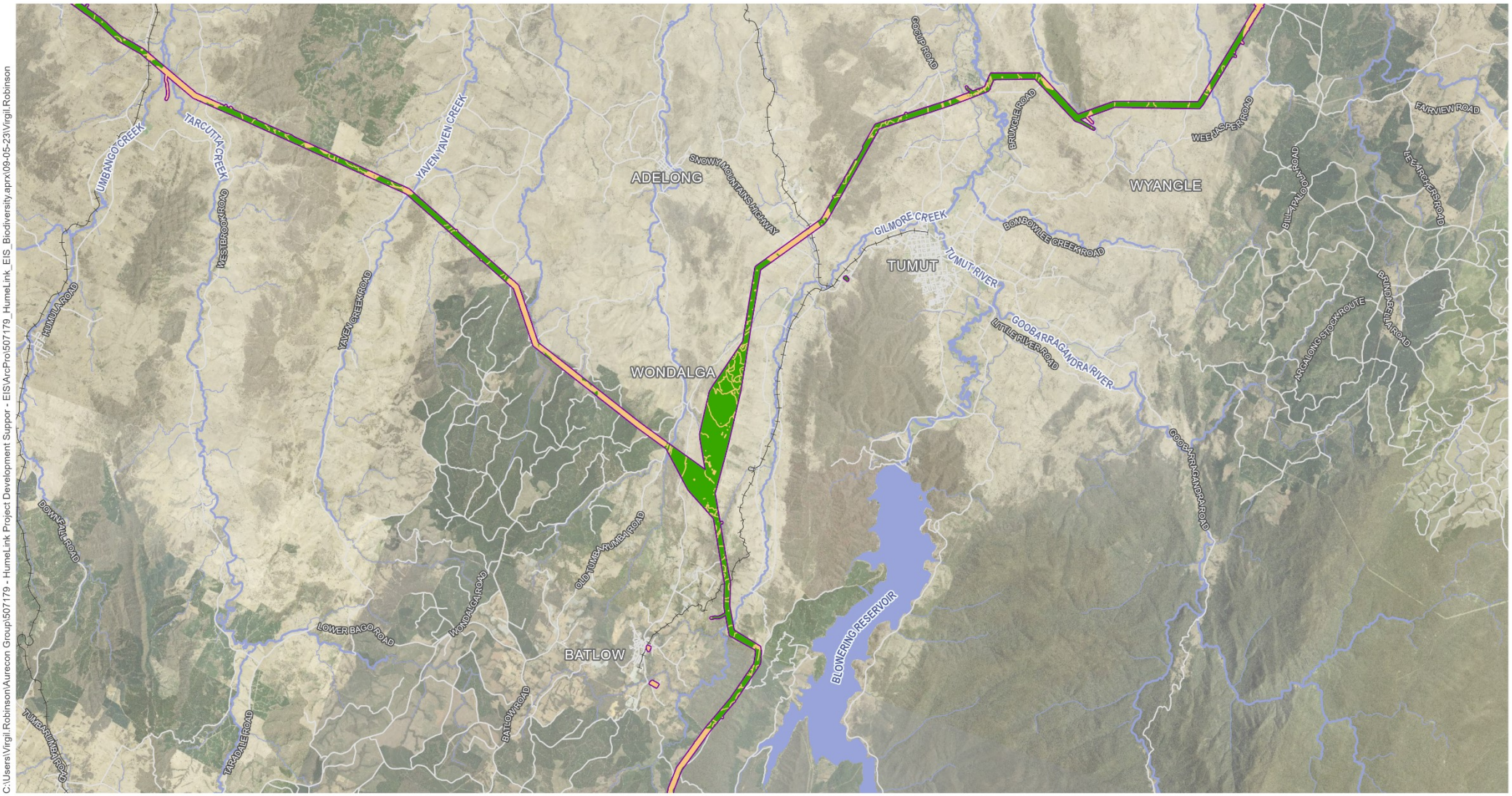
1:200,000
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Projection: GDA 1994 MGA Zone 55

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Figure 8-2d: Native vegetation within the project footprint

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

1:200,000

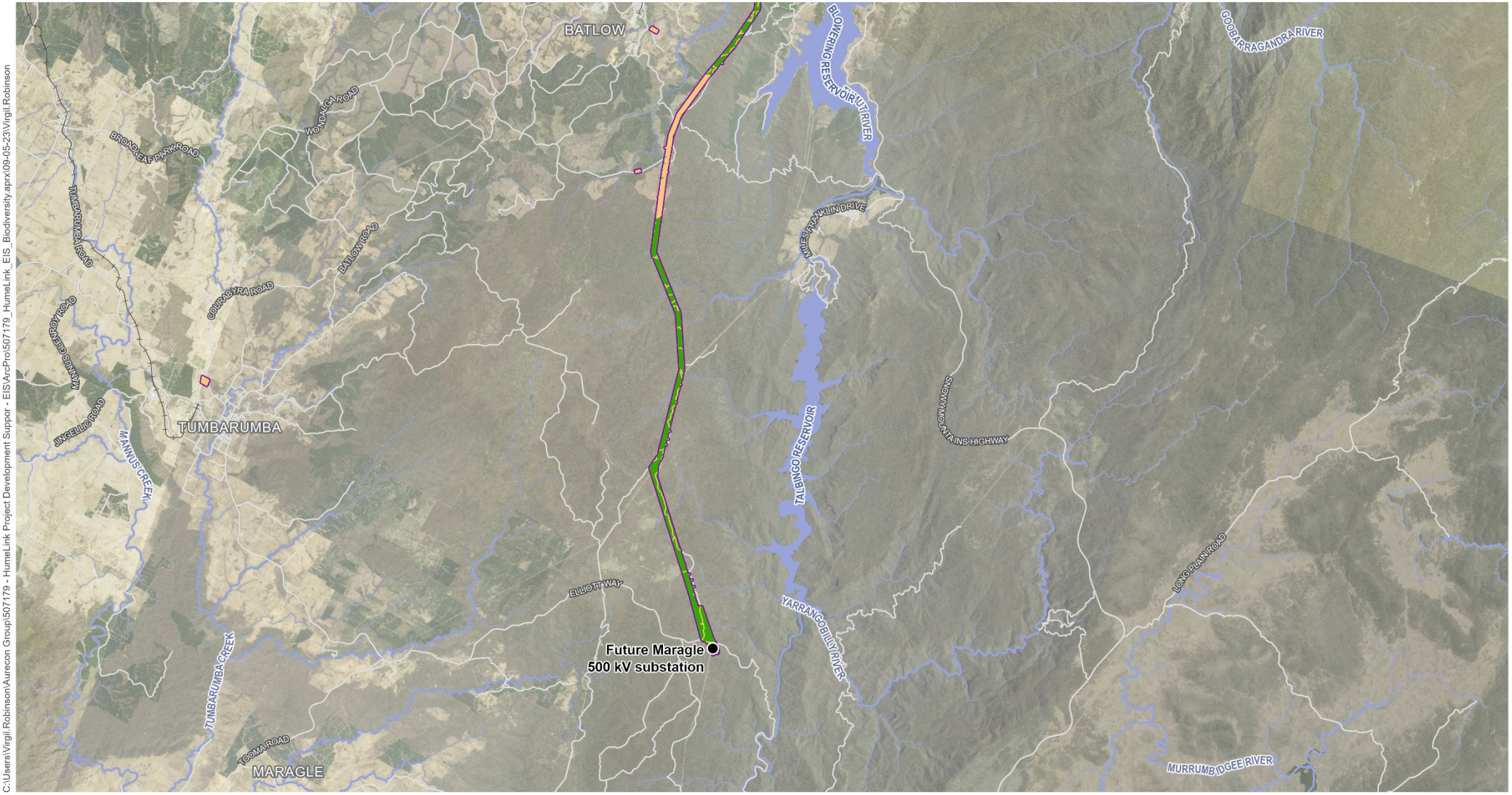
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Projection: GDA 1994 MGA Zone 55

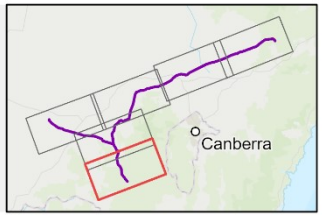
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Figure 8-2e: Native vegetation within the project footprint

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Project footprint
Native vegetation
Non-native vegetation
Railway
Waterway
Substation



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

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

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Figure 8-2f: Native vegetation within the project footprint

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In addition, there are about 48.65 hectares of mapped planted native vegetation within the project footprint, 17.93 hectares of which is situated within Category 1 – exempt land. This vegetation is largely planted along the boundaries of paddocks, for the purposes of windbreaks within agricultural lands. The majority of the planted native vegetation (about 38.71 hectares) is located in Crookwell and Inland Slopes IBRA subregions. There is no mapped planted native vegetation within the project footprint in the Snowy Mountains IBRA subregion.

Native vegetation recorded within the project footprint falls within 12 vegetation formations:

- Alpine Complex
- Dry Sclerophyll Forests (Shrub/grass sub-formation)
- Dry Sclerophyll Forests (Shrubby sub-formation)
- Eastern Riverine Forests
- Forested Wetlands
- Freshwater Wetlands
- Grasslands
- Grassy Woodlands
- Semi-arid Woodlands (Shrubby sub-formation)
- Western Slopes Grassy Woodlands
- Wet Sclerophyll Forests (Grassy sub-formation)
- Wet Sclerophyll Forests (Shrubby sub-formation).

These vegetation formations include 42 PCTs that have been mapped within the project footprint. Further detail on the native vegetation and the PCTs, including detailed maps, is provided in *Technical Report 1 – Biodiversity Development Assessment Report*.

8.3.3. Threatened ecological communities

Five threatened ecological communities (TECs) listed under the BC Act were recorded within the project footprint during field surveys. Two of these TECs are also listed under the EPBC Act. Table 8-4 lists the TECs recorded within the project footprint and their corresponding PCTs. The extent of TECs within the project footprint is based on several existing spatial datasets with field validation within accessible lands. Detailed mapping of the known and likely extent of the TECs within the project footprint is provided in *Technical Report 1 – Biodiversity Development Assessment Report*.

The BC Act and EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland TEC is the most widespread TEC within the project footprint and is located in all IBRA subregions with the exception of Snowy Mountains IBRA subregion. However, Murrumbateman and Inland Slopes IBRA subregions are the main areas where White Box-Yellow Box-Blakely's Red Gum Woodland TEC has been recorded.

Table 8-4 TECs within the project footprint

TEC	Estimated extent within project footprint	Conservation status[1]	Corresponding PCT	IBRA subregion
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South- Eastern Highlands, NSW South-Western Slopes, South-East Corner and Riverina Bioregion	3,137 ha	BC Act - CE	PCTs 266, 268, 277, 278, 280, 283, 352 and 1330	Bondo Bungonia Crookwell Murrumbateman Inland Slopes
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	940 ha	EPBC Act - CE		
Coolac-Tumut Serpentinite Shrubby Woodland in the NSW South-Western Slopes and South- Eastern Highlands Bioregions	33.1 ha	BC Act - E	PCT 301	Inland Slopes
Tableland Basalt Forest in the Sydney Basin and South-Eastern Highlands Bioregions	176.85 ha	BC Act - E	PCTs 952, 953, 1097 and 1107	Bondo Bungonia Crookwell
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South-East Corner, South-Eastern Highlands and Australian Alps bioregion	9 ha	BC Act - E	PCTs 939 and 1256	Crookwell Snowy Mountains
Alpine Sphagnum Bogs and Associated Fens	2.5 ha	EPBC Act - E		
Monaro Tableland Cool Temperate Grassy Woodland in the South-Eastern Highlands Bioregion	23.32 ha	BC Act - CE	PCTs 679 and 1191	Crookwell

Note:
1. Conservation status listings: CE - critically endangered; E - endangered; V – vulnerable

8.3.4. Threatened flora

Sixty-six potential candidate threatened flora species were identified for the project and assessed for habitat suitability. Of these, six were excluded from further assessment based on lack of suitable habitat, habitat constraints, and/or geographic limitations within the project footprint. As such, 60 candidate threatened flora species were the subject of targeted surveys.

Three candidate threatened flora species were recorded directly within the project footprint during surveys as part of the biodiversity assessment:

- Yass Daisy (*Ammobium craspedioides*) – listed as vulnerable under the BC and EPBC Act
- Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) – listed as endangered under the EPBC Act
- Swamp Everlasting (*Xerochrysum palustre*) – listed as vulnerable under the EPBC Act.

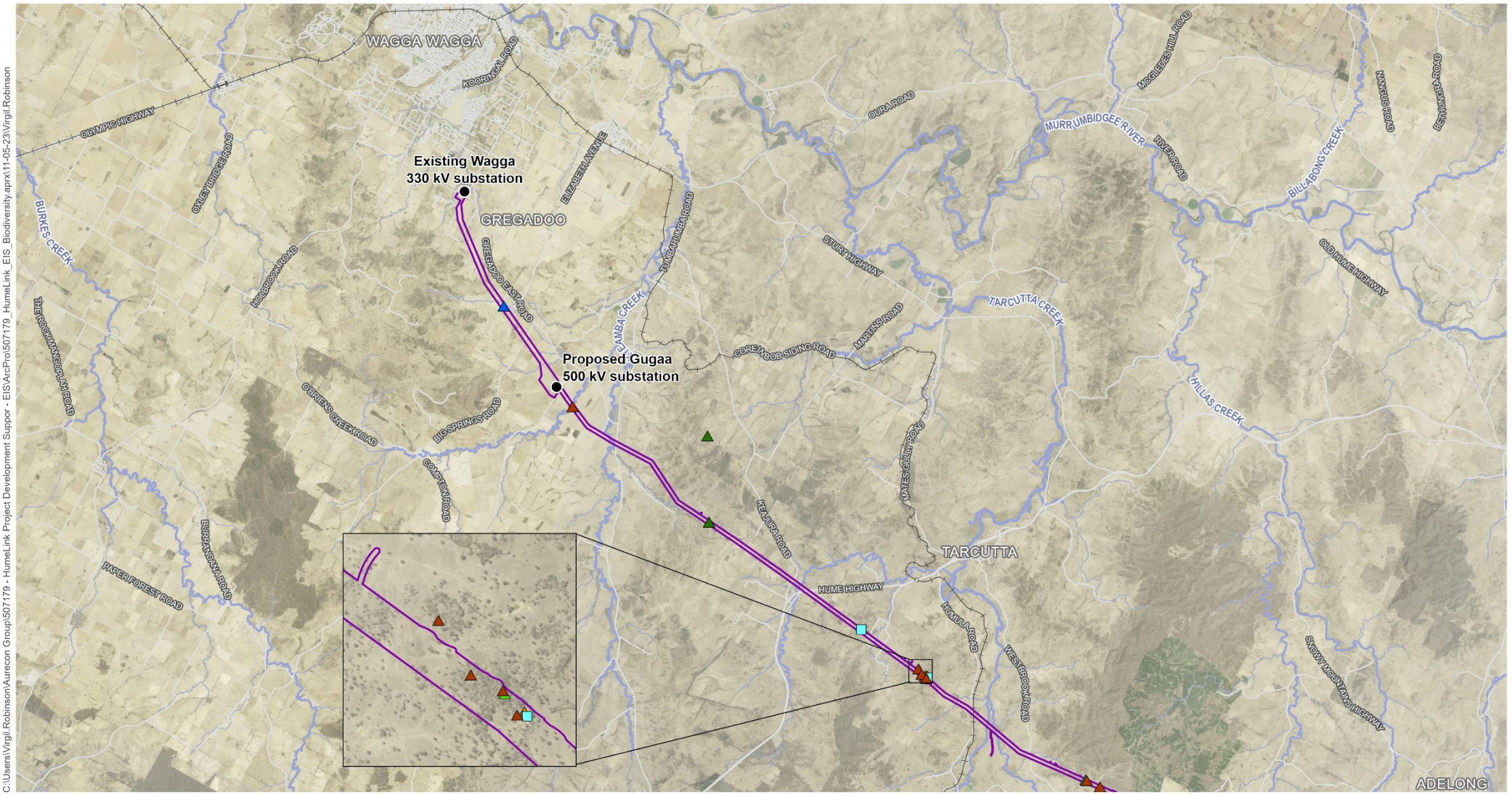
In addition, two critically endangered species under the EPBC Act and BC Act, Bago Leek Orchid (*Prasophyllum bagoense*) and Kelton's Leek Orchid (*Prasophyllum keltonii*), were recorded immediately adjacent to the project footprint. Bago Leek Orchid was recorded about 130 metres west of the project

footprint within Bago State Forest. Kelton's Leek Orchid was recorded about 750 metres west of the project footprint within Bago State Forest.

Both critically endangered orchid species have also been historically recorded by FCNSW or others within and immediately adjacent to the project footprint. This includes recordings on land subject to a conservation agreement under the BC Act which is intersected by the project footprint about 3.8 kilometres north of the future Maragle 500 kV substation.

Apart from the five candidate threatened flora species directly recorded within or immediately adjacent to the project footprint, the remaining 53 candidate flora species were assumed present within all suitable habitats in the project footprint where targeted surveys were not sufficient to exclude the species. However, many of the candidate flora species assumed present are considered to have a low likelihood of occurring within the project footprint.

Figure 8-3 shows the location of threatened flora (as well as threatened fauna) species recorded during surveys for the project (data sourced directly from the BCD is not shown on these figures due to confidentiality or sensitive species requirements). *Technical Report 1 – Biodiversity Development Assessment Report* provides more detailed mapping showing the threatened flora species recorded and further information on how candidate threatened flora species have been assumed present within the project footprint.



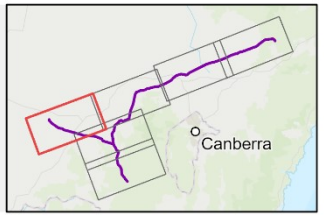
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Project footprint
Railway
Waterway
Substation

Threatened fauna

- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Dusky Woodswallow
- Grey-crowned Babbler (eastern subspecies)
- Little Eagle
- Varied Sittella
- Squirrel Glider
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Southern Myotis

Sensitive species (no. of records)
Niche and ELA, 2022
Superb Parrot (1)



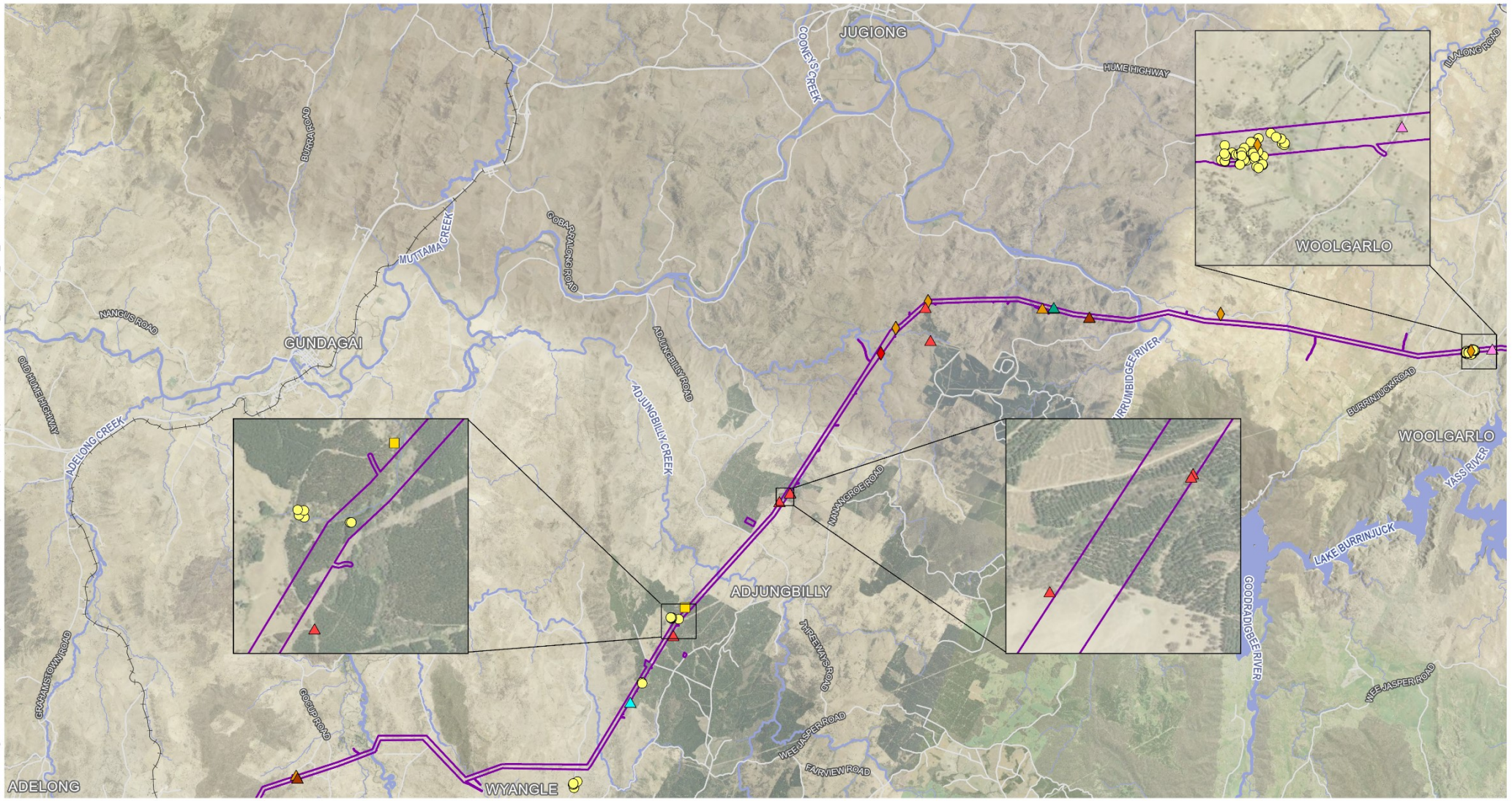
Source: *Aurecon, Transgrid, Niche, ELA, Forestry NSW, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 8-3a: Threatened species recorded during surveys for the project



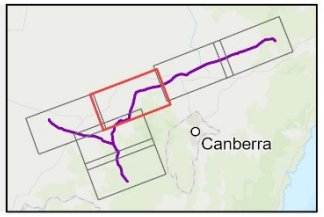
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Project footprint
Railway
Waterway
Substation

Threatened fauna
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Dusky Woodswallow
- Flame Robin
- Scarlet Robin
- Speckled Warbler
- Yellow-bellied Glider
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Southern Myotis

Threatened flora
- Yass Daisy

Sensitive species (no. of records)
Niche and ELA, 2022
Gang-gang Cockatoo (10)
Powerful Owl (1)



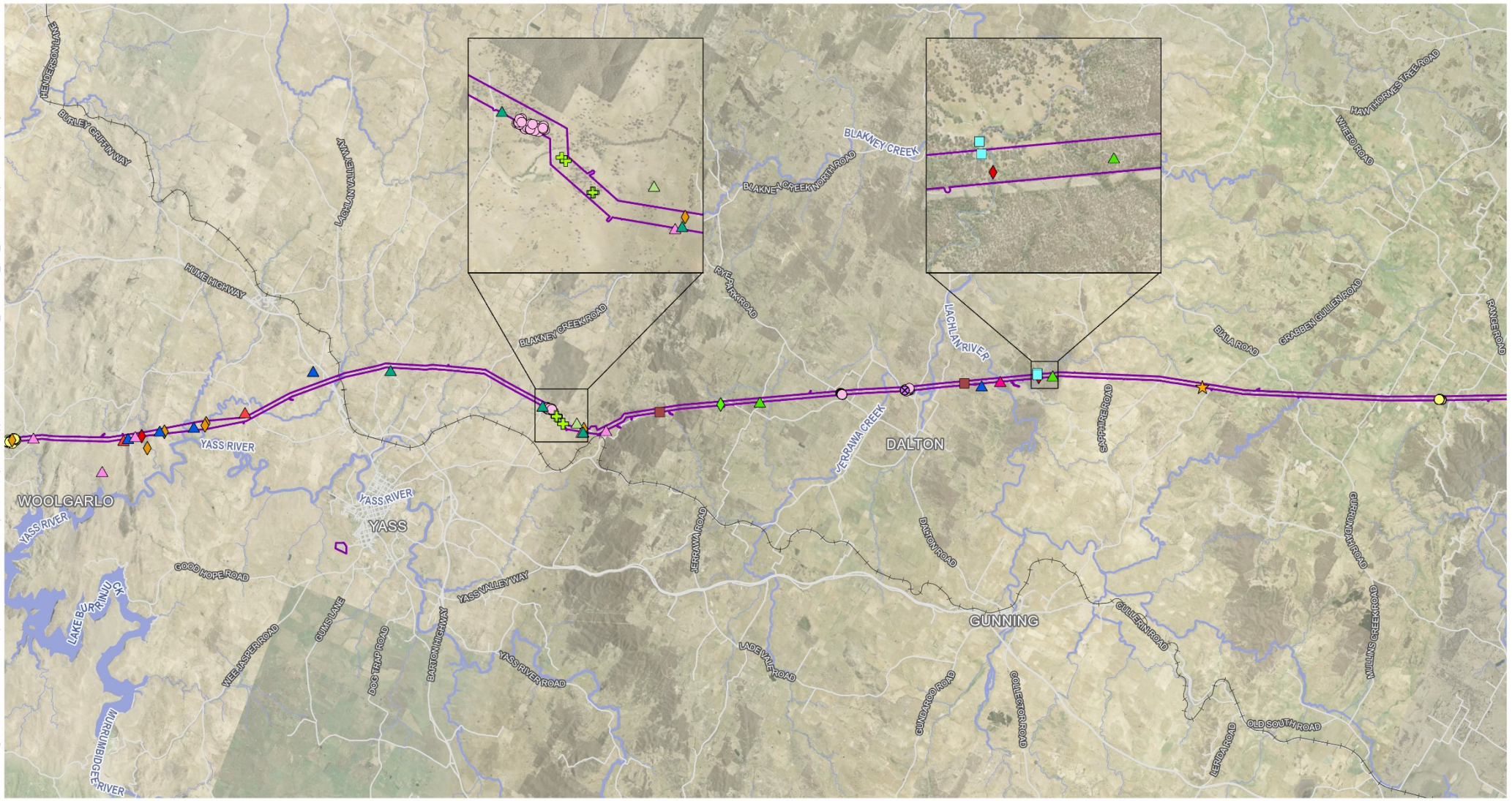
Source: *Aurecon, Transgrid, Niche, ELA, Forestry NSW, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 8-3b: Threatened species recorded during surveys for the project



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Project footprint
Railway
Waterway
Substation

Threatened fauna

- Diamond Firetail
- Dusky Woodswallow
- Little Eagle
- Scarlet Robin
- Spotted Harrier
- Varied Sittella
- White-bellied Sea-Eagle
- Eastern Pygmy-possum
- Squirrel Glider
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Southern Myotis
- Verreaux's Frog
- Pink-tailed Legless Lizard
- Key's Matchstick Grasshopper

Threatened flora

- Yass Daisy
- Hoary Sunray

Sensitive species (no. of records)

Niche and ELA, 2022

Gang-gang Cockatoo (3)

Superb Parrot (3)

Source: *Aurecon, Transgrid, Niche, ELA, Forestry NSW, Spatial Services (DCS), ESRI Basemap*

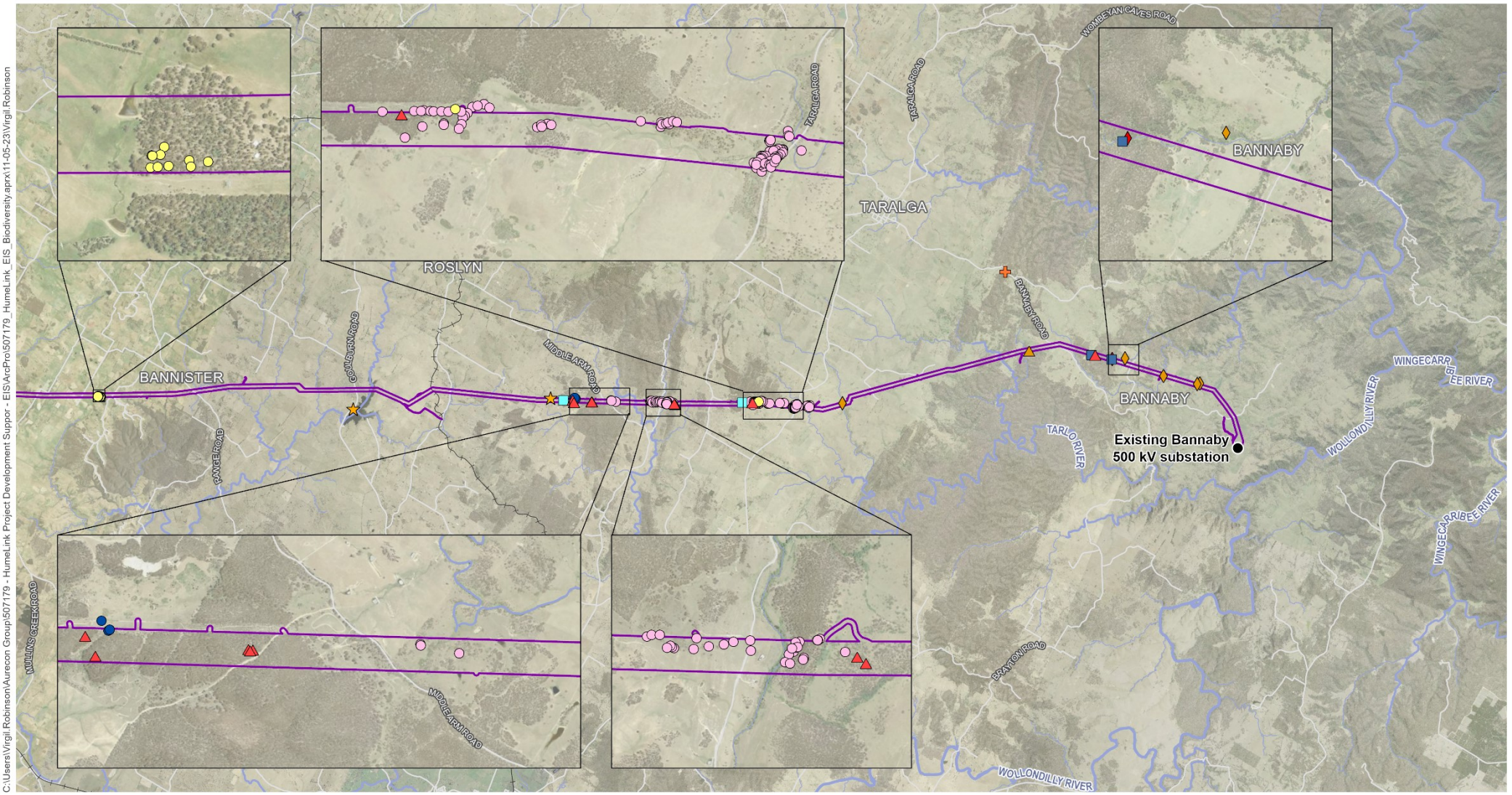
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Projection: GDA 1994 MGA Zone 55

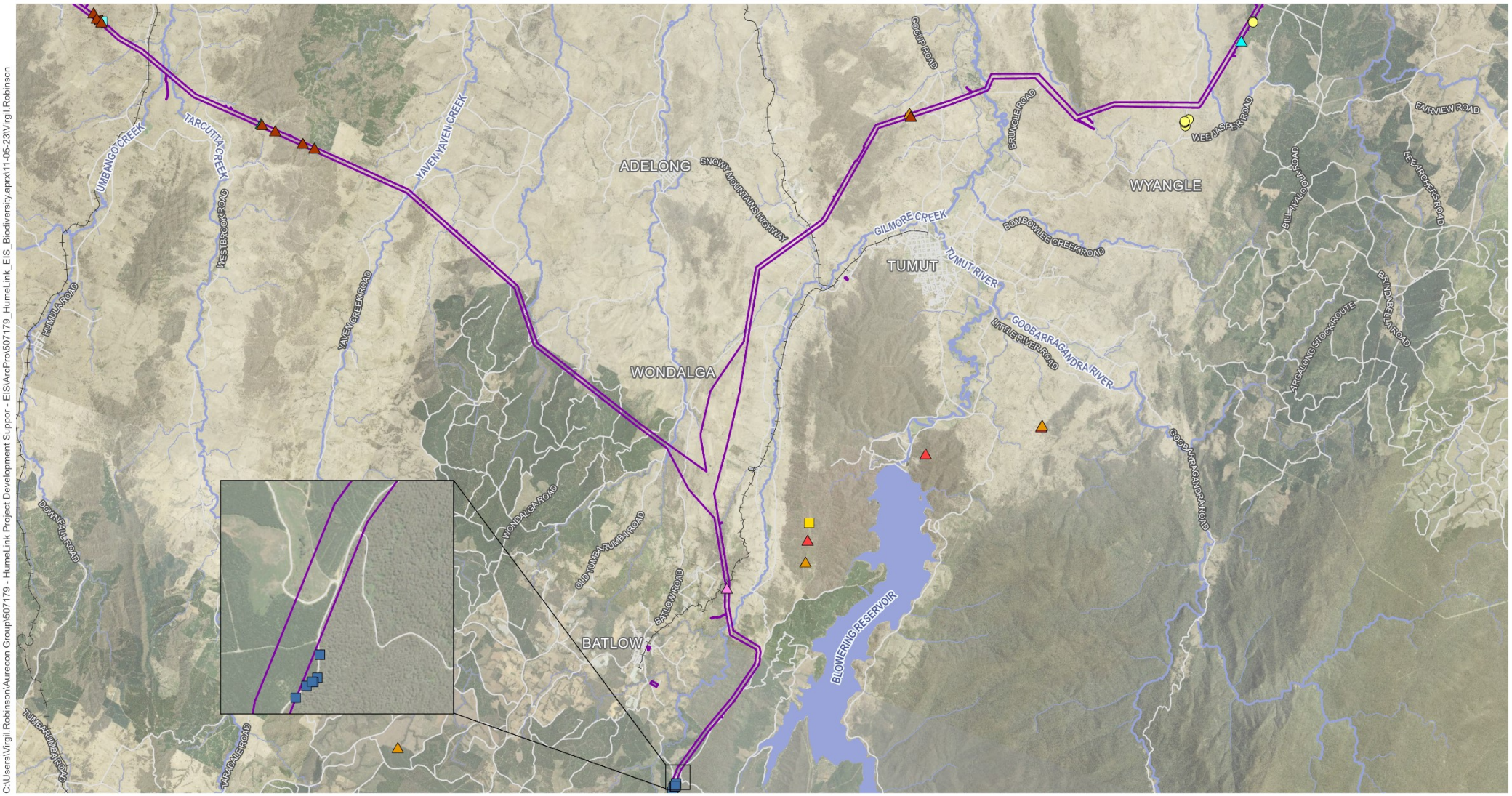
HumeLink

Figure 8-3c: Threatened species recorded during surveys for the project



HumeLink

Figure 8-3d: Threatened species recorded during surveys for the project



Project footprint
Railway
Waterway
Substation

Threatened fauna

- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Dusky Woodswallow
- Flame Robin
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- Greater Glider
- Squirrel Glider
- Yellow-bellied Glider
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Southern Myotis

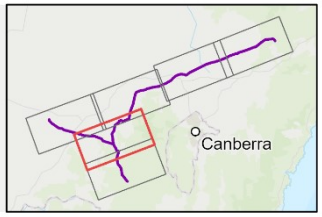
Threatened flora

- Yass Daisy

Sensitive species (no. of records)

Niche and ELA, 2022

Gang-gang Cockatoo (7)



Source: *Aurecon, Transgrid, Niche, ELA, Forestry NSW, Spatial Services (DCS), ESRI Basemap*

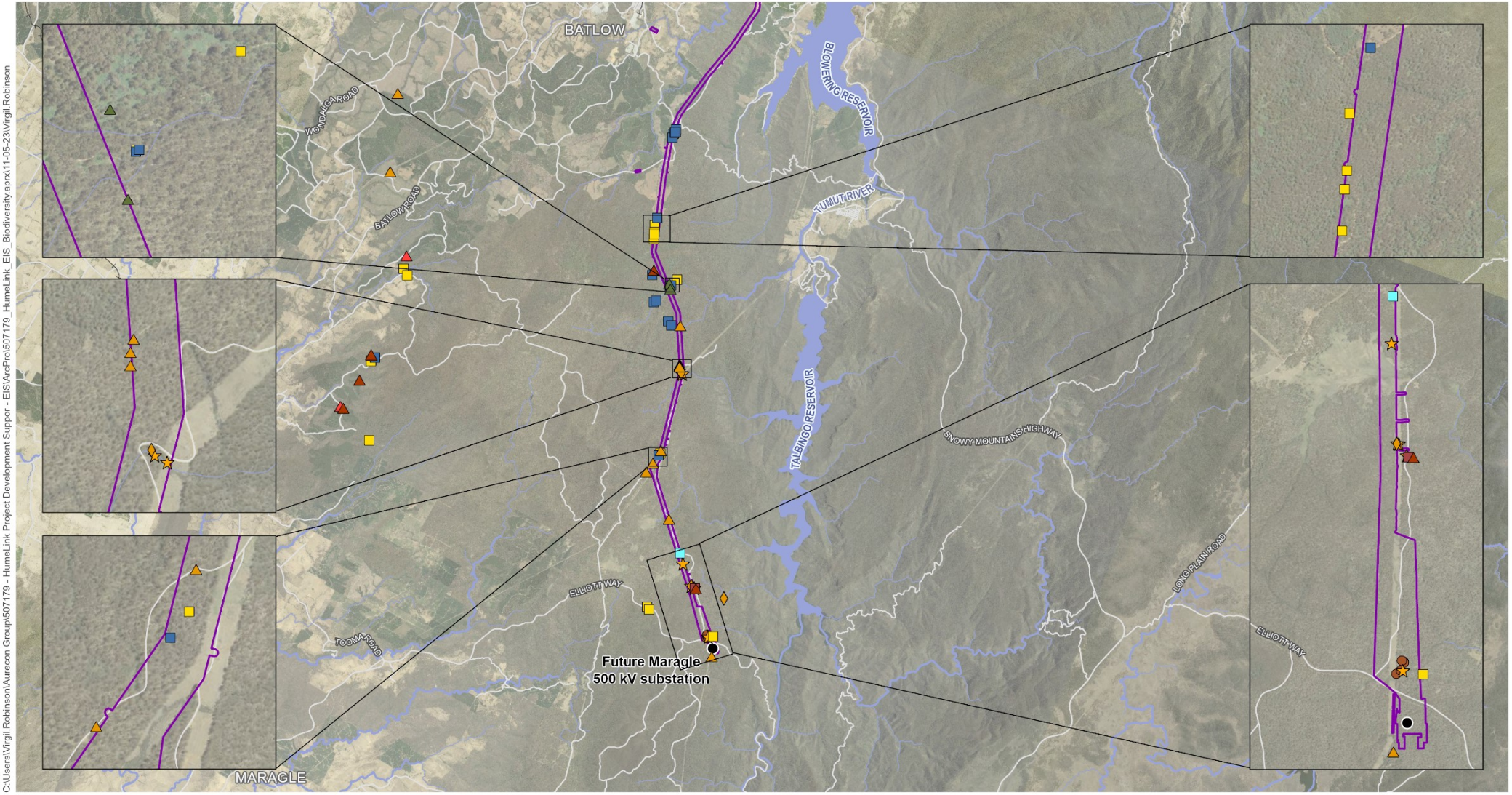
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Projection: GDA 1994 MGA Zone 55

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Figure 8-3e: Threatened species recorded during surveys for the project

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Project footprint
Railway
Waterway
Substation

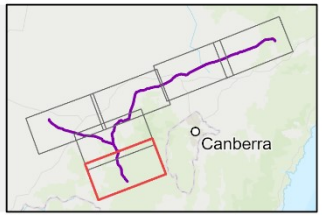
Threatened fauna
- Brown Treecreeper (eastern subspecies)
- Flame Robin
- Olive Whistler
- Scarlet Robin
- Eastern Pygmy-possum
- Greater Glider
- Squirrel Glider
- Yellow-bellied Glider
- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Verreaux's Frog

Threatened flora
- Swamp Everlasting

Sensitive species (no. of records)

Niche and ELA, 2022
- Barking Owl (1)
- Gang-gang Cockatoo (39)
- Bago Leek Orchid (25)

Forestry NSW
- Bago Leek Orchid (382)
- Kelton's Leek Orchid (49)



Source: *Aurecon, Transgrid, Niche, ELA, Forestry NSW, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 8-3f: Threatened species recorded during surveys for the project

8.3.5. Threatened and migratory fauna species and habitats

8.3.5.1. Fauna habitats

Table 8-5 lists the nine broad fauna habitat types observed within the project footprint. Further detail on the resources of each habitat type including corresponding PCTs, is provided in *Technical Report 1 – Biodiversity Development Assessment Report*.

Table 8-5 Fauna habitat types present within the project footprint

Habitat type	Description
Grassland habitat	The grassland habitats within the project footprint are typically dominated by moderately tall to tall dense to open native tussock grasses. The community is often treeless, or sparsely treed. The community supports a range of fauna species, some of which are unique to grassland communities or derived native grasslands, eg Pink-tailed Legless Lizard (*Aprasia parapulchella*), Striped Legless Lizard (*Delma impar*) and Golden Sun Moth (*Synemon plana*).
Semi-arid woodland habitat	The semi-arid woodland habitat within the project footprint consists of a stunted shrubby sub formation, has less grass cover and an abundance of perennial desert shrubs. Parrots and cockatoos are diverse and conspicuous inhabitants of semi-arid woodlands.
Tall wet sclerophyll forest (old growth) habitat	Tall wet sclerophyll forest habitat within the project footprint has a higher abundance of large old trees, many containing hollows. The subcanopy and understorey include a diverse structure and composition of species. Other habitat features include dead standing stags and fallen trees (logs).
Dry sclerophyll open woodland habitat	The dry sclerophyll open woodland habitat within the project footprint provides a wide range of food and shelter for birds and arboreal mammals. Trees from the family Myrtaceae generally dominate the upper canopy in these areas.
Alpine fen habitat	Alpine wetland habitat within the project footprint is found within the Snowy Mountain IBRA subregion. This habitat comprises either dense to open patches of herbs and sedges (fens), or more open and shorter communities of herbs and sedges.
Aquatic and riparian habitats	Aquatic and riparian habitats within the project footprint consist of floodplains, freshwater wetlands, and waterways. Aquatic and riparian habitats provide an important resource for fauna.
Rocky habitat	Rocky habitats within the project footprint consist of outcrops, karsts, steep cliffs and overhangs and are important in providing habitat for a variety of fauna (especially microbats and reptiles).
Wet sclerophyll forest habitat	Wet sclerophyll forest habitat within the project footprint supports a diverse range of birds (for nesting and foraging), mammals (arboreal, terrestrial, and flying), amphibians, reptiles, and invertebrates.
Artificial habitats	Culverts, bridges and dilapidated buildings within the project footprint are considered potential habitat for roosting bats at different times of the year.

8.3.5.2. Threatened fauna species

Forty-seven potential candidate threatened fauna species were considered to have associated habitat within the project footprint and were assessed for habitat suitability. Of these, 13 threatened fauna species were excluded from further assessment based on lack of suitable habitat, habitat constraints, and/or geographic limitations within the project footprint, or the species was recorded well outside their natural range (ie a vagrant recording). As such, 34 candidate threatened fauna species were the subject of targeted surveys. Fifty ecosystem credit species were also identified in accordance with the BAM as having potential habitat within the project footprint. Ecosystem credit species are species where mapped habitat can be used to assume presence, therefore targeted surveys are not required.

Field surveys carried out for the project recorded 232 native fauna species comprising 13 frog, 136 bird, 45 mammal, 37 reptile and one fish species. Table 8-6 lists the threatened fauna species recorded within the project footprint during surveys and includes 15 species credit species (candidate species) and 14 ecosystem credit species. Figure 8-3 shows the location of these threatened fauna species (along with

threatened flora species). *Technical Report 1 – Biodiversity Development Assessment Report* provides more detailed mapping showing the threatened fauna species recorded and further information on how candidate threatened fauna species have been assumed present within the project footprint.

Table 8-6 Threatened fauna species recorded within the project footprint

Common name	Scientific name	Conservation status[1]	
		BC Act	EPBC Act
Birds			
Barking Owl	*Ninox connivens*	V	-
Brown Treecreeper	*Climacteris picumnus victoriae*	V	-
Diamond Firetail	*Stagonopleura guttata*	V	-
Dusky Woodswallow	*Artamus cyanopterus*	V	
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V	V
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	V	-
Flame Robin	*Petroica phoenicea*	V	-
Little Eagle	*Hieraaetus morphnoides*	V	-
Olive Whistler	*Pachycephala olivacea*	V	-
Powerful Owl	*Ninox strenua*	V	-
Scarlet Robin	*Petroica boodang*	V	-
Speckled Warbler	*Chthonicola sagittata*	V	-
Spotted Harrier	*Circus assimilis*	V	-
Superb Parrot	*Polytelis swainsonii*	V	V
Varied Sitella	*Daphoenositta chrysoptera*	V	-
White-bellied Sea-eagle	*Haliaeetus leucogaster*	V	-
Bats			
Eastern False Pipistrelle	*Stagonopleura guttata*	V	-
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-
Southern Myotis	*Myotis Macropus*	V	-
Arboreal mammals			
Eastern Pygmy Possum	*Cercartetus nanus*	V	-
Greater Glider	*Petauroides volans*	E	E
Squirrel Glider	*Petaurus norfolcensis*	V	-
Yellow-bellied Glider	*Petaurus australis*	V	-
Reptiles			
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V
Rosenberg's Goanna	*Varanus rosenbergi*	V	-
Insects			
Key's Matchstick Grasshopper	*Keyacris scurra*	E	E

Note: Conservation status listings: CE - critically endangered; E - endangered; V – vulnerable

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the candidate threatened fauna species and ecosystem credit species.

8.3.5.3. Migratory species

Fauna surveys also recorded three migratory species listed under the EPBC Act:

- Fork-tailed Swift (*Apus pacificus*)
- Rufous Fantail (*Rhipidura rufifrons*)
- Satin Flycatcher (*Myiagra cyanoleuca*).

Searches of the NSW BioNet Atlas Database also identified six additional listed migratory species as previously being recorded within the locality and considered likely to fly over or forage within the project footprint:

- Common Greenshank (*Tringa nebularia*)
- Latham's Snipe (*Gallinago hardwickii*)
- Marsh Sandpiper (*Tringa stagnatilis*)
- Red-necked Stint (*Calidris ruficollis*)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- White-throated Needletail (*Hirundapus caudacutus*).

In addition, the Black-faced Monarch (*Monarcha melanopsis*) has been considered further as part of biodiversity assessment to address Commonwealth assessment requirements (refer to Appendix A (SEARs compliance table)). However, due to no records of Black-faced Monarch in proximity to the project footprint and the extent of habitat in the broader surrounds, this species is considered to have a low likelihood of occurrence within the project footprint.

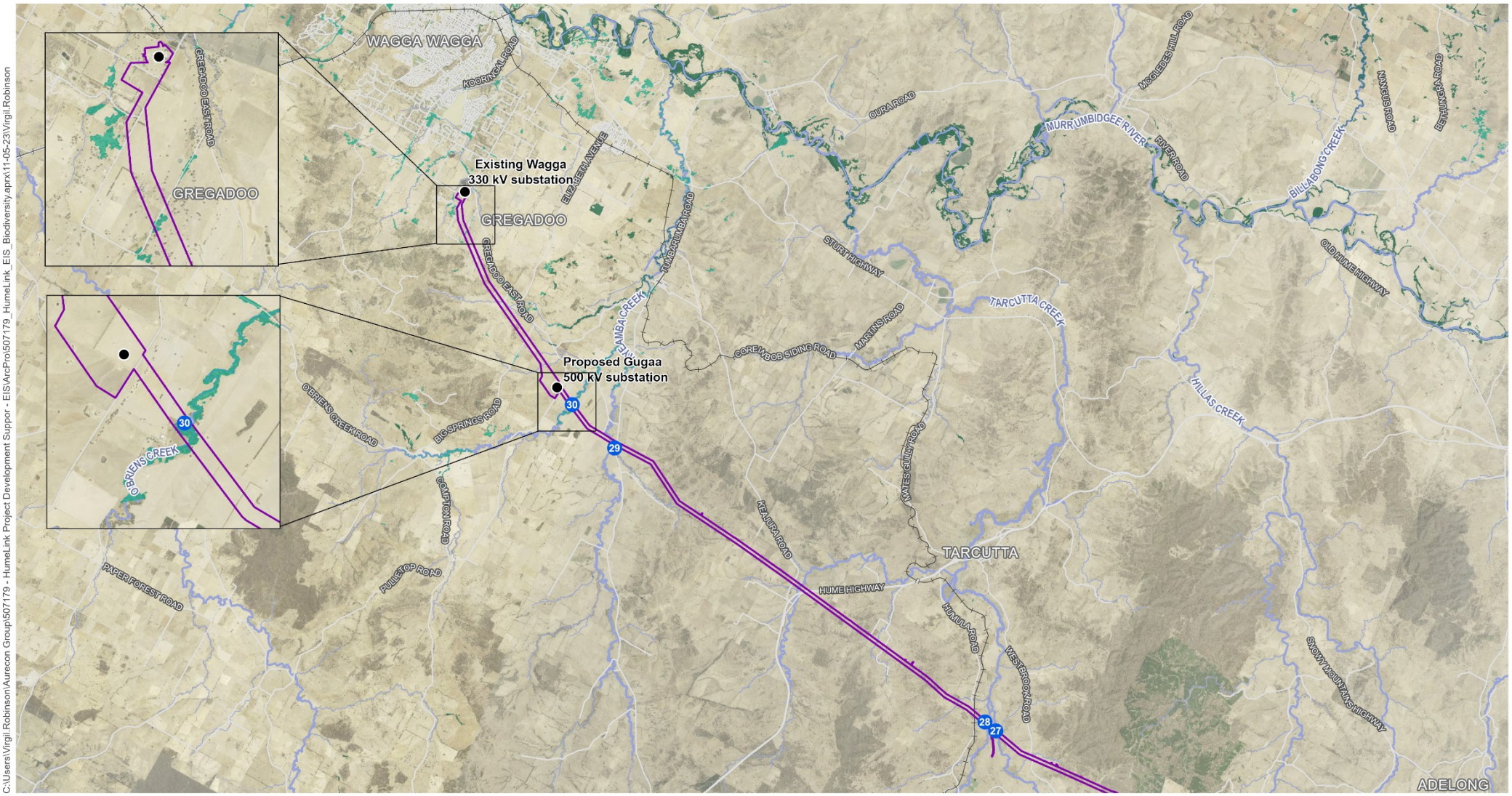
8.3.6. Aquatic species and habitats

8.3.6.1. Aquatic habitat

A total of 1,139 waterways are located within the project footprint, which traverses four major surface water catchments. From west to east, these catchments are the Murrumbidgee River, the Upper Murray River, the Lachlan River and the Hawkesbury-Nepean River catchments. Seventy-nine per cent of these waterways are first and second Strahler order streams, reflecting the dominance of smaller streams within the project footprint. Of the 1,139 waterways located within the project footprint, 30 have been identified as potentially providing habitat for threatened aquatic species (refer to Figure 8-4).

The 30 waterways potentially providing habitat for threatened aquatic species are typically fourth Strahler stream order and above. Twenty-four of the 30 waterways are also mapped as KFH (DPI, 2022). However, the majority of KFH is classed as being in ‘very poor’ condition, with only the Murrumbidgee River being classed as ‘poor’ condition. Additionally, the waterways also generally lack sensitive aquatic habitat features such as aquatic macrophytes, deep pools and large woody debris.

Overall, habitat for threatened aquatic species within the project footprint is in poor condition and subject to some form of degradation from clearing, grazing or cropping within the riparian zone, channel incision, bank erosion or weed encroachment.



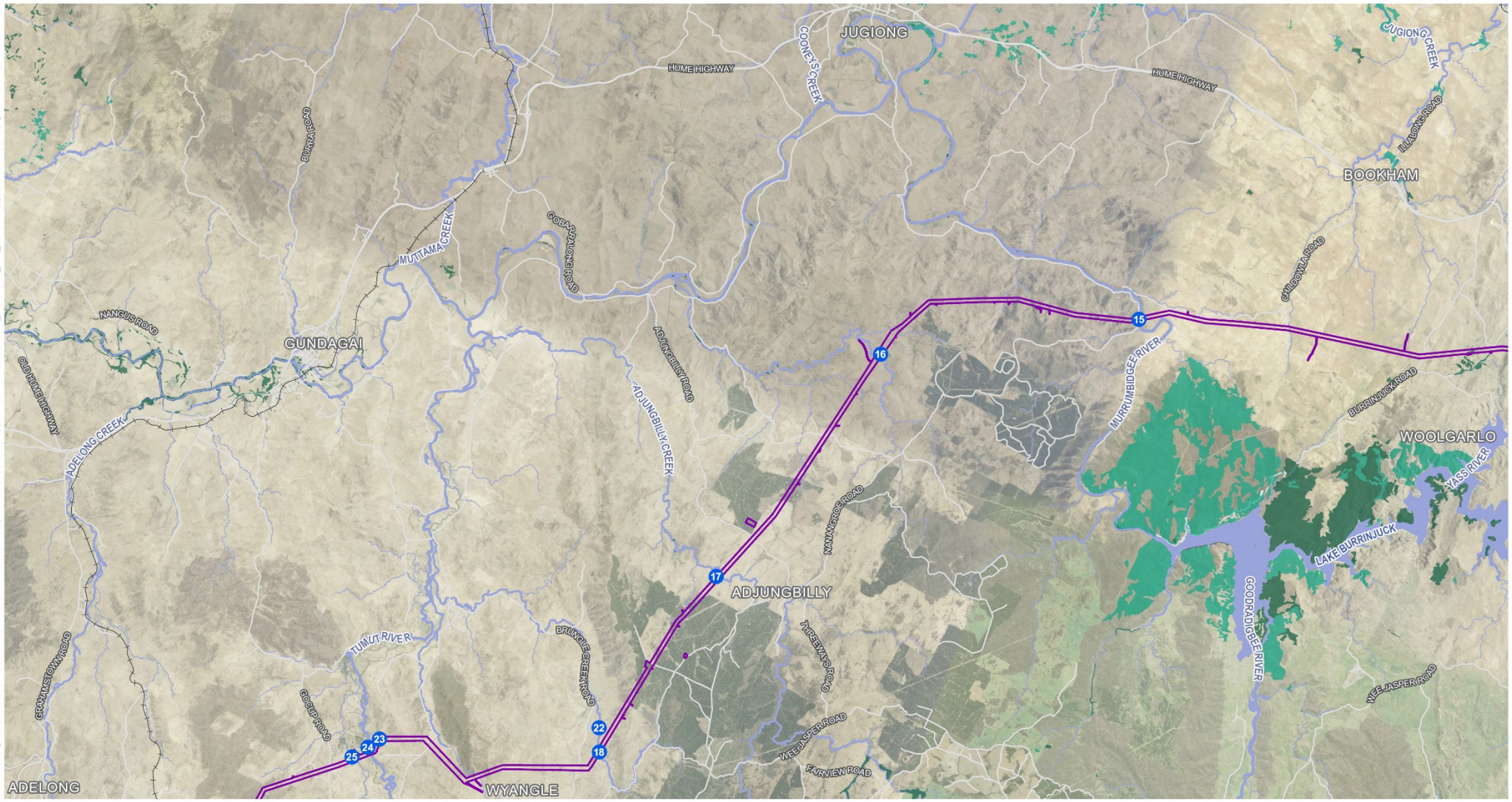
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 8-4a: Threatened aquatic species habitat and GDEs within the project footprint

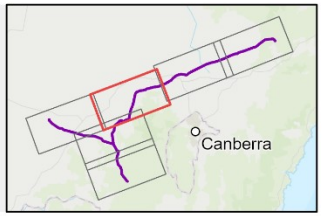


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Project footprint
Railway
Waterway
Substation

Terrestrial GDE
High potential GDE
Moderate potential GDE

Potential threatened aquatic species habitat
15 Murrumbidgee River
16 Oak Creek
17 Adjungbilly Creek
18 Brungle Creek
22 Brungle Creek
23 Tumut River
24 Tumut River (unmapped anabranch)
25 Gocup Creek



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

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Projection: GDA 1994 MGA Zone 55

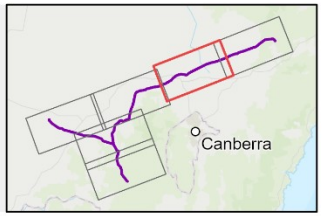
Figure 8-4b: Threatened aquatic species habitat and GDEs within the project footprint



Project footprint
Railway
Waterway
Substation

Terrestrial GDE
High potential GDE
Moderate potential GDE

Potential threatened aquatic species habitat
1 Unnamed waterway
2 Humes Creek
3 Merrill Creek
4 Lachlan River
5 Oolong Creek
6 Jerrawa Creek
7 Jerrawa Creek
8 Jerrawa Creek
9 Flacknell Creek
10 Three Waterholes Creek
11 Manton's Creek
12 Yellow Creek
13 Bango Creek
14 Cooks Creek



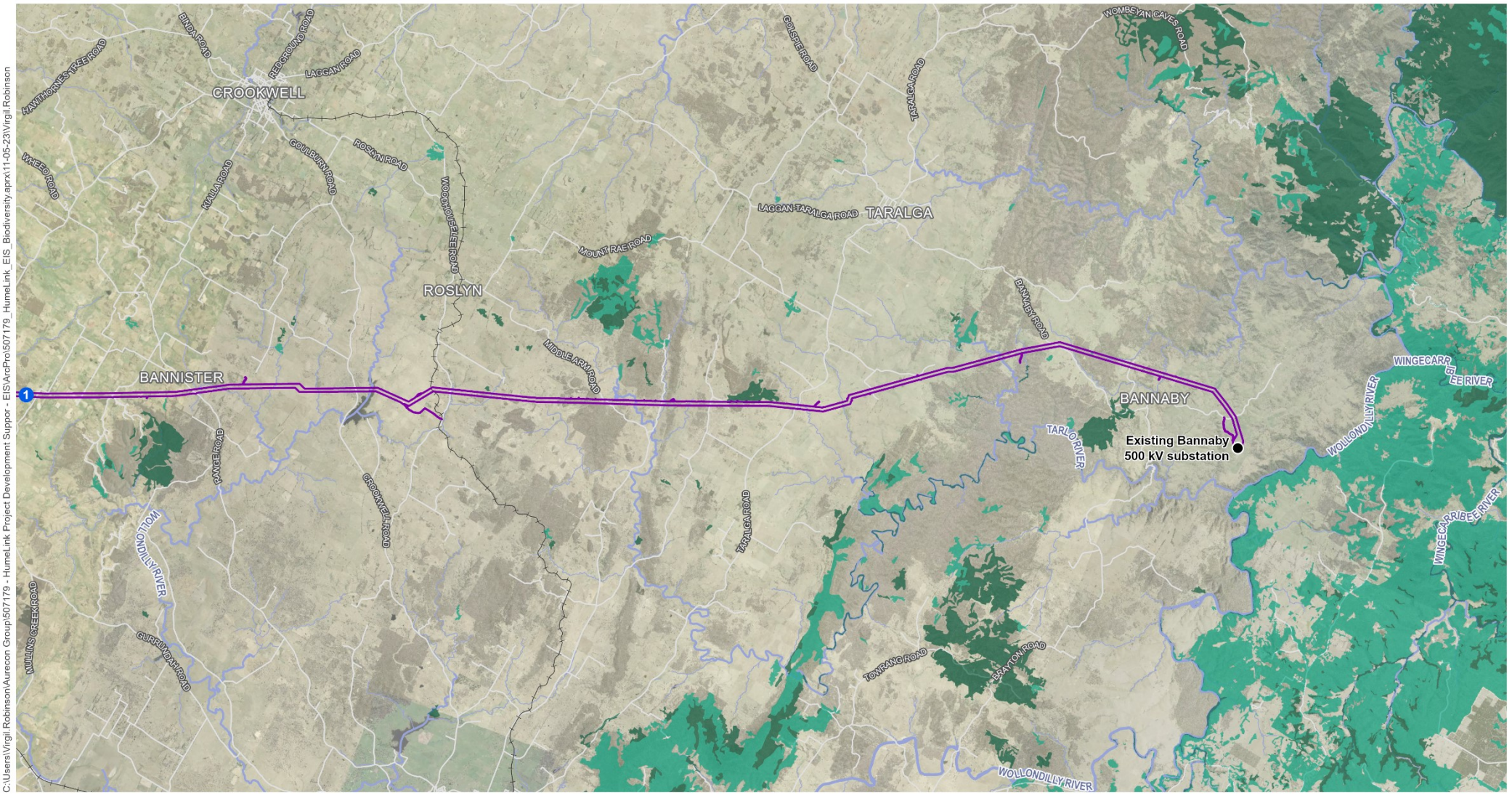
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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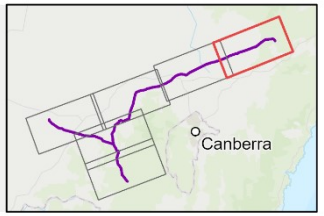
Figure 8-4c: Threatened aquatic species habitat and GDEs within the project footprint



Project footprint
Railway
Waterway
Substation

Terrestrial GDE
High potential GDE
Moderate potential GDE

Potential threatened aquatic species habitat
1 Unnamed waterway



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

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Projection: GDA 1994 MGA Zone 55

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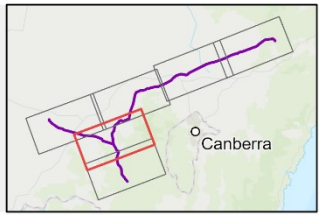
Figure 8-4d: Threatened aquatic species habitat and GDEs within the project footprint



Project footprint
Railway
Waterway
Substation

Terrestrial GDE
High potential GDE
Moderate potential GDE

Potential threatened aquatic species habitat
18 Brungle Creek
19 Bombowlee Creek
20 Goobarragandra River
21 Tumut River
22 Brungle Creek
23 Tumut River
24 Tumut River (unmapped anabranch)
25 Gocup Creek
26 Adelong Creek
27 Tarcutta Creek
28 Umbango Creek



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

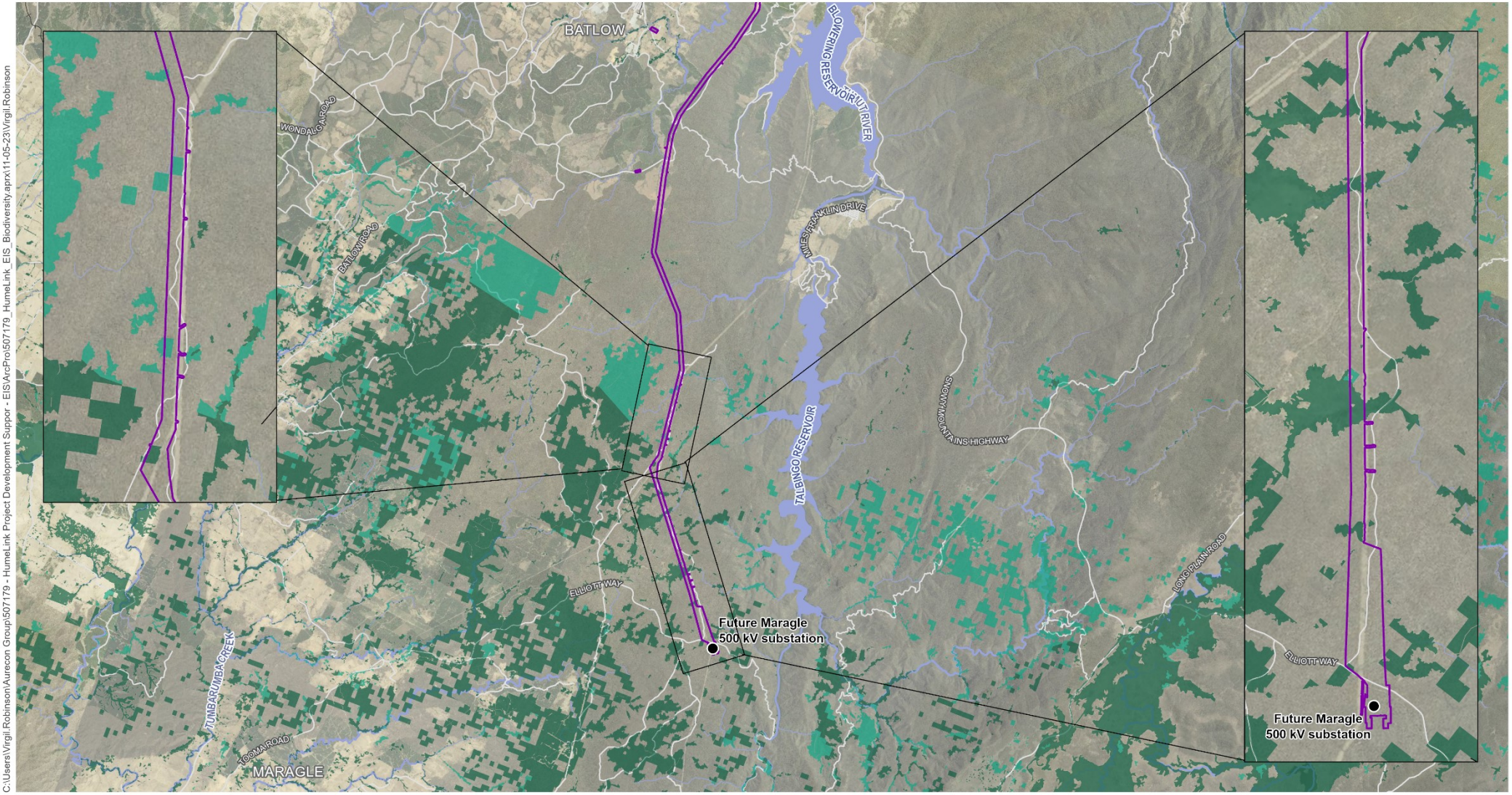
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Projection: GDA 1994 MGA Zone 55

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Figure 8-4e: Threatened aquatic species habitat and GDEs within the project footprint

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

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Projection: GDA 1994 MGA Zone 55

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Figure 8-4f: Threatened aquatic species habitat and GDEs within the project footprint

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8.3.6.2. Threatened aquatic species and communities

Despite the poor condition of aquatic habitat within the project footprint, threatened aquatic fauna species and TECs listed under the FM Act and EPBC Act have been identified as having the potential to occur within the project footprint and have been considered for potential impact. The likelihood of occurrence was based on desktop assessment and field investigation. The threatened aquatic fauna species and TECs include:

- Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment – listed as an endangered ecological community under the FM Act
- Silver Perch (*Bidyanus bidyanus*) – listed as vulnerable under the FM Act and critically endangered under the EPBC Act
- Murray Crayfish (*Euastacus armatus*) – listed as vulnerable under the FM Act
- Flatheaded Galaxias (*Galaxias rostratus*) – listed as critically endangered under the FM Act and EPBC Act
- Southern Pygmy Perch (*Nannoperca australis*) – listed as endangered under the FM Act and vulnerable under the EPBC Act
- Trout Cod (*Maccullochella macquariensis*) – listed as endangered under the FM Act and EPBC Act
- Macquarie Perch *(Macquaria australasica*) – listed as endangered under the FM Act and EPBC Act.

Murray Cod (*Maccullochella peelii*), listed as vulnerable under the EPBC Act, has the potential to occur within the project footprint in larger waterways, particularly the Murrumbidgee River. However, any population present would not constitute part of any important population identified in the recovery plan for the species (National Murray Cod Recovery Team, 2010). As such, the Murray Cod was excluded from further consideration.

8.3.7. Groundwater dependent ecosystems

A review of the Atlas of GDEs (Bureau of Meteorology, 2022a) found that 13 moderate and 15 high potential terrestrial GDEs have been mapped within the project footprint. These GDEs generally correspond with the location of large waterways in the project footprint and range from about 0.02 to 9.63 hectares.

Most moderate and high potential GDEs in the project footprint are located in the Snowy Mountains IBRA subregion, mainly between 11 kilometres south-east of Snubba Road and the future Maragle 500 kV substation. The remainder of the high potential GDEs in the project footprint are located in the Murrumbateman IBRA subregion, and the remainder of the moderate potential GDEs in the project footprint occur in Bungonia, Murrumbateman, and Inland Slopes IBRA subregions. No potential GDEs are located in the project footprint in Bondo or Crookwell IBRA subregions.

The GDEs have been attributed to 15 groundwater dependent PCTs and three associated TECs: White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland TEC, Monaro Tableland Cool Temperate Grassy Woodland TEC and Tableland Basalt Forest TEC.

Figure 8-4 provides the location of the GDEs within the project footprint. Further detail on each GDE is included in *Technical Report 1 – Biodiversity Development Assessment Report*.

8.3.8. Weeds and pest animals

Thirty-eight weed species were recorded within the project footprint during surveys carried out as part of the biodiversity assessment. Of the 38 weed species, five were classified as weeds of national significance, 22 weeds were classified as high threat weeds and 27 weeds were classified as priority weeds. Twelve weed species had two or more classifications. The weeds of national significance are:

- Chilean Needle Grass (*Nassella neesiana*) – recorded in Bungonia, Crookwell, Murrumbateman, and Inland Slopes IBRA subregions
- Serrated Tussock (*Nassella trichotoma*) – recorded in Bungonia, Crookwell, and Murrumbateman IBRA subregions
- Blackberry (*Rubus fruticosus sp. agg.*) – recorded in all IBRA subregions
- Willow (Salix *spp.*) – recorded in Murrumbateman IBRA subregion
- Fireweed (*Senecio madagascariensis*) – recorded in all IBRA subregions.

Technical Report 4 – Agricultural Impact Assessment also considers the presence of weeds on agricultural land within and surrounding the project footprint, and includes further detail on the potential for weeds to occur based on observations and engagement with Local Land Services and council weed officers.

Pest animals were recorded across the project footprint, with the majority of sightings occurring in the Murrumbateman and Inland Slopes IBRA subregions. Rabbit (*Oryctolagus cuniculus*) and Fox (*Vulpes vulpes*) were the most common pest animals sighted within the project footprint.

8.3.9. Severely burnt vegetation

The Dunns Road bushfire impacted the project footprint in the 2019–20 bushfire season and evidence of fire was still observed during field surveys undertaken in 2022. A total of 333,980 hectares of land was impacted (DPIE, 2020e).

Within the project footprint, about 2,038 hectares of land was impacted across Bondo, Inland Slopes and Snowy Mountains IBRA subregions. Refer to Chapter 19 (Hazards and risks) for further detail on the extent of the bushfire impact. The total area of severely burnt native vegetation within the project footprint included about 249.4 hectares within Inland Slopes IBRA subregion, 108.8 hectares within Bondo IBRA subregion, and 168.6 hectares within Snowy Mountains IBRA subregion. Severely burnt native vegetation recorded within the project footprint comprised 13 PCTs. Their post-bushfire condition varied between moderate and very high.

Apple Box – Red Stringybark basalt scree open forest in the upper Murray River region (PCT 314) had the largest area burnt in the project footprint, with 165.32 hectares of moderate to very high condition vegetation being severely burnt in the Inland Slopes IBRA subregion. While PCT 314 is not classified as a TEC, a number of TECs were also severely burnt within the project footprint including about:

- 92.7 hectares of high to very high condition Tableland Basalt Forest TEC in the Bondo IBRA subregion
- 27.76 hectares of high to very high condition White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland TEC (BC Act and EPBC Act listed) in the Inland Slopes IBRA subregion.
- 1.77 hectares of the Montane Peatlands and Swamps/Alpine Sphagnum Bogs and Associated Fens TEC (BC Act and EPBC Act listed) in the Snowy Mountains IBRA subregion.

Findings from the surveys and assessment of severely burnt vegetation in accordance with the *Guideline for Applying the Biodiversity Assessment Method at Severely Burnt Sites* (DPIE, 2020d) suggested the

response of flora and fauna to bushfires was highly variable depending on species and was taken into consideration in the PCT classification and survey methodology for the biodiversity assessment.

8.3.9.1. Commonwealth listed threatened species and ecological communities

Consideration of the effects of the 2019–20 bushfire on EPBC Act listed threatened species and TECs has also been carried out to clarify the importance of surviving populations, communities, and habitat within the project footprint. In summary, it was found that:

- any of the unburnt areas of Alpine Sphagnum Bogs and Associated Fens TEC within the project footprint are considered of high importance for the recovery of the TEC given its sensitivity to fire and slow recovery
- any remaining populations of Bago Leek Orchid and Kelton's Leek Orchid are considered important populations until there is substantial recovery of populations at burnt sites in the region and surrounds
- any potential populations of Blue-tongued Greenhood (*Pterostylis oreophila*) or Austral Toadflax (*Thesium australe*) within the project footprint are likely to be important populations post the 2019–20 bushfire
- any remaining Broad-toothed Rat (*Mastacomys fuscus*) habitat within the project footprint would be of substantially greater importance to the survival of the species post the 2019–20 bushfire
- any remaining populations of Yellow-bellied Gliders in the project footprint are likely to be considered more important, until there is substantial recovery of suitable habitat and populations in the region and surrounds.

Technical Report 1 – Biodiversity Development Assessment Report provides further detail on the surveys and assessment of severely burnt vegetation including details on all EPBC Act listed species likely to occur within severely burnt vegetation.

8.4. Potential impacts – construction

8.4.1. Direct impacts

An indicative disturbance area has been used to estimate the likely extent of vegetation and habitat clearing required for construction and operation of the project. This area is based on an indicative concept design within the project footprint and is made up of three different zones of vegetation clearing as detailed in Table 8-7. A more detailed description of the vegetation clearing zones is provided in Chapter 4 (Project description – construction).

Table 8-7 Indicative disturbance area zones

Zone	Description
TCZ	This zone encompasses land subject to total clearing and ground disturbance. Permanent structures including transmission line structures, access tracks and substations would be situated within this zone as well as temporary brake and winch sites and construction compounds. All areas that are part of the TCZ have been considered as full and permanent loss of vegetation.
ECZ	This zone encompasses land within the proposed transmission line easement where clearing and ongoing maintenance of tall growing vegetation would be undertaken. Tall growing vegetation includes any vegetation, which may intrude on the vegetation clearance requirements at maximum line operating conditions (maximum conductor sag and maximum conductor blowout) at that location now or at any time in the future. Earthwork and grubbing are not required within this zone except in limited circumstances. Vegetation clearance heights are set by Transgrid for operational and safety requirements, including bushfire risk management.
HTZ	This zone encompasses land located within and adjacent to the transmission line easement where selective tree removal, trimming or lopping would be undertaken to manage any risk of damage to transmission lines and structures in the event of tree fall. Light Detection and Ranging (LiDAR) analysis was performed to identify potential hazard trees outside the easement clearing zone, which were included in the indicative disturbance area. The outer boundary of the mapped trees was buffered to allow for a consolidated potential impact area. Any hazard tree showing risk of failure due to health, structure or defect would be removed.

The vegetation clearing extents and requirements for construction and operation of the project are detailed in Chapter 4 (Project description - construction) and Chapter 3 (Project description – infrastructure and operation) respectively. This includes likely clearing extents and requirements for all permanent and temporary infrastructure as well as vegetation clearance requirements during operation and requirements for establishing and maintaining asset protection zones (APZs).

The indicative disturbance area as an overall clearing estimate has been used for the purposes of describing the potential direct impacts on native vegetation, TECs and threatened species habitat in the following sections. *Technical Report 1 – Biodiversity Development Assessment Report* provides detailed mapping and further information on clearing estimates for each indicative disturbance area zone.

The disturbance area would be refined during detailed design and further construction planning to avoid and minimise impacts on biodiversity and would consider environmental management measures to further minimise biodiversity (refer to Section 8.7.3) and other environmental impacts.

8.4.1.1. Impacts on native vegetation

Transgrid has sought to avoid and minimise direct impacts to native vegetation during project development (refer to Section 8.7.2).

The project could potentially directly impact about 670.21 hectares of native vegetation based on the indicative disturbance area (excluding Category 1 – exempt land). The direct impacts would be associated with clearing for the construction of the transmission line and associated infrastructure including access tracks, work associated with the proposed and modified substations, and establishment of ancillary facilities required for construction. The exact location and extent of the vegetation clearance required for the final transmission line easement and associated infrastructure within the project footprint would be confirmed during detailed design. Where practicable, direct impacts to native vegetation would be avoided during detailed design and further construction planning. Direct impacts would also be minimised through the implementation of mitigation measures detailed in Section 8.7.3.

Table 8-8 provides a summary of impacts on native vegetation based on the IBRA subregions. These impacts have been calculated using the indicative disturbance area for the Bungonia, Crookwell, Murrumbateman, Bondo and Snowy Mountains IBRA subregions. *Technical Report 1 – Biodiversity Development Assessment Report* provides further details on the impacts of clearing on all PCTs affected by the project.

Table 8-8 Summary of potential impacts on native vegetation

IBRA subregion	Impacted PCTs	Impact (ha)
Bondo	PCTs 285, 295, 296, 299 and 953	38.84
Bungonia	PCTs 283, 870, 1093, 1097, 1107, 1150 and 1330	34.17
Crookwell	PCTs 280, 283, 335, 679, 727, 731, 952, 1093, 1151, 1191, 1256 and 1330	76.83
Murrumbateman	PCTs 266, 278, 280, 283, 287, 322, 349, 351, 352, 731, 1093, and 1330	98.11
Inland Slopes	PCTs 5, 266, 268, 277, 278, 280, 287, 290, 294, 297, 299, 301, 306, 314, 316, 319, 343, 352, 731 and 1191	245.29
Snowy Mountains	PCTs 300, 638, 679, 939, 953, 1196 and 1224	176.97
Total		**670.21**

8.4.1.2. Impacts on threatened ecological communities

Transgrid has sought to avoid and minimise direct impacts to TECs during project development (refer to Section 8.7.2).

Table 8-9 summarises the potential vegetation clearing impacts on the TECs identified within the project footprint based on the indicative disturbance area. During detailed design and construction planning, direct impacts on TECs would be avoided and/or minimised where practicable and in accordance with mitigation measures detailed in Section 8.7.3.

Table 8-9 Potential impacts on threatened ecological communities

TEC	PCT(s)	Conservation status[1]	Potential impact (ha)						
			Bondo	Bungonia	Crookwell	Murrumbateman	Inland Slopes	Snowy Mountains	Total
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South-Eastern Highlands, NSW South-Western Slopes, South-East Corner and Riverina Bioregion	266, 268, 277, 278, 280, 283, 352, 1330	BC Act - CE	-	16.41	38.42	76.56	180.39	-	311.78
		EPBC Act - CE	-	16.39	18.56	28.4	48.12	-	111.47
Coolac-Tumut Serpentinite Shrubby Woodland in the NSW South-Western Slopes and South-Eastern Highlands Bioregions	301	BC Act - E	-	-	-	-	1.42	-	1.42
Tableland Basalt Forest in the Sydney Basin and South-Eastern Highlands Bioregions	952, 953, 1097, 1107	BC Act - E	33.68	0.66	3.08	-	-	-	37.42
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South-East Corner, South-Eastern Highlands and Australian Alps bioregion	939 1256	BC Act - E	-	-	0.19	-	-	0.56	0.75
Alpine Sphagnum Bogs and Associated Fens	939 1256	EPBC Act - E	-	-	-	-	-	0.56	0.56
Monaro Tableland Cool Temperate Grassy Woodland in the South-Eastern Highlands Bioregion	679 1191	BC Act - CE	-	-	1.7	-	-	-	1.7

Note:

1. Conservation status listings: CE - critically endangered; E - endangered; V – vulnerable

8.4.1.3. Impacts on threatened flora

Transgrid has sought to avoid and minimise direct impacts to threatened species habitat during project development (refer to Section 8.7.2).

A total of 58 threatened flora species have the potential to be directly impacted by the project. This includes 18 species listed only under the BC Act, two species listed under only the EPBC Act and 38 species listed under both the BC Act and EPBC Act.

Direct impacts on threatened flora species are associated with impacts on individual plants and/or loss of their habitat in accordance with the BAM. The direct impacts have been calculated using the indicative disturbance area and presence of recorded and assumed habitat. Only three out of the 58 threatened flora species likely to be directly impacted have been recorded within the project footprint during surveys carried out for the biodiversity assessment, including Yass Daisy, Hoary Sunray and Swamp Everlasting. The remaining 55 threatened flora species have been assumed present due to the presence of suitable habitat within the project footprint and survey limitations. During detailed design and construction planning, direct impacts on threatened flora species would be avoided and/or minimised where practicable and in accordance with mitigation measures detailed in Section 8.7.3.

Of the 58 threatened flora species that have potential to be directly impacted, 11 species are listed as critically endangered under the BC Act and/or EPBC Act. Table 8-10 provides a summary of potential direct impacts on critically endangered flora species.

Table 8-10 Summary of potential direct impacts on critically endangered flora species under the BC Act and/or EPBC Act

Species	Conservation status[1]	Assessment outcome	Potential impact (ha)	IBRA subregion
Euphrasia arguta	BC Act - CE EPBC Act - CE	Assumed present	92.9	Inland Slopes
Prasophyllum sp. Wybong	EPBC Act - CE	Assumed present	87.8	Inland Slopes
Tumut Grevillea (*Grevillea wilkinsonii*)	BC Act - CE EPBC Act - CE	Assumed present	34.7	Inland Slopes
Bago Leek Orchid	BC Act - CE EPBC Act - CE	Assumed present	31.9	Snowy Mountains
Kelton's Leek Orchid	BC Act - CE EPBC Act - CE	Assumed present	31.7	Snowy Mountains
Bossiaea fragrans	BC Act - CE EPBC Act - CE	Assumed present	6.1	Inland Slopes
Wee Jasper Grevillea (*Grevillea iaspicula*)	BC Act - CE EPBC Act - E	Assumed present	3.9	Murrumbateman
Delicate Pomaderris (*Pomaderris delicata*)	BC Act - CE EPBC Act - CE	Assumed present	8.0	Bungonia
Blue-tongued Greenhood	BC Act - CE EPBC Act - CE	Assumed present	0.6	Snowy Mountains
Clover Glycine (*Glycine latrobeana*)	BC Act - CE EPBC Act - V	Assumed present	0.3	Snowy Mountains

Species	Conservation status[1]	Assessment outcome	Potential impact (ha)	IBRA subregion
Brandy Marys Leek Orchid (*Prasophyllum innubum*)	BC Act - CE EPBC Act - CE	Assumed present	0.3	Snowy Mountains

Note:
1. Conservation status listings: CE - critically endangered; E - endangered; V – vulnerable

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the potential impacts of clearing on listed endangered and vulnerable flora species affected by the project.

8.4.1.4. Impacts on threatened fauna

Transgrid has sought to avoid and minimise direct impacts to threatened species habitat during project development (refer to Section 8.7.2).

Of the 47 candidate threatened fauna species, a total of 33 species (12 bird, 11 mammal (including three bat species), three reptile, five amphibian and two insect species) and two endangered fauna populations have the potential to be directly impacted by the project. The impacted threatened fauna species includes 15 species listed only under the BC Act with the remaining 18 species listed under both the BC Act and the EPBC Act.

Direct impacts on threatened fauna species are associated with loss of habitat in accordance with the BAM. The direct impacts have been calculated using the indicative disturbance area and presence of recorded and assumed habitat. Fourteen out of the 33 threatened fauna species likely to be directly impacted have been recorded within the project footprint as part of the field surveys. The remaining 19 threatened fauna species have been assumed present due to the presence of suitable habitat within the project footprint and survey limitations. During detailed design and construction planning, direct impacts on threatened fauna species would be avoided and/or minimised where practicable and in accordance with mitigation measures detailed in Section 8.7.3.

Of the 33 threatened fauna species that have potential to be directly impacted, 13 species are listed as critically endangered or endangered under the BC Act and/or EPBC Act. Table 8-11 provides a summary of potential direct impacts on critically endangered and endangered fauna species and the two endangered populations.

Table 8-11 Summary of potential direct impacts on critically endangered and endangered fauna species under the BC Act and/or EPBC Act

Species/populations	Conservation status[1]	Assessment outcome	Impact (ha)	IBRA subregion
Koala (*Phascolarctos cinereus*)	BC Act - E EPBC Act - E	Assumed present	418.4	Bondo Bungonia Crookwell Murrumbateman Inland Slopes Snowy Mountains

Species/populations	Conservation status[1]	Assessment outcome	Impact (ha)	IBRA subregion
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	BC Act - V EPBC Act - E	Recorded	306.4	Bondo Bungonia Crookwell Murrumbateman Inland Slopes Snowy Mountains
Key's Matchstick Grasshopper (*Keyacris scurra*)	BC Act - E EPBC Act - E	Recorded	229.0	Bungonia Crookwell Murrumbateman Inland Slopes
Smoky Mouse (*Pseudomys fumeus*)	BC Act - CE EPBC Act - E	Assumed present	132.7	Bondo Snowy Mountains
Greater Glider (*Petauroides volans*)	BC Act - E EPBC Act - E	Recorded	116.3	Bondo Bungonia Crookwell Murrumbateman Inland Slopes Snowy Mountains
Bush Stone-curlew (*Burhinus grallarius*)	BC Act - E	Assumed present	60.5	Inland Slopes
Alpine She-oak Skink (*Cyclodomorphus praealtus*)	BC Act - E EPBC Act - E	Assumed present	12.2	Snowy Mountains
Sloane's Froglet (*Crinia sloanei*)	BC Act - V EPBC Act - E	Assumed present	2.6	Inland Slopes
Yellow-spotted Tree Frog (*Litoria castanea*)	BC Act - CE EPBC Act - CE	Assumed present	1.4	Crookwell Murrumbateman Snowy Mountains
Booroolong Frog (*Litoria booroolongensis*)	BC Act - E EPBC Act - E	Assumed present	0.1	Bondo Bungonia Crookwell Murrumbateman Inland Slopes
Stuttering Frog (*Mixophyes balbus*)	BC Act - E EPBC Act - V	Assumed present	13.8	Bungonia
Brush-tailed Rock Wallaby	BC Act - E EPBC Act - V	Assumed present	1.1	Bungonia
Southern Corroboree Frog (*Pseudophryne corroboree*)	BC Act - CE EPBC Act - CE	Assumed present	22.2	Snowy Mountains
Squirrel Glider in the Wagga Wagga City Local Government Area (*Petaurus norfolcensis - endangered population*)	BC Act - EP	Assumed present	46.7	Inland Slopes
Yellow-bellied Glider (*Petaurus australis*) population on the Bago Plateau	BC Act - EP	Assumed present	19.4	Snowy Mountains

Note:
1. Conservation status listings: CE - critically endangered; E - endangered; EP - endangered population; V – vulnerable

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the impacts of clearing on listed vulnerable fauna species affected by the project.

8.4.2. Indirect impacts

Table 8-12 presents the potential indirect impacts on native vegetation, threatened ecological communities and threatened species habitat likely to be affected by the project during construction. Relevant indirect impacts are defined in accordance with the BAM. Potential indirect impacts during construction would be managed through the implementation of mitigation measures detailed in Section 8.7.3.

Table 8-12 Potential indirect impacts during construction

Indirect impact	Discussion	Extent	Duration
Inadvertent impacts on adjacent habitat or vegetation	Construction of the project may result in disturbance or destruction of adjacent habitats and native vegetation. Construction activities may result in sedimentation and erosion and mobilisation of contaminants into adjoining native vegetation and aquatic habitats. In addition, inadvertent clearing or unauthorised vehicle movements or storage of materials may result in the destruction of adjacent habitats and native vegetation. However, the consequence of this impact is considered minor and would be managed with the implementation of mitigation measures detailed in Section 8.7.3.	Within 100 m of the disturbance area	Short-term
Reduced viability of adjacent habitat due to noise, dust, or light spill	Adjacent habitats could be subject to disturbance during the construction as a result of increased noise, dust, and light spill. Noise and dust impacts are expected to be localised and temporary. Artificial lighting, if used at work sites, construction compounds and the worker accommodation facility, could affect the foraging, breeding, and dispersal behaviours of nocturnal fauna. In addition, fauna also use lighting cues as a means for predator detection and habitat selection, both of which are impacted by the introduction of artificial light (Blackwell, et al. 2015). However, impacts would be considered short-term and are unlikely to have long-term adverse effects on the viability of adjacent habitats. The implementation of mitigation measures detailed in Section 8.7.3 would minimise residual impacts.	Within 100 m of the disturbance area	Short-term
Transport of weeds and pathogens from the site to adjacent vegetation	During construction, there is the potential for the introduction or spread of weeds and pathogens through imported materials and movement of machinery and vehicles and construction workers. No evidence of pathogens such as the root-rot fungus *Phytophthora cinnamomi*, Myrtle Rust (*Austropuccinia psidii*) or Chytrid Fungus (*Batrachochytrium dendrobatidis*) was recorded within the project footprint. However, these have the potential to occur. Biosecurity measures detailed in Section 8.7.3 would be implemented to ensure risks are managed.	Within 100 m of the disturbance area	Long-term
Increased risk of starvation or exposure, and loss of shade or shelter	Displacement of resident fauna species during vegetation clearing is considered relatively low in some areas due to modified vegetation structure resulting from long-term agricultural practices. However, the risk is likely to increase in areas with larger intact remnants such as those in Bondo and Snowy Mountains IBRA subregions. Given the linear nature of the project, proposed mitigation measures in Section 8.7.3 and the resident fauna species likely to occur being highly mobile, the increased risk of starvation, exposure and loss of shade or shelter due to the project is considered low.	Final disturbance area and within 100 m of the disturbance area	Short-term

Indirect impact	Discussion	Extent	Duration
Loss of breeding habitat	The loss of breeding habitat such as large old growth trees, hollows, stick nests, drays and fallen timber has the potential to affect native animals such as, hollow-dependent bats, hollow-nesting and canopy-nesting birds, arboreal mammals, and reptiles. The loss of breeding habitats is unlikely to extend beyond the indicative disturbance area. Impacts beyond the final disturbance area would be minimised with the implementation of mitigation measures detailed in Section 8.7.3.	Disturbance area	Long-term
Trampling of threatened flora species	Inadvertent trampling could impact existing threatened flora species and available habitat during construction. Any potential impacts from trampling are likely to be minor and contained to any retained scrub and undergrowth or vegetation adjacent the final disturbance area. Mitigation measures detailed in Section 8.7.3 would help to manage potential trampling impacts.	Disturbance area and within 100 m of the disturbance area	Long-term
Removal and disturbance of rocks, including bush rock	Reduction in population extent and available habitat of small terrestrial fauna (eg small mammals and reptiles) could occur due to the direct removal or disturbance of rock habitat, including bush rock during the construction. Mitigation measures detailed in Section 8.7.3 would help to manage potential impacts associated with removal or disturbance of rock habitat.	Disturbance area and within 100 m of the disturbance area	Long-term
Increase in pest animal populations and predation of native fauna	It is unlikely that construction would result in the introduction or spread of pest species within the project footprint. Given the project footprint consists of large areas of agricultural land it is highly likely that there are already varying degrees of pest animal encroachment. Despite this, it is possible that native fauna may be more susceptible to predation as a result of vegetation clearing and increased levels of fragmentation within the locality. Mitigation measures detailed in Section 8.7.3 would help to manage potential impacts associated with pest animals and predation of native fauna.	Disturbance area and within 100 m of the disturbance area	Long-term

8.4.3. Prescribed biodiversity impacts

Prescribed biodiversity impacts are those that may affect biodiversity values in addition to, or instead of, impacts from vegetation clearing and loss of habitat. These impacts may be difficult to quantify or offset as they often affect biodiversity values that are irreplaceable. Table 8-13 summarises the relevant prescribed biodiversity impacts associated with the construction of the project and the associated threatened species or TECs. Mitigation measures detailed in Section 8.7.3 would help to manage potential prescribed biodiversity impacts.

Prescribed biodiversity impacts that relate to operation of the project are discussed in Section 8.5.3. Some prescribed biodiversity impacts would likely be experienced during construction, such as impacts on connectivity or risk of collision with transmission line structures. However, as the impacts would be predominantly during operation, they are not included in Table 8-13.

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the extent, duration, and consequence of prescribed biodiversity impacts on the relevant threatened species or TECs.

Table 8-13 Assessment of prescribed biodiversity impacts during construction

Prescribed biodiversity impact	Description of feature characteristic and location	Relevant threatened species or TEC dependent on feature	Discussion
Impacts of development on the habitat of threatened species or TECs associated with karst, caves, crevices, cliffs and other geological features of significance, or rocks.	There are numerous limestone deposits displaying features of karst environments within the project footprint including about 14.81 ha of potential karstic geologies. No cave environments were identified within the project footprint during field surveys. However, areas of typical rocky hillslope and rock overhangs occur throughout the project footprint including 6.23 ha of steep cliffline habitat within the Bungonia and Inland Slopes IBRA subregions.	• Large Bent-winged Bat • Large-eared Pied Bat (*Chalinolobus dwyeri*) • Masked Owl	Impacts on karst environments and rocky habitat is expected to be negligible. No deep excavation or drilling is proposed within high potential karst environments and suitable rocky habitat for relevant threatened species would be avoided. As such, impacts would be minor. Any residual impacts would be appropriately offset (refer to Section 8.7.5).
Impacts of development on water bodies, water quality and hydrological processes that sustain threatened species and TECs	As discussed in Section 8.3.6.1, there are a total of 1,139 waterways located within the project footprint. Major waterways such as O'Briens Creek, Kyeamba Creek, Umbango Creek, Tarcutta Creek, Tumut River, Adjungbilly Creek, Murrumbidgee River and Lachlan River are considered important in their IBRA subregions for several species. The project footprint also contains TECs which have been attributed to GDEs.	• Southern Myotis • Greater Broad-nosed Bat • Sloane's Froglet • Booroolong Frog • Yellow-spotted Tree Frog	During construction, the main potential impacts on waterways would be from sedimentation, changes to geomorphology or from accidental spills of chemicals, fuels, hydrocarbons, and heavy metals. However, with the implementation of the mitigation measures listed in Section 8.7.3, water quality impacts from construction activities are anticipated to be short-term and limited in extent. In addition, changes to geomorphology from installation of waterway crossings or construction of transmission line structures is also expected to be short-term and limited in extent. Detailed design and construction planning would consider locating transmission line structures and other infrastructure as far from waterways as possible. Where infrastructure is to be located near smaller ephemeral waterways, construction techniques and design elements would be considered to reduce impacts. As such, the construction of the project is unlikely to result in significant impacts on aquatic systems or values that would in turn impact reliant terrestrial threatened species.

Prescribed biodiversity impact	Description of feature characteristic and location	Relevant threatened species or TEC dependent on feature	Discussion
		• Monaro Tableland Cool Temperate Grassy Woodland TEC • White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland TEC • Tableland Basalt Forest TEC	Construction of the project is unlikely to impact hydrological processes on which TECs are reliant. While excavations required for substations may have a moderate impact significance on groundwater flow paths/recharge and groundwater levels (without mitigation), there are no TECs that have been attributed to GDEs in proximity to this work. In addition, construction of transmission line structures is unlikely to restrict groundwater flows or alter water quality. Refer to Section 8.4.6 for further consideration of groundwater impacts during construction.
Impacts of development on the habitat of threatened species or TECs associated with: • human made structures, or • non-native vegetation.	There are 29 culverts, bridges or other possible structures identified within the project footprint which could provide potential habitat for roosting microbats at different times of the year. These structures occur throughout all IBRA subregions except for Bungonia IBRA subregion. The project footprint also includes about 2,047.48 hectares of non-native vegetation.	• Grey-headed Flying-fox (*Pteropus poliocephalus*) • Golden Sun Moth • Striped Legless Lizard • Pink-tailed Legless Lizard	No human made structures would be impacted by the project. As such, potential impacts on microbat species reliant on human made structures would be negligible. Some areas of non-native vegetation would be impacted by the project with impacts considered permanent, ranging from minor to moderate. No known Grey-headed Flying-fox camps occur within the project footprint, and any non-native vegetation would likely be supplementary foraging resources for the species. As such, impacts associated with the removal of non-native vegetation are not considered important for the species' survival. Golden Sun Moth, Striped Legless Lizard and Pink-tailed Legless Lizard have been recorded within areas dominated by exotic weeds and grasses. While these species have not been recorded in areas dominated by exotic weeds and grasses during surveys within the project footprint, there is potential for this habitat type in inaccessible lands. Mitigation measures to avoid known Golden Sun Moth, Striped Legless Lizard and Pink-tailed Legless Lizard habitat (native and non-native grassland habitats) would be implemented. Refer to Section 8.7.3 for further detail on mitigation measures.

Prescribed biodiversity impact	Description of feature characteristic and location	Relevant threatened species or TEC dependent on feature	Discussion
Impact of vehicle strikes on threatened species of animals or on animals that are part of a TEC.	Construction of the project would require the transport of construction materials and equipment from multiple locations using national, state, regional and local road networks, as well as new and upgraded access tracks. Chapter 4 (Project description - construction) provides an overview of the location of roads expected to provide access to the project footprint.	• Koala • Eastern Pygmy-possum • Squirrel Glider • Superb Parrot • Powerful Owl • Masked Owl	The project has the potential to impact fauna through vehicle and machinery strike during construction. The risk of mortality or injury from vehicle and machinery strike for relevant threatened fauna is likely to be higher at certain times when their mobility and home range sizes increase, particularly during the breeding season. Clearing of vegetation may also increase the risk of mortality or injury through increased exposure to vehicle and machinery strike as the fauna attempt to move to nearby habitats. Some bird species may also be susceptible to vehicle strike as they feed on carrion or seeds along road corridors. Mitigation measures detailed in Section 8.7.3 would be implemented to minimise potential vehicle and machinery strike impacts.

8.4.4. Serious and irreversible impacts

Transgrid has sought to avoid and minimise potential impacts to threatened species and TECs at risk of SAII during project development to the extent practicable (refer to Section 8.7.2).

The project has the potential to impact threatened species and TECs at risk of SAII as defined by Section 6.7 of the Biodiversity Conservation Regulation 2017. This includes 18 flora species and five fauna species which are considered to have limited potential to be impacted, and four TECs, five flora species and three fauna species which are considered to have a moderately likelihood of potential impact. The potential for SAII was determined by a conservative assessment of the likelihood of occurrence of those communities or species, based on the results of the field survey, TEC and species assessment and analysis against direct, prescribed, and indirect impacts. Potential SAII entities are generally highly threatened and/or unlikely to respond to management actions at a biodiversity stewardship site.

SAII assessments were not carried out for Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*) or Little Bent-winged Bat. The SAII for Regent Honeyeater and Swift Parrot relates exclusively to impacts on their species credit (important mapped areas only) not present within the project footprint. As such, an SAII assessment is not required. For Little Bent-winged Bat, potential breeding habitat would not be impacted, which is the SAII consideration for this species.

Table 8-14 and Table 8-15 summarises the SAII assessment based on potential direct impacts with the full SAII assessment included in *Technical Report 1 – Biodiversity Development Assessment Report*. However, the consent authority will make the ultimate determination of SAII.

Indirect impacts on all TECs and habitat of threatened species at risk of SAII would include edge effects (ie impacts that occur at the boundary of the vegetation community or habitat), potential changes to fire regimes in surrounding vegetation, and potential for introduction of weeds, diseases and pathogens during both construction and operation. The potential indirect impacts to threatened species and TECs at risk of SAII are detailed in Sections 8.4.2 and 8.5.2 and have not been included in Table 8-14 and Table 8-15. Potential connectivity or fragmentation impacts are considered in Section 8.5.4 for relevant SAII entities.

Avoiding and minimising impacts on SAII entities would be prioritised during detailed design and further construction planning to the greatest extent practicable. Section 8.7.3 details a number of mitigation measures that will be implemented during detailed design and construction of the project to avoid and minimise impacts on SAII entities. Mitigation measures include but are not limited to route refinement and design avoidance, micro-siting of the transmission line infrastructure and associated work sites, pre-clearing surveys, retention of habitat features, and establishment of biodiversity exclusion zones. A Biodiversity Management Plan (BMP) and Connectivity Strategy will also be developed and implemented to guide the management and evaluation of mitigation measures. Additional surveys are proposed during spring 2023 and ongoing during detailed design to identify further impact reduction opportunities and confirm assumed presence and the conservative approach to assessing SAII entities.

The additional surveys would inform the need for TEC or threatened species-specific management plans or additional site-specific mitigation measures to further avoid and minimise impacts on SAII entities if a SAII is confirmed. If required, the TEC or threatened species-specific management plans would be prepared with consideration of any relevant NSW or Commonwealth Government recovery plan for the community or species.

Table 8-14 includes SAII entities which are considered to have limited potential to be impacted. SAII entities with limited potential to be impacted include entities with incomplete information to be able to exclude them from SAII assessment despite a limited likelihood of potential impacts and/or occurrence within the disturbance footprint. For example, SAII entities were not found during field surveys of comparable habitat, however the survey was not complete due to access availability, or sub-optimal weather conditions were experienced and the entity is known or predicted from the broader IBRA subregion.

Table 8-14 SAII assessment summary – SAII entities with limited potential to be impacted

SAII entity	Conservation status[1]	SAII assessment summary
Threatened flora		
Phantom Wattle (*Acacia phasmoides*)	BC Act – V EPBC Act – V	Phantom Wattle was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 2.00 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 4% of suitable habitat within the project footprint and less than 0.01% of the species' estimated extent of occurrence in NSW. The species is only known from one location in NSW, ie Woomargama National Park, about 60 km south-west of the project footprint. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Bossiaea fragrans	BC Act – CE EPBC Act – CE	*Bossiaea fragrans* was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 6.10 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 6% of suitable habitat within the project footprint and 2-4% of the species' estimated extent of occurrence in NSW. The species is currently only known from the Abercrombie Karst Conservation Reserve and within the adjacent travelling stock reserve (TSR), south of Bathurst on the NSW central tablelands (about 78 km north-west of the project). Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Crimson Spider Orchid (*Caladenia concolor*)	BC Act – E EPBC Act – V	Crimson Spider Orchid was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 34.10 ha of potential habitat in the Murrumbateman and Inland Slopes IBRA subregions. This impact would equate to about 33% of suitable habitat within the project footprint and 0.002% of the species' estimated extent of occurrence in NSW. There are seven records of this species near the project (43 individuals), with the closest being 4 km from the project footprint. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Thick Lip Spider Orchid (*Caladenia tessellate*)	BC Act – E EPBC Act – V	Thick Lip Spider Orchid was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 16.00 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 15% of suitable habitat within the project footprint and 0.02% of the species' estimated extent of occurrence in NSW. There are no nearby records of this species within 20 km of the project footprint. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.

SAII entity	Conservation status[1]	SAII assessment summary
Mauve Burr-daisy (*Calotis glandulosa*)	BC Act – V EPBC Act – V	Mauve Burr-daisy was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 16.00 ha of suitable habitat in the Bondo and Snowy Mountains IBRA subregions. This impact would equate to about 15% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. There are no nearby records of this species within 20 km of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Pale Golden Moths (*Diuris ochroma*)	BC Act – E EPBC Act – V	Pale Golden Moths was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 0.25 ha of potential habitat in the Snowy Mountain IBRA subregion. This impact would equate to about 3% of suitable habitat within the project footprint and 0.000005% of the species' estimated extent of occurrence in NSW. The species is confined to a single population in the Kyeban area (about 120 km south-east of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Eucalyptus alligatrix subsp. alligatrix	BC Act – V EPBC Act – V	*Eucalyptus alligatrix subsp. alligatrix* was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 1.14 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 2% of suitable habitat within the project footprint and 2.8% of the species' estimated extent of occurrence in NSW. The species has only been identified in NSW as a single population in Rylstone (about 180 km north of project). Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Robertson's Peppermint (*Eucalyptus robertsonii subsp. hemisphaerica*)	BC Act – V EPBC Act – V	Robertson's Peppermint was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. The project could directly impact about 0.29 ha of potential habitat in the Crookwell IBRA subregion. This impact would equate to about 2% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. There are no records of this species within 20 km of the project. The species was not recorded, however due to survey limitations, it was assumed present based on the requirement to assess under the BAM. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Euphrasia arguta	BC Act – CE EPBC Act – CE	*Euphrasia arguta* was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 92.90 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 7% of suitable habitat within the project footprint and 0.016% of the species' estimated extent of occurrence in NSW. There are no records of this species within 20 km of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.

SAII entity	Conservation status[1]	SAII assessment summary
Rough Eyebright (*Euphrasia scabra*)	BC Act – E	Rough Eyebright was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 1.90 ha of potential habitat in the Snowy Mountain IBRA subregion. This impact would equate to about 30% of suitable habitat within the project footprint and 0.004% of the species' estimated extent of occurrence in NSW. There are no records of this species within 20 km of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Superb Midge Orchid (*Genoplesium superbum*)	BC Act – E	Superb Midge Orchid was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 8.80 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 18% of suitable habitat within the project footprint and 0.003% of the species' estimated extent of occurrence in NSW. The species is only known from two locations near Nerriga (about 74 km south-east of the project). Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Clover Glycine	BC Act – CE EPBC Act – V	Clover Glycine was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 0.25 ha of suitable habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 4% of suitable habitat within the project footprint and 0.004% of the species' estimated extent of occurrence in NSW. There are no records of this species within 20 km of the project and there is only one known population in the Kelly Plains in Kosciuszko National Park (about 28 km east of the project). Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Wee Jasper Grevillea	BC Act – CE EPBC Act – E	Wee Jasper Grevillea was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 3.85 ha of suitable habitat in the Crookwell, Inland Slopes and Murrumbateman IBRA subregions. This impact would equate to about 6% of suitable habitat within the project footprint and 0.06% of the species' estimated extent of occurrence in NSW. There are 24 nearby records of this species (about 1,080 individuals), with the closest record being 11 km from the project footprint. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Tumut Grevillea	BC Act – CE EPBC Act – CE	Tumut Grevillea was not recorded and has a low likelihood of occurring, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 34.70 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 11% of suitable habitat within the project footprint and 1% of the species' estimated extent of occurrence in NSW. There are 17 records of this species near the project, with the closest record being 14 km from the project footprint. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.

SAII entity	Conservation status[1]	SAII assessment summary
Elusive Cress (*Irenepharsus magicus*)	BC Act – E	Elusive Cress was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 26.50 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 45% of suitable habitat within the project footprint and 6.6% of the species' estimated area of occupancy in NSW. There are no records of this species within 10 km of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Delicate Pomaderris	BC Act – CE EPBC Act – CE	Delicate Pomaderris was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 8.00 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 19% of suitable habitat within the project footprint and 1% of the species' estimated extent of occurrence in NSW. There are no records of this species within 20 km of the project. Overall, the project is unlikely to be deemed a significant risk to the species becoming extinct.
Pale Pomaderris (*Pomaderris pallida*)	BC Act – V EPBC Act – V	Pale Pomaderris was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 0.77 ha of potential habitat in the Murrumbateman IBRA subregion. This impact would equate to about 2% of suitable habitat within the project footprint. There are no records of this species within 20 km of the project. Overall, the project is considered unlikely to lead to further decline or extinction of the species given it is not considered likely to be present within the project footprint.
Granite Zieria (*Zieria obcordata*[1])	BC Act – E EPBC Act – E	Granite Zieria was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 43.40 ha of potential habitat in the Inland Slopes IBRA subregion. This impact would equate to about 7% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. There are no records of this species within 20 km of the project. The project is considered unlikely to lead to further decline or extinction of the species given it is not considered likely to be present within the project footprint.
Threatened fauna		
Large-eared Pied Bat	BC Act – V EPBC Act – V	Large-eared Pied Bat was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 7.70 ha of potential foraging habitat in the Bungonia and Inland Slopes IBRA subregion. No known breeding habitat (the SAII component for this species) would be impacted, however potential breeding habitat has been modelled to cater for areas not accessed that indicated potential breeding habitat. While targeted surveys did not record individuals or any maternity caves within the project footprint, there are 19 nearby records (about 31 individuals) of this species within 20 km of the project. The closest record is 8 km from the project footprint. Overall, given the limited impact to potential breeding habitat and that the species was not recorded, an SAII outcome decision for this species is considered unlikely.

SAII entity	Conservation status[1]	SAII assessment summary
Large Bent-winged Bat	BC Act – V	The Large Bent-winged Bat was recorded within and immediately adjacent to the project footprint within all IBRA subregions affected by the project. The project could directly impact about 0.12 ha of potential breeding habitat constituting modelled areas of potential caves. The Large Bent-winged Bat is highly mobile with a dispersal range of 300 km from maternity caves (when not breeding). This indicates that the habitat in the project footprint constitutes part of the broad ranging foraging habitat for this species. While no roosts were identified within the project footprint, the extent of roosting habitat was difficult to determine. However, based on a low likelihood of modelled roost habitat and no direct impacts to this habitat, an SAII outcome decision is considered unlikely.
Stuttering Frog (*Mixophyes balbus*)	BC Act – E EPBC Act – V	Stuttering Frog was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 13.80 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 18% of suitable habitat within the project footprint. The extent of occurrence and area of occupancy for this species is unknown. There are no nearby records of this species within 20 km of the project. The closest records are near Ruby Creek in Blue Mountains (about 40 km north of the project). Overall, based on a low likelihood of occurrence or direct impacts to breeding habitat and the implementation of mitigation measures detailed in Section 8.7.3, an SAII outcome decision for this species is considered unlikely.
Brush-tailed Rock-wallaby (*Petrogale penicillate*)	BC Act – E EPBC Act – V	Brush-tailed Rock-wallaby was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 1.10 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 10% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. There are no records of this species within 20 km of the project. Overall, given the limited extent of impact and limited likelihood of occurrence, an SAII outcome decision for this species is considered unlikely.
Southern Corroboree Frog (*Pseudophryne corroboree*)	BC Act – CE EPBC Act – CE	Southern Corroboree Frog was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 22.20 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 51% of suitable habitat within the project footprint and 0.6% of the species' estimated extent of occurrence in NSW. There are no records within 20 km of the project. Overall, given the low likelihood of occurrence within the indicative disturbance area and the implementation of mitigation measures detailed in Section 8.7.3, an SAII outcome decision for this species is considered unlikely.

Note:
1. Conservation status listings: CE - critically endangered; E - endangered; V - vulnerable

Table 8-15 includes SAII entities where impact is considered at least moderately likely within the indicative disturbance area due to recordings in the project footprint during field surveys, proximity of historic records or availability of habitat.

As discussed above, during detailed design and construction planning, impacts on SAII entities would be avoided and minimised where practicable in accordance with mitigation measures detailed in Section 8.7.3.

Table 8-15 SAII assessment summary – SAII entities likely to be impacted

SAII entity	Conservation status[1]	SAII assessment summary
TECs		
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland	BC Act – CE	The majority of White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC within the project footprint (82%) is in a low to very low condition. The project would directly impact about 311.78 ha of White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC (refer to Table 8-9) which would equate to less than 0.01% of the TEC's estimated extent of occurrence with NSW. Overall, given the extent of proposed clearing, the project could reduce the TEC's ecological function and contribute to its further decline. However, there are extensive areas of this TEC that remain and if impacts were limited to lower condition remnants, there is potential for a 'non-significant risk' of extinction determination.
Tableland Basalt Forest	BC Act – E	The majority of Tableland Basalt Forest TEC within the project footprint (60%) is in a high to very high condition. The project would directly impact about 37.42 ha of Tableland Basalt Forest TEC (refer to Table 8-9) which would equate to about 0.1% of the TEC's estimated extent of occurrence in NSW. Overall, given the extent of proposed clearing, the project could reduce the TEC's ecological function and contribute to its further decline. As such, the project is likely to be deemed a significant risk to this TEC. However, if clearing within higher condition areas can be further limited, it should significantly reduce the risk of an SAII outcome.
Coolac-Tumut Serpentinite Shrubby Woodland	BC Act – E	The majority of Coolac-Tumut Serpentinite Shrubby Woodland TEC within the project footprint (40%) is in a low condition. The project would directly impact about 1.42 ha of Coolac-Tumut Serpentinite Shrubby Woodland TEC (refer to Table 8-9) which would equate to about 0.02% of the TEC's estimated extent of occurrence in NSW. Overall, given the limited extent of impacts it is considered very unlikely that the project would be considered as contributing significantly towards the risk of extinction of this TEC.
Monaro Tableland Cool Temperate Grassy Woodland	BC Act – CE	The majority of Monaro Tableland Cool Temperate Grassy Woodland TEC within the project footprint (58%) is in a very low to low condition. The project would directly impact about 1.7 ha of Monaro Tableland Cool Temperate Grassy Woodland TEC (refer to Table 8-9) which would equate to about 0.01% of the TEC's estimated extent of occurrence in NSW. Overall, given the limited extent of impacts and that no areas of this TEC are expected to be totally cleared, it is considered unlikely that the project would be considered as contributing significantly towards the risk of extinction of this TEC.
Threatened flora		
Bago Leek Orchid	BC Act – CE EPBC Act – CE	Bago Leek Orchid was not recorded within the project footprint during targeted surveys and assumed to be present within identified habitat of the project footprint. There are 397 historic records of the species within 10 km of the project footprint and 20 individuals were recorded by FCNSW in 2016 within the project footprint. Targeted surveys carried out for the project recorded individuals 130 m west of the project footprint. The project could directly impact about 31.90 ha of suitable habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 31% of suitable habitat within the project footprint and 8% of the species' estimated extent of occurrence in NSW. Overall, given the proposed impact on potential habitat, the project is likely to be deemed a significant risk to the species becoming extinct. However, additional surveys to confirm habitat status may reduce this risk.

SAII entity	Conservation status[1]	SAII assessment summary
Brandy Marys Leek Orchid	BC Act – CE EPBC Act – CE	Brandy Marys Leek Orchid was not recorded during targeted survey, however was assumed to be present. There are four nearby records of this species near the project, with the closest record being 600 m from the project footprint. The project could directly impact about 0.25 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 3% of suitable habitat within the project footprint and 0.06% of the species' estimated extent of occurrence. Overall, given the limited impact to potential habitat, the project is unlikely to be deemed a significant risk to the species becoming extinct. In addition, with the implementation of mitigation measures detailed in Section 8.7.3, potential impacts are likely to be avoided or minimised, which would likely result in a non-significant risk determination.
Kelton's Leek Orchid	BC Act – CE EPBC Act – CE	Targeted surveys carried out for the project only recorded Kelton's Leek Orchid individuals 750 m west of the project footprint, however the species was assumed to be present. FCNSW has historically recorded 330 individuals in 2016 within the vicinity of the project footprint, with three records occurring within the project footprint. The project could directly impact about 31.70 ha of suitable habitat in Snowy Mountains IBRA subregion. This impact would equate to about 34% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. Overall, given the proposed impact on potential habitat, the project is likely to be deemed a significant risk to the species becoming extinct. However, additional surveys to confirm habitat status may reduce this risk.
Blue-tongued Greenhood	BC Act – CE EPBC Act – CE	Blue-tongued Greenhood was not recorded during targeted surveys, however was assumed to be present. There are five nearby records of this species, with the closest record 300 m from the project footprint. The project could directly impact about 0.56 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 19% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. Overall, given the proposed impact on very high condition habitat, the project may be deemed a significant risk to the species becoming extinct. However, with the implementation of mitigation measures detailed in Section 8.7.3, potential impacts are likely to be avoided or minimised, which would likely result in a non-significant risk determination.
Solanum armourense	BC Act – E	*Solanum armourense* was not recorded during targeted survey, however was assumed to be present. There are two nearby records of this species, with the closest record being 6.5 km from the project footprint. The project could directly impact about 0.51 ha of suitable habitat in the Bungonia IBRA subregion. This impact would equate to about 6.6% of suitable habitat within the project footprint. An impact as a percentage of extent of occupancy cannot be accurately determined as there is insufficient or inconsistent data available for this species. Overall, given the proposed impact on moderate to high condition habitat, the project may be deemed a significant risk to the species becoming extinct. However, with the implementation of mitigation measures detailed in Section 8.7.3, potential impacts are likely to be avoided or minimised, which would likely result in a non-significant risk determination.

SAII entity	Conservation status[1]	SAII assessment summary
Threatened fauna		
Yellow-spotted Tree Frog	BC Act – CE EPBC Act – E	Yellow-spotted Tree Frog was not recorded, however was assumed to be present. There are two nearby records of this species (about 400 individuals), with the closest record being 9 km from the project footprint. The project could directly impact up to 1.36 ha of suitable habitat in the Crookwell, Murrumbateman and Snowy Mountains IBRA subregions. However, the habitat impacted only provides opportunistic forage and the species has a high dispersal across its range. No potential breeding habitat is expected to be directly impacted for the species. Overall, given the low likelihood of direct impacts to potential breeding habitat, the limited extent of impact on surrounding foraging habitats, and the implementation of mitigation measures detailed in Section 8.7.3, an SAII outcome is considered unlikely for this species.
Sooty Owl (*Tyto tenebricosa*)	BC Act – V	Sooty Owl was not recorded during targeted survey, however was assumed to be present. There are nine nearby records with the closest being 650 m from the project footprint. The project could directly impact up to 21.20 ha of potential foraging habitat and potential breeding habitat in the Bondo, Bungonia and Snowy Mountains IBRA subregion. However, based on a review of available data, it is likely that a moderate proportion of the breeding habitat does not support suitable hollows. The impact on potential foraging habitat would equate to less than 0.01% of the species' estimated extent of occurrence in NSW. Overall, given impacts to breeding habitats are likely to be limited in extent, and the implementation of mitigation measures detailed in Section 8.7.3, the project is deemed unlikely to pose a significant risk to the species becoming extinct.
Smoky Mouse	BC Act – CE EPBC Act – E	Smoky Mouse was not recorded, however due to survey limitations, it was assumed present on the requirement to assess under the BAM. The project could directly impact about 132.66 ha of potential habitat in the Bondo and Snowy Mountains IBRA subregions. However, the majority of this impact (132.6 ha) occurs with the Snowy Mountains IBRA subregion. The direct impact would equate to about 0.05% and 99.95% of the suitable habitat within the project footprint in the Bondo and Snowy Mountains IBRA subregions respectively, and 0.5% of the species' estimated extent of occurrence in NSW. There are no records of this species within 20 km of the project. Overall, given the extent of potential impacts to habitat, the project may be deemed a sufficiently high risk to be an SAII depending on the likelihood of the species being present. Additional surveys are likely to assist in confirmation of the species presence within the project footprint.

8.4.5. Impacts on aquatic species and habitats

Aquatic species and habitats may be impacted during construction as a result of:

- installation of waterway crossings for access tracks, which could directly impact aquatic habitat and fish passage and result in changes to geomorphology
- construction of transmission line and associated infrastructure, including access tracks directly impacting riparian vegetation and disturbance to, or excavation of waterway banks
- activities that impact water quality from excess runoff, sedimentation, or accidental spills of chemicals, fuels, hydrocarbons, and heavy metals
- construction plant and machinery introducing aquatic pests and diseases.

These impacts are considered below.

The project would use existing access tracks where possible. Where required, the construction of waterway crossings for new access tracks could impact aquatic species and habitats. Potential waterway crossings have been identified for 23 waterways mapped as KFH or are within indicative distribution mapping for threatened aquatic species. This includes two 'Class 1 – Major key fish habitat' waterways (Derringullen Creek and Gilmore Creek) as defined by *Policy and Guidelines for Fish Habitat Conservation and Management (2013 update)* (DPI, 2013) and two waterways within the indicative distribution mapping for Southern Pygmy Perch (Yellow Creek and an unnamed waterway). However, Derringullen Creek and Gilmore Creek are noted as being in very poor condition KFH and located within degraded landscapes with existing access tracks in proximity to the waterways. While Yellow Creek is included within indicative distribution mapping for Southern Pygmy Perch, it is unlikely that this species would be present. The waterway is in a degraded environment with sub-optimal habitat features and an existing informal crossing already in place. In addition, the unnamed waterway is a highly modified chain of farm dams that are not connected by surface flow under normal conditions, which would allow for a potential waterway crossing to be located to avoid potential fish passage impacts. Notwithstanding, all waterway crossings associated with access tracks would be constructed in accordance with mitigation measures provided in Section 8.7.3, which would minimise potential impacts on aquatic habitat and fish passage and manage changes to waterway geomorphology.

Construction of the project would directly impact riparian zones, which could result in removal of some aquatic habitat features or increased risk of sedimentation impacts within the adjacent waterways. Not all waterways within the project footprint have vegetated riparian zones. Where present, their extent is generally limited and condition degraded. However, some areas of remnant riparian vegetation, woodland or native grasslands surrounding waterways do persist in places within the project footprint. Based on applying the buffer distances in *Guidelines for Controlled Activities on Waterfront Land – Riparian Corridors* (DPI, 2018a), there are about 52.14 hectares of vegetated riparian zones within the project footprint. The vegetated riparian zones are made up of four PCTs and the potential direct impact based on the indicative disturbance area is about 6.81 hectares. Potential impacts on riparian vegetation would be avoided or minimised where possible in accordance with mitigation measures included in Section 8.7.3. Any residual impacts would be appropriately offset (refer to Section 8.7.5).

Water quality impacts associated with sedimentation have the potential smother aquatic habitat features. However, with the implementation of the mitigation measures listed in Section 8.7.3, water quality impacts from construction activities are anticipated to be short term and limited in extent. Water quality impacts during construction are considered in more detail in Chapter 17 (Surface water and groundwater quality).

There is a low potential for any construction plant or machinery used in waterway crossing construction to transport the Epizootic Haematopoietic Necrosis Virus (EHNV), which is known to occur within the Murrumbidgee River catchment and is associated with the invasive Redfin Perch (*Perca fluviatilis*). EHNV is known to infect introduced wild populations of Redfin Perch and farmed Rainbow Trout (*Oncorhynchus mykiss*), which is stocked at a number of locations surrounding the project footprint. However, EHNV may also infect native fish species with a number of fish species listed under the FM Act and EPBC Act known to be susceptible to the virus (DPI, n.d.). Potential risks associated with the introduction of EHNV would be managed in accordance with mitigation measures included in Section 8.7.3.

8.4.6. Impacts on groundwater dependent ecosystems

Construction of the project is unlikely to pose a significant risk to GDEs. As discussed in Chapter 17 (Surface water and groundwater quality), substation construction and/or modification, which would involve earthworks to a maximum depth of five metres, would have the potential to cause the greatest impact on

groundwater. Without mitigation, substation construction and/or modification is likely to have a moderate impact significance on groundwater flow paths/recharge and groundwater levels. However, there are no GDEs in close proximity to substation locations.

Construction of the transmission line structures is expected to have a negligible to low potential impact significance without mitigation. While the transmission line structures may require piling up to 27 metres deep, they would only impact a relatively small surface area, which is unlikely to restrict groundwater flows or alter water quality.

The storage and use of chemicals during construction may pose an increased risk to groundwater quality and GDEs due to accidents (such as from hydrocarbon spill). However, this risk would be effectively managed with the implementation of relevant mitigation measures proposed for the project.

8.4.7. Key threatening processes

Key threatening processes are processes that threaten or could threaten the survival or evolutionary development of species, populations, or ecological communities. Nineteen key threatening processes listed under the EPBC Act and BC Act, and three key threatening processes listed under the FM Act are considered relevant to construction of the project.

Relevant key threatening processes listed under the EPBC Act and BC Act with a high likelihood of occurring during construction include bush rock removal and clearing native vegetation. Impacts associated with these key threatening processes are considered in Section 8.4.1 and Section 8.4.2. Mitigation measures included in Section 8.7.3 would be implemented to minimise potential impacts.

The key threatening process relating to fire regimes that cause declines in biodiversity and/or ecological consequences of high-frequency fires listed under the EPBC Act and BC Act, respectively, was considered to have a moderate likelihood of occurring. Fire regimes within and surrounding the project footprint are already subject to considerable alteration as a result of the agricultural and forestry land uses which dominate the landscape. However, there would be an increased risk of bushfire during construction due to several potential ignition sources, eg hot works, equipment or services failure, or accidental ignitions. This is further discussed in Chapter 19 (Hazards and risks). Should a bushfire occur during construction from a project ignition source, this may result in the disruption of lifecycle processes in plants and animals and loss of vegetation structure and composition. The implementation of a Bush Fire Emergency Management and Evacuation Plan (BFEMEP) is expected to minimise the bushfire risk during construction (refer to Chapter 19 (Hazards and risks)).

All other relevant key threatening process listed under the EPBC Act and BC Act were considered to have a low to moderate likelihood of occurring and would mainly relate to spread of diseases, weeds, and pest animals. Impacts associated with these key threatening processes are considered in Section 8.4.2. Biosecurity measures detailed in Section 8.7.3 would be implemented to minimise biosecurity risks.

Relevant key threatening processes listed under the FM Act include degradation of native riparian vegetation, installation and operation of instream structures and other mechanisms that alter natural flow regimes, and removal of large woody debris from rivers and streams. Impacts associated with these processes are detailed in Section 8.3.6. While the project would require activities that would result in these key threatening processes, it is considered unlikely that the project would significantly contribute to increasing the effect of these processes beyond the levels encountered in the existing landscape. Mitigation measures included in Section 8.7.3 would be implemented to minimise potential impacts.

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the relevant key threatening processes listed under the EPBC Act, BC Act and FM Act.

8.5. Potential impacts – operation

8.5.1. Direct impacts

Potential direct impacts on native vegetation and habitats of threatened species during operation would occur through ongoing vegetation management to ensure vegetation clearance requirements and APZs are maintained (refer to Section 8.4.1 for further detail). Potential direct impacts on native vegetation, TECs and threatened species habitat during operation are included in the clearing estimates in Section 8.4.1.

8.5.2. Indirect impacts

Some indirect impacts associated with construction of the project may also occur during operation, including:

- inadvertent impacts on adjacent habitat or vegetation
- transport of weeds and pathogens from the site to adjacent vegetation
- trampling of threatened flora species
- removal and disturbance of rocks, including bush rock
- increase in pest animal populations and predation of native fauna.

These indirect impacts are described in Section 8.4.2, however, given the limited scale of work associated with the operation of project compared to construction, the extent of these impacts would be less.

Table 8-16 includes potential indirect impacts on native vegetation, threatened ecological communities and threatened species habitats likely to be affected by the project during operation. Potential indirect impacts during operation would be avoided and minimised through the implementation of mitigation measures detailed in Section 8.7.3.

Table 8-16 Potential indirect impacts during operation

Indirect impact	Discussion	Extent	Duration
Reduced viability of adjacent habitat due to edge effects	Much of the landscape surrounding the project footprint has been historically cleared and is subject to high levels of fragmentation. Vegetated fragments remaining within the landscape are generally small, isolated, and already likely to be subject to considerable edge effects such as weed invasion and altered floristic composition and structure. New forest edges created by the project could promote resource partitioning (this is a way to avoid competition between species and allow for coexistence), shifts in species composition, or create a barrier effect (with individuals exhibiting avoidance behaviours), particularly in microbats and birds. Potential edge effects would be managed with the implementation of mitigation measures provided in Section 8.7.3.	Within 100 m of the disturbance area	Long-term
Changed fire regimes	With the implementation of the maintenance activities and vegetation management practices detailed in Chapter 3 (Project description - infrastructure and operation), there would be a low risk of bushfire as a result of the project during operation. Potential risks would be managed though implementation of mitigation measures provided in Chapter 19 (Hazards and risks).	Within the disturbance area, and the surrounding vegetation that has been impacted by fire	Ongoing
Electric and magnetic field (EMF) exposure	Native fauna interaction with the proposed transmission lines is likely to be transient and, as such, risk of exposure to EMF is considered low. However, there is an increased risk of EMF exposure for some birds (eg White-bellied Sea-eagle) if they nest for prolonged periods on transmission line structures. Design measures would be considered to discourage birds from nesting on transmission line structures in accordance with the mitigation measures provided in Section 8.7.3. The EMF generated by the new transmission line may also impact bat activity by affecting echolocation capabilities or reducing insect densities. This sort of influence on bat behaviour may provoke avoidance behaviour and thus the transmission line may create a movement barrier.	In proximity to the transmission lines	Ongoing
Fauna collision, electrocution with transmission lines	Injury or mortality from transmission line collision, entanglement, or electrocution is a prescribed biodiversity impact. Refer to Table 8-17 for consideration of potential impacts and proposed mitigation measures.	In proximity to the transmission lines	Ongoing

8.5.3. Prescribed biodiversity impacts

Table 8-17 summarises the relevant prescribed biodiversity impacts associated with the operation of the project and the associated threatened species or TECs. Mitigation measures provided in Section 8.7.3 would help to manage potential prescribed biodiversity impacts.

Table 8-17 Assessment of prescribed biodiversity impacts during operation

Prescribed biodiversity impact	Description of feature characteristic and location	Relevant threatened species or TEC dependent on feature	Discussion
Impacts of development on habitat connectivity.	The project footprint consists of a mosaic of large areas of intact remnant vegetation, smaller remnants, and agricultural lands. Levels of connectivity vary within the project footprint as described in Section 8.3.1. Waterways throughout the project footprint would also provide connectivity between upstream and downstream habitats.	• Large-eared Pied Bat • Southern Myotis • Eastern False Pipistrelle • Broad-toothed Rat • Koala • Eastern Pygmy-possum • Long-nosed Potoroo (*Potorous tridactylus*) • Greater Glider • Yellow-bellied Glider • Yellow-bellied Glider population on the Bago Plateau (endangered population) • Squirrel Glider • Squirrel Glider in the Wagga Wagga Local Government Area (endangered population) • Flame Robin • Scarlet Robin • Varied Sitella • Pink-tailed Legless Lizard • Striped Legless Lizard	Installation of transmission lines and associated structures and vegetation clearing would reduce existing connectivity and increase habitat fragmentation. The impacts on connectivity and fragmentation would be permanent. However, they are likely to reduce over time as species acclimatise to the presence of the new transmission lines and associated structures. Impacts would vary depending on fauna species. Impacts on aerial species (eg bats) are expected to be minor as they have the ability to fly under, over and/or around the transmission lines and associated structures. Impacts on other species subject to open-space barriers from vegetation clearing would be localised in proximity to the project. However, any increased fragmentation may hinder the ability of some arboreal species (eg gliders and Koala) to traverse the landscape, which could reduce species dispersal and genetic exchange, and may indirectly increase predation risk for many species. As such, impacts on some arboreal species would be considered moderate. The retention of groundcover and shrub-layers within the transmission line easement would facilitate connectivity between patches of vegetation either side of the easement for small woodland bird species (eg Flame Robin). As such, impacts on woodland bird species are likely to be negligible. For reptile species with restricted dispersal ability, eg Pink-tailed Legless Lizard and Striped Legless Lizard, the reductions in habitat connectivity may effectively isolate individuals. The impacts on connectivity in some areas are likely to be permanent, ranging from minor to moderate. However, the impacts are likely to reduce over time as traffic and disturbance subside to operational levels, groundcover and understorey recover and species acclimatise. Mitigation measures provided in Section 8.7.3 would be implemented to minimise potential connectivity impacts.
		• Sloane's Froglet • Booroolong Frog • Yellow-spotted Tree Frog	Construction of access tracks across waterways may reduce connectivity along the length of the waterway. Reduced waterway connectivity may be permanent depending on whether the crossing is permanent or temporary. However, most amphibian species are highly mobile and would disperse to find other individuals and foraging resources. As such, impacts from reduced waterway connectivity are likely to be minor for amphibians.

Prescribed biodiversity impact	Description of feature characteristic and location	Relevant threatened species or TEC dependent on feature	Discussion
		• Coolac-Tumut Serpentinite Shrubby Woodland TEC • Monaro Tableland Cool Temperate Grassy Woodland TEC • Tableland Basalt Forest TEC	Increased fragmentation of TECs may result in loss of community composition, structure and function, and reduced viability of smaller remnants that remain following clearing. The impacts of fragmentation in some areas are likely to be permanent, ranging from minor to moderate. Mitigation measures provided in Section 8.7.3 would be implemented to minimise potential connectivity impacts.
Injury or mortality from transmission line collision, entanglement, or electrocution.	The project would install new transmission lines and associated structures throughout the length of the project footprint.	• Large Bent-winged Bat • Little Bent-winged Bat • Large-eared Pied Bat • Southern Myotis • Eastern False Pipistrelle • Grey-headed Flying-fox • Square-tailed Kite • Little Eagle • White-bellied Sea Eagle • Barking Owl • Masked Owl • Powerful Owl • Sooty Owl • Gang-gang Cockatoo • Glossy Black Cockatoo • Fork-tailed Swift • Sharp-tailed Sandpiper • Red-necked Stint • Latham's Snipe • Common Greenshank • Marsh Sandpiper	Potential impacts could occur along the length of the project footprint although they are more likely in areas supporting remnant vegetation. Risk of entanglement and electrocution as a result of the project is considered low due to the proposed spacing of transmission lines (ie 6 m apart). However, there is a risk that collision impacts could occur. The collision risk for bats would be higher near forest edges, during nightly foraging. For raptors, owls and cockatoos, the risk is likely to be higher in areas adjacent to intact vegetation, wetlands, and riverine habitats. Collision impacts may result in altered flight patterns or behaviour, injury or mortality. The risk of injury or mortality from transmission line collision would be permanent. However, they are likely to reduce over time as species acclimatise to the presence of the new transmission lines and associated structures. Fauna deterrent devices would also be installed in higher risk areas to deter species from nesting in the structures. As such, impacts are considered to be minor given likely habituation of fauna to the transmission lines and structures over time and use of fauna deterrent devices in higher risk areas to mitigate this potential impact.

8.5.4. Serious and irreversible impacts

As noted in Section 8.4.4, the majority of SAII impacts associated with the project are related to the removal of habitat during construction. However, some impacts on SAII entities could potentially occur during operation due to increased fragmentation and/or loss of habitat connectivity.

For TECs, the project may alter the current connectivity or increase fragmentation of the remaining areas of White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC and Tableland Basalt Forest TEC. This is due to the direct impacts of clearing (refer to Table 8-9) and potential long-term impacts on vegetation condition. For Coolac-Tumut Serpentinite Shrubby Woodland TEC and Monaro Tableland Cool Temperate Grassy Woodland TEC, the project is unlikely to alter the current connectivity or increase fragmentation of the remaining areas of these TECs due to the localised nature of the direct impacts of clearing.

For all threatened flora SAII entities listed in Table 8-14 and Table 8-15, habitat connectivity is expected to remain largely unaffected as a result of the project and it is not expected that the project would create a barrier to dispersal of the species.

Consistent with the discussion on connectivity impacts in Section 8.5.3, the project is also unlikely to impact connectivity for threatened fauna SAII entities listed in Table 8-14 and Table 8-15. Mitigation measures provided in Section 8.7.3 including the development and implementation of a Connectivity Strategy would be implemented to minimise potential connectivity impacts.

8.5.5. Impacts on aquatic species and habitats

Potential impacts on to aquatic species and habitats during operation would generally be limited to:

- changes to waterway geomorphology from waterway crossings for permanent access tracks
- water quality impacts from sedimentation or accidental spills of chemicals, fuels, hydrocarbons, and heavy metals.

The main impact on aquatic species and habitats from waterway crossings would occur during construction (refer to Section 8.4.5). However, permanent waterway crossings may further alter the flow and bank stability and consequently affect the geomorphology of the waterways. Notwithstanding, provided waterway crossings are constructed in accordance with the mitigation measures provided in Section 8.7.3, it is expected that any ongoing changes to waterway geomorphology during operation would be limited.

Water quality impacts associated with sedimentation or accidental spills have the potential to impact aquatic species and habitat features. However, with the implementation of the mitigation measures provided in Section 8.7.3, water quality impacts from operational activities would be minimised and adequately addressed.

Changes to waterway geomorphology and water quality impacts during operation are discussed in Chapter 17 (Surface water and groundwater quality).

8.5.6. Impacts on groundwater dependent ecosystems

Operation of the project is unlikely to pose a significant risk to GDEs. As discussed in Chapter 17 (Surface water and groundwater quality), the deep piles for the transmission line structures are unlikely to restrict groundwater flow paths in the long term. While the proposed or modified substations may impact groundwater recharge and levels, there are no GDEs near substation locations. In addition, potential

impacts on groundwater quality from maintenance activities are considered negligible where effective controls are implemented to guide the storage and management of chemicals, fuels, hydrocarbons, and heavy metals.

8.5.7. Key threatening processes

The majority of key threatening processes listed under the EPBC Act and BC Act that are considered relevant to construction of the project in Section 8.4.7 would also likely persist during operation, including those associated with clearing native vegetation and spread of diseases, weeds, and pest animals.

Operational impacts associated with these key threatening processes are considered in Section 8.5.1, Section 8.5.2 and Section 8.5.3. Mitigation measures provided in Section 8.7.3 would be implemented to minimise potential impacts.

Similarly for the key threatening processes listed under the FM Act, the processes identified as relevant to construction in Section 8.4.7 are likely to persist during operation. However, the scale of work associated with operation of the project compared to construction would be limited. Therefore, the extent of the impacts from relevant key threatening processes listed under the FM Act would be less than those for construction. Permanent waterway crossings and their potential to alter natural flow regimes are considered in Section 8.5.5. Mitigation measures provided in Section 8.7.3 would be implemented to minimise potential impacts.

Technical Report 1 – Biodiversity Development Assessment Report provides further details on the relevant key threatening processes listed under the EPBC Act, BC Act and FM Act.

8.6. Matters of national environmental significance

Relevant MNES were considered for the assessments carried out as part of *Technical Report 1 – Biodiversity Development Assessment Report* and in accordance with the supplementary SEARs (refer to Appendix A (SEARs compliance table)). Potential impacts for EPBC Act listed species and communities have been summarised in Section 8.4 and Section 8.5 as relevant.

Based on the potential impacts identified and extent or likelihood of presence, precautionary significance assessments were carried out in accordance with *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of Environment, 2013) for:

- two TECs
- 12 threatened flora species
- 23 threatened fauna species
- five threatened aquatic species
- 10 migratory species.

Sections 8.6.1 and 8.6.2 summarise the EPBC Act listed species and communities that are likely to be significantly impacted or have potential for significant impacts due to the project based on the indicative disturbance area. For some of the species and TECs nominated as potentially significantly impacted, this conclusion is made due to the requirement to take a precautionary approach where there is uncertainty eg incomplete survey coverage. Therefore, while there is a limited likelihood of significant impacts for many species, this means that the species has conservatively been assigned as having the potential for significant impacts (refer to Section 8.6.1). Conversely, a potential or likely significant impact conclusion for

some species is a more confident conclusion given known occurrences and impacts from the project (refer to Section 8.6.2).

Potential impact areas for EPBC Act listed species and communities may differ for some MNES compared to potential impact areas discussed in Section 8.4. The difference is due to the inclusion of Category 1 – exempt land (refer to Section 8.2.1) and habitats within some IBRA subregions not being considered due to a low likelihood of species occurrence. *Technical Report 1 – Biodiversity Development Assessment Report* provides further detail on how impact areas for MNES were calculated.

The project is unlikely to have a significant impact on EPBC Act listed threatened aquatic species.

Avoiding and minimising impacts on EPBC Act listed species and communities would be prioritised during detailed design and further construction planning to the greatest extent practicable. Section 8.7.3 details a number of mitigation measures that will be implemented during detailed design and construction of the project to avoid and minimise impacts on EPBC Act listed species and communities. Mitigation measures include but are not limited to micro-siting of the transmission line infrastructure and associated work sites, pre-clearing surveys, retention of habitat features, and establishment of biodiversity exclusion zones. A Biodiversity Management Plan (BMP) and Connectivity Strategy will also be developed and implemented to guide the management and evaluation of mitigation measures. Additional surveys are proposed during detailed design to identify further impact reduction opportunities and confirm assumed presence and the conservative approach to assessing MNES. Any residual impacts would be appropriately offset (refer to Section 8.7.5).

The additional surveys would inform the need for TEC or threatened species-specific management plans or additional site-specific mitigation measures to further avoid and minimise impacts on EPBC Act listed species and communities if a significant impact is confirmed. If required, the TEC or threatened species-specific management plans would be prepared with consideration of any relevant NSW or Commonwealth Government recovery plan for the community or species.

Technical Report 1 – Biodiversity Development Assessment Report provides the significance assessments for all EPBC Act listed species and communities and includes further details on the assessment and potential impact on MNES.

8.6.1. Potential significant impacts based on a precautionary approach

Table 8-19 includes EPBC Act listed species and communities which are considered to have potential to be significantly impacted. This includes species and communities with incomplete information to be able to exclude them from a potential significant impact conclusion despite a limited likelihood of actual significant impacts. This assumption is based on the following considerations:

- the species or communities were not found during field surveys of comparable habitat, however the survey coverage was incomplete or surveys were not conducted during the required season and the species is known from the region
- the species are known or likely to occur within the project footprint but are found in easily avoided habitats with a limited extent
- the species can use a wide range of habitats and are not restricted to the type being impacted which is not considered limiting/important habitat.

Following detailed design, a significant impact would depend on the species or community actually occurring, the extent of confirmed impact and inability to avoid the impact.

Table 8-18 EPBC Act listed species and communities with potential for significant impacts based on a precautionary approach

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
TECs			
Alpine Sphagnum Bogs and Associated Fens	E	Potential significant impact	The project could directly impact about 0.56 ha of Alpine Sphagnum Bogs and Associated Fens TEC from the Snowy Mountains IBRA subregion. This impact would equate to less than 0.007% of existing Alpine Sphagnum Bogs and Associated Fens TEC on a national scale. The project would impact two of the four remnant patches within the project footprint. If not avoided the project would adversely affect habitat critical to the TEC's survival and interfere with its recovery. However, the habitat appears in discrete locations that can be avoided during detailed design. All four patches would be expected to persist in a very high condition state following construction if avoided.
Threatened flora			
Austral Toadflax (*Thesium australe*)	V	Potential significant impact	Austral Toadflax was not recorded within the project footprint during targeted surveys, but it is considered to have a moderate likelihood of occurrence and there are 19 previous records within 20 km of the project footprint. The project could directly impact about 23.70 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 20% of suitable habitat within the project footprint.
Blue-tongued Greenhood (*Pterostylis oreophila*)	CE	Potential significant impact	Blue-tongued Greenhood was not recorded during targeted surveys, however it has the potential to occur in all areas of suitable habitat. The project could directly impact about 0.56 ha of potential habitat in the Snowy Mountains IBRA subregion. This impact would equate to about 19% of suitable habitat within the project footprint. Considering the direct impacts on suitable habitat, and the species' presence adjacent to the project footprint, the project has the potential to lead to a long-term decrease in Blue-tongued Greenhood populations if impacts cannot be avoided. However, this species' habitat appears in discrete locations in areas that can be readily identified and avoided during detailed design.
Bynoe's Wattle (*Acacia bynoeana*)	V	Potential significant impact	Bynoe's Wattle was not recorded during substantial targeted surveys within the project footprint. However, it is considered to have potential to occur within areas of suitable habitat that were unavailable for survey. The project could directly impact about 3.00 ha of potential habitat from the Bungonia and Crookwell IBRA subregions.
Cambage Kunzea (*Kunzea cambagei*)	V	Potential significant impact	Cambage Kunzea was not recorded during surveys, however it has a moderate likelihood of occurrence in all areas of suitable habitat. Targeted surveys were unable to be undertaken in areas of potential habitat due to seasonal and land access limitations. The project could directly impact about 12.34 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 17% of suitable habitat within the project footprint.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Cotoneaster Pomaderris (*Pomaderris cotoneaster*)	E	Potential significant impact	Cotoneaster Pomaderris was not recorded within the project footprint during targeted surveys containing suitable habitat, however its presence could not be excluded. It is considered to have a moderate likelihood of occurrence as there are 141 previous records within 20 kilometres of the project footprint. The project could directly impact about 11.70 ha of potential habitat in the Bungonia IBRA subregion. This impact would equate to about 18% of suitable habitat within the project footprint. Indirect impacts, eg edge effects, may also adversely affect its habitat if the species is present.
Swamp Everlasting (*Xerochrysum palustre*)	V	Potential significant impact	Targeted surveys recorded six Swamp Everlasting individuals within the project footprint, just outside of the western edge of predicted habitat as identified in the species SPRAT profile. These individuals and their associated habitat are assumed to comprise an important population. The project could directly impact about 1.50 ha of known and potential habitat in Snowy Mountains IBRA subregion. This impact would equate to about 8.6% of known and potential habitat within the project footprint. Considering the potential direct impacts on suitable habitat, and the species' presence within the project footprint, the project would be considered likely to lead to a long-term decrease in the species or a population of the species if it could not be avoided. However, this species' habitat appears in discrete locations in areas that can be readily identified and avoided during detailed design, therefore the potential for a significant impact to occur to this species as a result of the project has been considered on a precautionary basis.
Threatened fauna			
Pilotbird (*Pycnoptilus floccosus*)	V	Potential significant impact	Pilotbird was not recorded during targeted surveys but it is considered to have a high likelihood of occurrence in suitable habitat due to multiple records within 20 km of the project footprint. Given that 'important populations' are not defined in the conservation advice for this species, a precautionary approach has been taken. The project could directly impact about 130.50 ha of potential habitat in the Bondo, Inland Slopes and Snowy Mountains IBRA subregions. This impact would equate to about 0.01% of known habitat for this species nationally.
Regent Honeyeater (*Anthochaera phrygia*)	CE	Potential significant impact	Within the project footprint, the Regent Honeyeater has a moderate likelihood of occurrence as a nomadic forager in all IBRA subregions impacted by the project due to the presence of suitable myrtaceous and lerp foraging resources. The project footprint could result in the loss of about 149.34 ha of potential foraging habitat for the species, however this habitat is widespread across the species range. No breeding habitat or important mapped habitat would be impacted by the project. Identified potential foraging habitat is available in discrete patches along the project footprint and avoidance measures could minimise the minor impacts to foraging habitat.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Migratory species			
Fork-tailed Swift (*Apus pacificus*)	M	Potential significant impact	Fork-tailed Swift have been recorded in the project footprint in the Inland Slopes IBRA subregion. Field surveys identified one individual about 6.3 km from the project footprint within the Inland Slopes IBRA subregion. In line with the draft *Referral guideline for 14 birds listed migratory under the EPBC Act* (DoE, 2015), 100 birds per year would need to be impacted to require referral under the EPBC Act. Given that the disturbance area would likely comprise transient habitat for this highly mobile species, potential impacts have been considered on a precautionary basis. The project could potentially impact about 727.40 ha of non-breeding habitat from the Bondo and Inland Slopes IBRA subregions. Potential direct impacts include injury or mortality from collision with the new transmission lines, or during clearing and construction work.

Note:
1. EPBC Act conservation status listings: CE - critically endangered; E - endangered; V – vulnerable; M – migratory

8.6.2. Potential or likely significant impacts based on sufficient information

Table 8-19 includes EPBC Act listed species and communities which are potentially or likely to be significantly impacted by the project based on the indicative disturbance area and the information currently available.

Table 8-19 EPBC Act listed species and communities with likely or potential for significant impacts based on sufficient information

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
TECs			
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland	CE	Likely significant impact	The project could directly impact about 111.47 ha of White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC in the Bungonia, Crookwell, Murrumbateman and Inland Slopes IBRA subregions (refer to Table 8-9). This impact would equate to 0.03% of existing White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC on a national scale, and 0.04% of existing TEC in NSW. This TEC has been extensively cleared and is severely fragmented within the project footprint. The project would also likely result in further loss and fragmentation of TEC remnants within the project footprint.
Threatened flora			
Bago Leek Orchid (*Prasophyllum bagoense*)	CE	Potential significant impact	The project could directly impact about 31.90 ha of suitable habitat in the Snowy Mountains IBRA subregion. As discussed in Section 8.4.4, while the species was not recorded in the project footprint during field surveys, individuals were recorded 130 m west of the project footprint. As such, there is a high probability that undetected individuals occupy suitable habitats that would be impacted.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
			Considering the potential direct impacts on suitable habitat, and the species presence within the project footprint, the project has the potential to lead to a long-term decrease in the Bago Leek Orchid populations. Given the extent of potential direct impacts and likelihood of further indirect impacts, eg weed encroachment and altered hydrology, it is also likely the project could adversely affect habitat of the type considered critical to the species' survival.
Hoary Sunray (*Leucochrysum albicans var. tricolor*)	E	Potential significant impact	The project could directly impact Hoary Sunray and about 200.23 ha of suitable habitat across all six IBRA subregions affected by the project. The project is considered likely to lead to a long-term decrease in the species or a population of the species. This is due to the direct impacts on suitable habitat and its records within the project footprint. Given the extent of potential direct impacts and likelihood of further indirect impacts, eg edge effects, it is also likely the project could adversely affect habitat of the type considered critical to the species' survival.
Kelton's Leek Orchid (*Prasophyllum keltonii*)	CE	Potential significant impact	Kelton's Leek Orchid was not recorded during targeted surveys, however the species is known from the project footprint (refer to Section 8.4.4) and there is a high probability that undetected individuals occupy the suitable habitats that would be impacted by the project. The project could directly impact about 31.70 ha of suitable habitat in Snowy Mountains IBRA subregion. Considering the direct impacts on suitable habitat, and the species' presence within the project footprint, the project has the potential to lead to a long-term decrease in the Kelton's Leek Orchid populations. Additionally, given the extent of potential direct impacts and likelihood of further indirect impacts, eg weed encroachment and edge effects, it is also likely the project could adversely affect habitat of the type considered critical to the species' survival.
Yass Daisy (*Ammobium craspedioides*)	V	Potential significant impact	Seventy-seven clusters of Yass Daisy, representing 7,500 individuals, were recorded within or directly adjacent to the project footprint during targeted surveys. These records and suitable habitat are assumed to comprise an important population. The project could directly impact about 187.82 ha of suitable habitat in the Crookwell, Murrumbateman, Inland Slopes and Bondo IBRA subregions. This impact would equate to about 5.9% of suitable habitat within the project footprint. Considering the potential direct impacts on suitable habitat, and the species' presence within the project footprint, the project is considered likely to lead to a long-term decrease in the species or a population of the species.
Threatened fauna			
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	E	Potential significant impact	The project could result in the removal of about 423.78 ha of foraging habitat and potential breeding habitat across all six IBRA subregions affected by the project and has the potential to cause direct impacts on the species via injury or mortality during clearing and construction. Due to the likely removal of suitable nesting hollows, the project has the potential to disrupt the breeding cycle and reduce the area of occupancy for this species. Given the extent of impacts on foraging habitat and potential breeding habitat it is also likely the project would adversely affect habitat of the type considered critical to the species' survival.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	Potential significant impact	The project could directly impact about 42.29 ha of suitable habitat in the Bungonia and Inland Slopes IBRA subregions. This habitat consists of known (19.31 ha) and potential (22.98 ha) foraging and breeding habitat. Due to the likely removal of suitable nesting hollows, the project has the potential to lead to a long-term decrease in the size of the population, disrupt the breeding cycle, and reduce the area of occupancy for this species. Given the extent of impacts on foraging habitat and potential breeding habitat, it is also likely the project would adversely affect habitat of the type considered critical to the species' survival.
Greater Glider (*Petauroides volans*)	V	Potential significant impact	The project could directly impact about 109.25 ha of known habitat and 3.10 ha of potential habitat from the Bondo, Bungonia, Inland Slopes and Snowy Mountains IBRA subregions. Due to the likely removal of suitable tree hollows for this species and potential for the transmission line easement to create a partial movement barrier, the project may lead to a long-term decline in local populations and/or fragment an existing population into two or more populations. Given the extent of impacts on known and potential habitat, it is also likely the project would adversely affect habitat of the type considered critical to the species' survival.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	Potential significant impact	During surveys, no breeding or roosting habitat was observed. However, eight known Grey-headed Flying-fox camps occur within less than 20 km of the project footprint. An area of about 226.68 ha of potential foraging habitat for the Grey-headed Flying-fox could be impacted in the Bungonia, Crookwell, Inland Slopes and Murrumbateman IBRA subregions. Based on the reduction in foraging resources within 20 km of known camps and the increased risk of entanglement and collision with transmission lines (refer to Section 8.5.3), the project is likely to lead to the long-term decrease in the size of an important Grey-headed Flying-fox population. Additionally, given the scale of potential direct impacts on potential foraging habitat, the project would likely reduce an area in occupancy of an important population and adversely affect habitat of the type considered critical to the species' survival.
Golden Sun Moth (*Synemon plana*)	V	Potential significant impact	Golden Sun Moth was not recorded during targeted surveys, however it has a high likelihood of occurrence in suitable habitat within the project footprint. The project could directly impact about 38.63 ha of foraging and breeding habitat from Inland Slopes and Murrumbateman IBRA subregions. Based on the scale of potential direct impacts on foraging and breeding habitat, the project may reduce habitat connectivity between subpopulations of this species and lead to the long-term decrease in the size of the population.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Key's Matchstick Grasshopper (*Keyacris scurra*)	E	Potential significant impact	Four Key's Matchstick Grasshopper individuals were opportunistically recorded within the Murrumbateman IBRA subregion portion of the project footprint. The project could directly impact about 192.30 ha of known foraging and breeding habitat from Bungonia, Crookwell, Murrumbateman, and Inland Slopes IBRA subregions. This impact would equate to about 1.6% of known habitat for this species nationally. Given the scale of potential direct impacts on habitat used by the species for all stages of its life cycle, the project has the potential to disrupt the breeding cycle of the species and likely lead to a long-term decrease in the size of the population. Additionally, due to the direct impacts on habitat the project is also likely to adversely affect habitat of the type considered critical to the species' survival.
Koala (*Phascolarctos cinereus*)	E	Likely significant impact	Koalas were not recorded during field surveys but are considered likely to occur based on the high number of local records and the occurrence of Koala feed tree species. The project could directly impact about 418.40 ha of habitat across all six IBRA subregions affected by the project. This includes 19.40 ha of high potential foraging and shelter habitat in the Bungonia IBRA subregion, and 399.00 ha of moderate potential foraging and shelter habitat in the Bondo, Crookwell, Inland Slopes, Murrumbateman, and Snowy Mountains IBRA subregions. Given the scale of the project and the area of habitats impacted, it is considered that the project may fragment an existing population into two or more populations. In addition, due to the potential direct impacts on habitat the project is also likely to adversely affect habitat of the type considered critical to the species' survival.
Painted Honeyeater (*Grantiella picta*)	V	Potential significant impact	Painted Honeyeater was not recorded during targeted surveys, however it is considered to have a high likelihood of occurrence in suitable habitat. The project could directly impact about 85.10 ha of potential breeding and foraging habitat in the Inland Slopes IBRA subregion. Given the scale of potential direct impacts on potential breeding and foraging habitat, the project may reduce the area of occupancy for this species, and it is also likely that the project would adversely affect habitat of the type that may be critical to the species' survival.
Pink-tailed Legless Lizard (*Aprasia parapulchella*)	V	Likely significant impact	Pink-tailed Legless Lizard was recorded in the project footprint in the Murrumbateman, and Snowy Mountains IBRA subregions and has a high likelihood of occurrence in suitable habitat in Crookwell and Bungonia IBRA subregions due to nearby records. An area of about 57.40 ha of foraging and shelter habitat could be impacted by the project in the Murrumbateman, Crookwell, Bungonia, and Snowy Mountains IBRA subregions. This area consists of 40.10 ha of known habitat and 17.30 ha of potential habitat. Due to the potential direct impacts on foraging and shelter habitat and potential for individuals to be impacted during construction, the project is likely to disrupt the breeding cycle and lead to a long-term decrease in the size of the population within the project footprint and reduce its area occupancy. Given the above impacts, the project is also likely to adversely affect habitat of the type considered critical to the species' survival.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Spotted-tailed Quoll (*Dasyurus maculatus*)	E	Potential significant impact	Spotted-tailed Quoll was not recorded during field surveys but has high likelihood of occurrence in suitable habitat within Bondo, Inland Slopes and Snowy Mountains IBRA subregions and a moderate likelihood of occurrence in the remaining IBRA subregions. The project could directly impact about 414.15 ha of potential habitat across all six IBRA subregions affected by the project. Due to the potential for the project to remove a number of small patches of contiguous bushland, the project could fragment an existing population and therefore may disrupt the breeding cycle of this species.
Striped Legless Lizard (*Delma impar*)	V	Potential significant impact	Striped Legless Lizard was not recorded during targeted surveys but has a high likelihood of occurrence in suitable habitat due to nearby records. An area of about 124.90 ha of potential foraging and shelter habitat could be impacted by the project in the Inland Slopes and Murrumbateman IBRA subregions. The Striped Legless Lizard is likely to experience similar impacts to those detailed for Pink-tailed Legless Lizard.
Superb Parrot (*Polytelis swainsonii*)	V	Potential significant impact	Superb Parrot was recorded within the project footprint in the Murrumbateman and Inland Slopes IBRA subregions and has a moderate to high likelihood of occurrence in the project footprint in the Bondo and Crookwell IBRA subregions. The project could directly impact about 125.41 ha of known habitat and 18.21 ha of potential habitat in the Murrumbateman, Inland Slopes, Bondo and Crookwell IBRA subregions. Given the direct impact on known and potential habitat, which includes suitable foraging and potential nesting habitat (ie tree hollows), the project may potentially disrupt the breeding cycle for the species and lead to a long-term decrease in the size of population and area of occupancy. Additionally, the project would remove preferred foraging habitat and vegetation for the species within a Priority Management Area and the South-west Slopes Key Breeding Areas. As such, the project would adversely affect habitat of the type considered critical to the species' survival.
Swift Parrot (*Lathamus discolor*)	E	Potential significant impact	Swift Parrot has a high likelihood of occurrence in the project footprint in the Inland Slopes IBRA subregion and a moderate likelihood of occurrence for Bungonia and Murrumbateman IBRA subregions. The project footprint also intersects a Priority Management Area for the species under the NSW Save our Species program. The project could directly impact about 190.73 ha of potential foraging habitat in the Bungonia, Murrumbateman and Inland Slopes IBRA subregions. Given the potential direct impact on potential foraging habitat and impact on a Priority Management Area, the project may lead to a long-term decrease in the size of population and would likely adversely affect habitat of the type considered critical to the species' survival.

EPBC Act listed species and communities	EPBC Act conservation status[1]	Level of impact	Discussion
Yellow-bellied Glider (*Petaurus australis*)	V	Potential significant impact	Yellow-bellied Glider was recorded during targeted surveys in the project footprint in the Bondo, Inland Slopes and Snowy Mountains IBRA subregions and has a high likelihood occurrence in the Bungonia IBRA subregion. The project could directly impact about 167.96 ha of known habitat and 50.63 ha of potential habitat from the Bungonia, Bondo, Inland Slopes and Snowy Mountains IBRA subregions. Due to the scale of impacts on known and potential habitat, there is potential for the project to reduce the area of occupancy for this species and result in the long-term decrease of the population. Additionally, the transmission line easement may create a partial movement barrier for Yellow-bellied Glider which may fragment an existing population into two or more populations. Given the above, it is considered likely that the project would impact habitat of the type considered critical to the species' survival.
Migratory species			
Sharp-tailed Sandpiper (*Calidris acuminata*) Red-necked Stint (*Calidris ruficollis*) Latham's Snipe (*Gallinago hardwickii*) Common Greenshank (*Tringa nebularia*) Marsh Sandpiper (*Tringa stagnatilis*)	M	Potential significant impact	These migratory species have not been recorded in the project footprint, but the project has the potential to indirectly impact 54.98 ha of riparian habitat associated with these species in the Inland Slopes IBRA subregion. Potential direct impacts include injury or mortality from collision with the new transmission lines, or during clearing and construction.

Note:
1. EPBC Act conservation status listings: CE - critically endangered; E - endangered; V – vulnerable; M – migratory

8.7. Management of impacts

8.7.1. Environmental management

Environmental management of the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental Management). Environmental management strategies to mitigate and manage biodiversity impacts have been developed for detailed design, construction, and operation of the project.

During detailed design and construction planning, biodiversity impacts would be avoided where practicable with priority given to avoidance of recorded threatened species and their habitat. This would include, but would not be limited to, locating transmission line infrastructure and associated work sites and access tracks to avoid areas of biodiversity conservation significance wherever practicable. A Connectivity Strategy would also be developed during this phase to outline the final location of the proposed mitigation measures provided in Table 8-20. The Connectivity Strategy would identify the connectivity corridors required to facilitate fauna movement.

During construction of the project, a range of measures to minimise and manage impacts on biodiversity would be specified in the BMP prepared as part of the Construction Environmental Management Plan (CEMP). The BMP would include a process for implementing, evaluating and reporting on the effectiveness of all mitigation measures. The BMP would be complemented by the Connectivity Strategy and preparation and implementation of a Supplementary Hollow and Nest Strategy to offset loss of tree hollow fauna

habitat. In addition, a Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) would be implemented as part of the CEMP, which would assist in minimising and managing impacts on aquatic species and habitat and GDEs (refer to Chapter 17 (Surface water and groundwater quality) for further detail).

During operation, existing Transgrid guidelines and procedures for operation and maintenance will be implemented, in addition to the conditions of approval specific to any vegetation clearance or maintenance requirements. would be updated where required and implemented to address the vegetation clearing and maintenance mitigation measures provided in Table 8-20.

The mitigation and management measures proposed in Table 8-20 have been developed based on experience on other major transmission line projects similar in nature and location in addition to other linear infrastructure projects. Consideration has also been given government and industry policies, guidelines and procedures which have been proven to be effective.

To confirm the effectiveness of the mitigation measures in Table 8-20, compliance monitoring audits would be undertaken as detailed in Chapter 26 (Environmental management).

The estimated costs of the environmental mitigation measures provided in Table 8-20 are considered an integral component to the project and as a result have been captured in the project capital costs.

8.7.2. Avoidance and minimisation of impacts

The project has been developed through a comprehensive assessment of alternatives and options. This has included consideration of transmission line corridors, substation locations, ancillary facilities such as construction compounds and worker accommodation, and access tracks. Chapter 2 (Strategic context and project need) provides an overview of the alternatives and options considered with further detail included in Appendix E (Options Report).

The process for selecting the preferred option for the transmission line included several biodiversity related criteria to avoid and minimise impacts on biodiversity values. These included avoiding wilderness protection areas and, where possible minimising impacts on wetlands, ecological conservation areas (eg national parks and nature reserves), TECs and, more broadly, PCTs and waterway crossings greater than 800 metres. Biodiversity impacts have been minimised through design refinements such as, use of a double-circuit transmission line (which reduces the overall transmission line length from over 500 kilometres to 360 kilometres) and co-locating the transmission line route with existing areas of disturbance where possible. To further minimise biodiversity impacts, the transmission line route avoided the following areas:

- Kosciuszko National Park, Minjary National Park and Tarlo River National Park
- Mudjarn Nature Reserve, Bango Nature Reserve, Back Arm Nature Reserve and Burrinjuck Nature Reserve
- a biodiversity offset area south-east of Bango Nature Reserve.

The process for selecting the preferred option for the proposed Gugaa 500 kV substation and the construction compound locations also included several biodiversity related criteria to avoid and minimise impacts on biodiversity values. These included:

- avoiding wilderness protection areas
- minimising areas mapped as PCTs (especially TECs) and threatened species habitat
- minimising the need for vegetation clearing
- maximising the distance from waterbodies and waterways
- targeting areas which have previously been disturbed, or would require disturbance as part of the construction of the project
- using existing roads and access tracks
- avoiding natural drainage lines and low wetland areas where possible or, where unavoidable, minimising impacts on KFH and riparian vegetation.

The project has also adopted a partial clearing methodology for the management of the transmission line easement instead of full continuous clearance of the easement. This methodology would minimise direct impacts on native vegetation along the length of the transmission line route.

Detailed design and construction planning would continue to avoid and/or minimise impacts where practicable and in accordance with mitigation measures detailed in Table 8-20.

8.7.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to manage potential biodiversity impacts during the construction and operation of the project are discussed in Table 8-20.

The following chapters provide mitigation measures that would also help to mitigate potential biodiversity impacts associated with noise and dust:

- Chapter 15 (Noise and vibration)
- Chapter 21 (Air quality).

Table 8-20 Summary of biodiversity mitigation measures

Reference	Impact	Mitigation measure	Timing	Relevant location
Biodiversity				
B1	Biodiversity conservation significance	Impacts to matters of biodiversity conservation significance will be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the project. Micro-siting of the transmission line infrastructure and associated work sites and other areas of disturbance will occur to avoid or minimise impacts wherever practicable. Site features with the highest biodiversity conservation significance, in particular recorded threatened species, and their habitat, will be given the highest priority for impact avoidance. This will also include micro-siting to avoid or minimise prescribed impacts (as described in the BDAR) where possible (ie avoiding impact to rocky habitats or caves and waterways). Micro-siting of infrastructure requiring sub-surface work, such as transmission line structure footings, will be undertaken as part of the detailed design stage of the project, to minimise prescribed impacts where possible (ie avoiding impact to breeding habitat features, GDEs, aquatic habitats and supporting aquifers). Spatial data (refer to *Technical Report 1 - Biodiversity Development Assessment Report* for species polygons for species credit species) and buffered threatened species locations will be provided to the design and construction teams and considered in detailed design. Associated mapping will be included on sensitive area plans and provided to the construction workforce.	Detailed design and construction	All locations
B2	Biodiversity conservation	Where native vegetation disturbance activities are required in areas that have not been previously subject to biodiversity survey, additional survey will be carried out prior to work occurring in any such areas to inform detailed design. Priorities for additional survey will be based on potential conservation value (identified through vegetation and habitat mapping for threatened species), and geographic and landform/habitat coverage data gaps. Additional biodiversity survey will be conducted to assess the condition of vegetation where threatened species habitat has conservatively been assumed to be present. The surveys will be carried out by a suitably qualified ecologist and will allow for additional impact reduction opportunities.	Detailed design	All locations
B3	Hazard tree clearing	Opportunities for individually assessing and selectively clearing hazard trees will be considered further during detailed design to minimise impacts. Hazard tree inspections would be undertaken by an appropriately qualified arborist prior to the commencement of construction in accordance with Transgrid's Maintenance Plan – Easement and Access Tracks.	Detailed design and construction	Hazard tree zone

Reference	Impact	Mitigation measure	Timing	Relevant location
B4	Biodiversity conservation along access tracks	Existing tracks and clearings will be used, where possible, to limit the construction of new tracks. Where this is not possible, the design will seek to minimise impacts to native vegetation, including cut and fill. Design and micro-siting of new access tracks will seek to avoid or minimise impacts to habitat trees and rocky habitats (ie rock outcrops, large boulders, piled rock, and rock features that provide potential sheltering and breeding habitat for fauna, including threatened species). Access track corridors will be established with consideration to terrain to minimise cut/fill and vegetation clearing.	Detailed design and construction	All locations
B5	Biodiversity conservation within protected areas and conservation lands	Design and micro-siting of project infrastructure including transmission line structure benches and access tracks will avoid and/or minimise impacts within protected areas (ie nature refuges) and conservation lands (ie established BioBank and Biodiversity Stewardship sites and Conservation Agreement sites) occurring within the project footprint.	Detailed design	Conservation Agreement site situated adjacent to Bago State Forest or any established BioBank and Biodiversity Stewardship sites within the project footprint
B6	Booroolong Frog habitat	Where Booroolong Frog habitats have been identified the following avoidance measures will be implemented: • avoid installing waterway crossings • avoid disturbance within 50 m of the top of bank of the waterway (including riparian vegetation). Where avoidance is not possible: • Waterway crossing designs should avoid instream structures to minimise the potential for hydrological change, erosion and sedimentation impacts of downstream environments. • Location of waterway crossings will be determined in consultation with a suitably qualified Ecologist to avoid or minimise impacts to potential habitats or ecological features. • Develop site specific erosion and sedimentation control plans to ensure the potential for erosion and sedimentation impacts are minimized as far as practicable, including monitoring the success of erosion and sediment control measures. A suitably qualified ecologist will be engaged to undertake monitoring surveys for the species at the crossing site and in downstream receiving environments, in accordance with the Biodiversity Management Plan (BMP) and in consultation with the BCD.	Detailed design and construction	Leech Gully (and associated first and second order tributaries), Gilmore Creek and Adjungbilly Creek

Reference	Impact	Mitigation measure	Timing	Relevant location
B7	Surface water, soils and groundwater	The key measures proposed to avoid, manage and/or mitigate impacts to surface water, and groundwater and soils will involve: • Preparation of Soil and Water Management Plans (SWMPs) as part of the Construction Environmental Management Plan (CEMP) to manage water quality impacts during construction of the project. • Preparation of Erosion and Sediment Control Plans (ESCPs) by a certified professional in erosion and sediment control and Water Quality Monitoring Program (WQMP) within the SWMPs. • Consideration of appropriately designed scour protection at new stormwater management points. The SWMP will include a combination of the following plans: • ESCPs • WQMP • Excavation Dewatering Plans • Emergency Spill Plans • Unexpected Contaminants Finds Protocol. ESCPs will be developed for the activities and areas that are considered higher risk. The plans will detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volumes 2A (DECC, 2008a) and Volume 2C (DECC, 2008b), commonly referred to as the 'Blue Book' • Best Practice Erosion and Sediment Control (IECA, 2008) • Guidelines for Controlled Activities on Waterfront Land (NRAR 2018).	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
B8	Riparian corridors	To the greatest extent practicable: • Transmission line structures will be located and constructed to minimise impact to vegetated riparian zones (VRZs) • The final transmission line easement will target narrow crossing points of waterways and riparian areas clear of vegetation. Shrub or ground stratum native vegetation within vegetated riparian zones will be protected to the greatest extent practicable, with vegetation clearing ideally limited to the tree stratum only, with trunk bases being retained in-situ. Where threatened species are known to occur, work methods will avoid or minimise impacts by limiting clearing wherever possible and delineating their habitat outside the final disturbance area as no-go zones. Work near waterways will be undertaken to avoid impacts such as herbicide drift/overspray, erosion and damage to the banks. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated.	Detailed design and construction	Transmission line corridor - within riparian corridors
B9	Waterway crossing (access tracks)	The following factors will be considered during the detailed design and micro siting process for waterway crossings to minimise potential impacts to aquatic environments, wherever practicable: • Any existing crossings will be re-used or upgraded in preference to establishing new crossings. • Disturbance to waterways (bed, banks and associated riparian zones), will be avoided or minimised. • The crossing design and construction work sites will minimise disturbance to any native vegetation, including native instream, fringing, and riparian vegetation within the access track alignment. • Waterway crossings will be constructed perpendicular to the flow of the water and be positioned away from channel bends (where erosive forces are typically greatest). Preferably crossings will be located in straight stream sections with well-defined channel geometries and shallow stream gradients, in stable dry reaches. • Micro-siting will avoid direct and indirect (erosion or sedimentation) impacts to riverine features such as riffles and rapids and sensitive habitat features (ie snags, coarse woody debris, instream macrophytes, boulders). • Where instream structures are required, considerations to potential flooding and erosive effects will be made in the design and construction of the crossing.	Detailed design and construction	Transmission line corridor - access track waterway crossing

Reference	Impact	Mitigation measure	Timing	Relevant location
B10	Waterway crossing (access tracks)	Crossing structures will be designed so that the existing nominal flow velocity, low flow conditions and fish passage are maintained wherever possible. This will include the following considerations: • Minimise the impact of essential instream structures by mimicking natural flows (DPI, 2005b). • Following Fairfull (2013), for waterway crossings incorporating culverts, a minimum of 300 mm of water should pool through the structure, with a centrally placed low-flow cell being preferable. • In line with Cotterell (1998), it is recommended that flow over or through instream crossing structures are designed such that they maintain water velocity of 0.3 m/s or less, which is likely to facilitate passage for native species of fish (velocities exceeding 1 m/s, are likely to prevent upstream migration of native fish).	Detailed design	Transmission line corridor - access track waterway crossing
B11	Waterway crossing (access tracks)	Any sections of stream or waterway banks that are impacted or modified by the project will be reformed or remediated to resemble the pre-work condition and form wherever possible or alternatively to a stable design form, as appropriate following the completion of construction work. This may include revegetation to stabilise bank sediments. Waterway banks impacted by the project will be reinstated such that bank stability at the crossing location is the same or better than prior to construction. Stabilising materials such as rock armouring, hydro mulch, jute matting, or other suitable geotextile materials may be utilised where necessary. Any temporary stream crossings will be removed and rehabilitated at the completion of their operational use.	Construction and operation	Transmission line corridor -access track waterway crossing
B12	Waterway crossing (access tracks)	The need for and location of waterway crossings at identified locations (V9-14 - Derringullen Creek, V9-28 - Gilmore Creek, as well as V9-13 - Yellow Creek and V9-12) will be confirmed during detailed design by the construction contractors. This may include consultation with DPI Fisheries. Crossing design would preference a single span bridge structure at Derringullen Creek and Gilmore Creek (aligning with the recommended crossing types identified by NSW DPI Fisheries for CLASS 1 streams).	Detailed design and construction	V9-14 - Derringullen Creek, V9-28 - Gilmore Creek, V9-13 - Yellow Creek, V9-12 - unnamed stream
B13	Waterway crossing (access tracks)	In the event that any further or alternative waterway crossings are required in areas mapped as Key Fish Habitat (KFH) or indicative threatened species distribution mapping (DPI 2022a), an aquatic ecological assessment will be undertaken at the proposed crossing location. The assessment approach will be consistent with that used for the EIS and will address any potential impacts to threatened aquatic species or KFH. This assessment may be desktop based if suitable levels of information are available but may also recommend a field inspection if threatened aquatic species or sensitive aquatic habitat features are considered to have a moderate or higher likelihood of occurring, in order to guide micro-siting and design/mitigation measures to minimise impacts to aquatic environments.	Detailed design and construction	Access track waterway crossing

Reference	Impact	Mitigation measure	Timing	Relevant location
B14	Waterway crossing (access tracks)	In addition to standard erosion and sediment control measures, the following procedures and considerations will be incorporated into construction methodologies for waterway crossings, where appropriate and practicable: • Minimise disturbance to native vegetation, including instream, fringing and riparian vegetation within the indicative disturbance area. This may include the demarcation of areas of native vegetation to be retained during work. • Any coarse woody debris or boulders located within instream work sites will be temporarily relocated during construction and then returned to the watercourse, at locations where scour risk can be avoided. • Waterway crossing work will be constructed during no or low flow conditions and under calm weather conditions. Work will also be timed to occur outside of any locally high seasonal flow periods. • Silt curtains or coffer dams will be deployed around instream work sites where required, to protect against any impacts to water quality or indirect impacts to retained vegetation. These measures will be situated so to avoid blocking fish passage wherever practical and removed as soon as they are no longer required. • Flow diversion measures will be installed on bunded waterway crossings as appropriate or where construction during no or low flow conditions is not feasible. Flow diversion measures may include pumps to ensure that water can be moved from one side of blockages to the other, with screened inlets to prevent the entrapment of aquatic fauna and outlet structures that are designed to avoid scouring of the channel. Where waterways are bunded or flow obstructed, all obstructions to flow will need to be removed as soon as practical after watercourse crossing construction has been completed. • Appropriate erosion and sediment controls that take into account the potentially flood prone nature of the land will be employed to protect against any impacts to water quality or indirect impacts to retained vegetation. • Waterway bed and bank material excavated during construction will be stockpiled outside of the active channel and avoid riparian vegetation. Any material excavated from the bed of waterways will be stockpiled separately from other materials and returned to the waterway bed following the completion of construction work. • If the stockpiling of sediment or soil is required, it will be located as far away from waterways as practicable and managed so that it is secure against flooding and runoff to prevent any sediment entering waterways. Adequate erosion and sediment control measures will be in place to protect stockpiled sediment against runoff during rainfall or flooding.	Construction	Transmission line corridor -access track waterway crossing

Reference	Impact	Mitigation measure	Timing	Relevant location
		• Only excavated natural materials (ENM) or virgin excavated natural materials (VENM) will be used as fill during reclamation work, ie no contaminated material, building or demolition rubble will be used as fill in any stream crossings. • Chemicals will be stored in adequate bunding (in accordance with Australia Standard 1940 – The storage and handling of flammable and combustible liquids) as far away from streams as practicable and appropriately protected against flooding or runoff. Spill kits will be made available, and a spill response plan developed. • Plant refuelling will occur as far away from streams as possible and appropriate spill prevention measures (such as diversion bunds/cut off drains upslope and drip trays and spill kits) will be implemented when refuelling.		
B15	Waterway crossing and access tracks	Regular monitoring/inspections of waterway crossing and access track conditions will be undertaken during operation. Consideration of the maintenance and inspection recommendations detailed in *Fish passage in streams: Fisheries guidelines for design of stream crossings* (Cotterell 1998) to inform the monitoring/inspection details are recommended. This may include monitoring/inspections following random events, eg flooding. This will review: • the crossing structures, access tracks and associated erosion and sediment control measures to determine if they are continuing to operate satisfactorily • any maintenance requirements in order to prevent impacts to aquatic environments • any issues that require intervention or rehabilitation eg bank erosion as a result of, or in proximity to, crossing locations.	Operation	Transmission line corridor -access track waterway crossing
B16	Connectivity strategy	As a part of the BMP, a Connectivity Strategy will be developed following design refinement and pre clearing. The core objectives of the strategy will be to outline the final location of the proposed mitigation measures identified within the BDAR. The Connectivity Strategy will be implemented to maintain connectivity in areas identified as facilitating fauna movement (as identified in *Technical Report 1 - Biodiversity Development Assessment Report*). Consideration of connectivity corridors will occur as a minimum at: • Key riparian crossings • Areas of the transmission line joining proposed biodiversity stewardship sites (ie Donna Valley Biodiversity Stewardship Site) and or conservation reserve estate (ie Tarlo River National Park, Bango Nature Reserve, Mudjarn Nature Reserve and Minjary National Park) • Transmission line structure locations that occur in woodland vegetation at strategic locations (ie vegetation corridors with moderate to high landscape connectivity, and with moderate to high levels of fauna activity/ movement).	Detailed design and construction	Transmission line corridor at strategic locations (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Figure 13-15*)

Reference	Impact	Mitigation measure	Timing	Relevant location
		The final locations of connectivity corridors and minimum width requirements will be identified as part of a Connectivity Strategy developed in consultation with BCD (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Figure 13-15*). Access tracks will avoid connectivity corridors and favour existing access wherever possible. Construction will avoid and minimise any disturbance of connectivity corridors, where practicable. Connectivity measures such as fauna sensitive structures (ie under transmission glider poles), vegetation stepping stones, or reduced clearing will be considered in at least six locations within the project footprint, where gliders have been observed using the area.		
B17	Bird-strike	As a part of the BMP, conductor line-marking techniques will be considered at specific locations identified in the BDAR during design refinement to minimise bird strike. Use of fauna deterrent devices, most likely consisting of the "flapper" variety, will be considered. Positioning and exact diverter model will also be considered during detailed design and will be developed as part of the Connectivity Strategy. At a minimum, these will be used at sites recommended for specific corridors (refer to *Technical Report 1 - Biodiversity Development Assessment Report*) where flapper devices are considered warranted based on distribution, and nature of avifauna records, and nearby suitable waterbird habitat (within 1 km).	Detailed design	Transmission line corridor – at sites recommended for specific corridors (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Attachment 21*)
B18	Biodiversity management	A BMP will be prepared in consultation with BCD and approved by DPE prior to construction. The BMP will be prepared by a qualified ecologist and include a plan for implementing, evaluating and reporting on the effectiveness of all mitigation measures outlined in the BDAR, including: • Measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna • Preparation of a fauna handling and rescue procedure to be implemented during construction and operation for the ethical handling of injured or displaced fauna. Further, the fauna handling and rescue procedure would include an incident reporting protocol for fauna relocations, rescue and rehabilitation, euthanasia and/or fatality. • Procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas and weed management • Vegetation clearing procedures for a two staged habitat removal process required for removal of key habitat features (hollow-bearing trees, habitat trees, and bushrock) identified in the BDAR and/or pre-clearing inspection. Including procedures to record the effort and outcomes of the habitat removal process • Measures to protect retained vegetation	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
		• Measures to avoid and minimise impacts to Golden Sun Moth, Striped Legless Lizard and Pink-tailed Legless Lizard habitats within transmission line easements during construction and operation • A rehabilitation plan for Golden Sun Moth habitat temporarily disturbed during construction incorporating seeding without the use of fertiliser or clover. The plan would include a suitable mix of native C3 grasses including Wallaby grasses *Rytidosperma spp*. and Speargrasses *Austrostipa bigeniculata, A.scabra* and a low biomass dryland C4 grass (ie Redleg grass Bothriochloa macra). A temporary nurse crop such as sterile ryecorn could be used to stabilise the soil and suppress weeds during establishment. Planting specifications and requirements for post-care, including weed control, are to be outlined in the plan. • Retention of habitat features such as rocky outcrops, surface rock, logs, wherever practicable • Habitat supplementation measures such as nest boxes, hollow re-use / creation, re-use of timber/logs as habitat within the transmission line easement where practicable. A monitoring program will also be developed to assess the efficacy of supplementary habitat measures on an ongoing basis in accordance with a Supplementary Hollow and Nest Strategy • Proposed rehabilitation of temporary disturbance areas including management and maintenance measures • Unexpected species finds protocol to be implemented if threatened ecological communities, flora and fauna species, not assessed in the BDAR, are encountered during pre-clearing inspections • A description of biosecurity protocols for plant and equipment movement between sites, including species specific measures • Education of construction teams regarding the presence of native fauna and risks of vehicle collision, particularly early in the morning and late in the afternoon/at night; implementation of speed limits on sealed and unsealed tracks and roads • Outline monitoring and compliance management requirements • Approach to relocation of nests by suitably qualified ecologist where found within construction work sites (i.e. nests found in hazardous areas will be translocated to nearby safe areas, direct handling of eggs and chicks will be avoided where possible). This could include potentially new poles/nest platforms • Details on the pre-clearing and clearing supervision process • Approach to avoid building during raptor nesting periods • Site specific monitoring of Booroolong Frog habitats within and adjacent to proposed work locations to inform appropriate construction controls and contingency measures.		

Reference	Impact	Mitigation measure	Timing	Relevant location
		This plan will also the guide the re-use of hollows, logs, limbs and other habitat features encountered during clearing to be retained for placement within adjacent vegetation or on the maintained easement within shrub retention areas, in accordance with the revegetation plan. The BMP will include a program to monitor, evaluate and report on the outcomes of a biodiversity monitoring program, as relevant. The monitoring program will be developed to target specific species considered to be most at risk of significant impacts, as determined during the detailed design phase. The BMP will stipulate objectives for monitoring, and how baseline data will be captured and represented.		
B19	Biosecurity and hygiene protocols	A Biosecurity Management Plan will be developed as a part of the BMP, to be implemented during construction. The plan will include: • Protocols for the identification of priority weed species, relevant pests and diseases of concern, mandatory reporting obligations and management of Emergency, Control and Biosecurity zones as per the NSW *Biosecurity Act 2015*. • Weed and pest animal management and monitoring requirements would also be outlined within the plan where relevant. • Locations, timing and methods for removing soil and plant matter from vehicles and machinery and sourcing clean soil and materials free of contaminants for construction work. Clean down stations (water or air, dependent on the identified biosecurity risk) will be constructed at suitable locations to clean down vehicles and employee shoes to stop the spread of weeds, pathogens (eg amphibian chytrid fungus, Phytophthora cinnamomic, exotic rust fungi and Epizootic Haematopoietic Necrosis Virus (EHNV)) and the introduction of new species. The biosecurity plan would address any Property Management Plan requirements where relevant.	Detailed design and construction	All locations
B20	Weed management	Weed control strategy during the operational stage of the project will be guided by existing Transgrid operational weed management procedures. During maintenance activities, general biosecurity duty obligations will be implemented as per existing Transgrid procedures. Biosecurity risks within the works footprint, such as weeds, would also be assessed and control measures implemented, as required, to manage existing or emerging issues.	Operation	All locations, as relevant
B21	Alternative roosting and/or nesting habitat for threatened fauna	Nest boxes will be provided for alternative roosting and/or nesting habitat for threatened fauna displaced during clearing in accordance with a Supplementary Hollow and Nest Strategy. The strategy will include the following requirements: • survey of tree hollows and nests within the proposed clearing extents • identify the size, type, number and location of nest boxes required based on the results of the ecological surveys and active hollow resources in adjacent areas	Construction	All locations where hollow bearing trees are being removed

Reference	Impact	Mitigation measure	Timing	Relevant location
		• appropriately sized nest boxes will be installed within the vicinity of hollow-bearing trees (subject to landowner agreement and suitable trees being present) no more than two weeks prior to clearing of the tree • nest boxes will also include the re-use of existing hollows salvaged prior to or during clearing where practicable measures to address and manage nests (such as raptor nests) prior to clearing.		
B22	Pre-clearing survey	Pre-clearing surveys will be completed prior to clearing at each location by a suitability qualified and experienced ecologist. The proposed clearing extents will be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist will: • survey the proposed clearing extent • identify any fauna that will require relocation prior to clearing • confirm the location and mark out the extents of any biodiversity exclusion zones • confirm that hollow-bearing trees within and adjacent to the clearing extents are prominently marked/tagged • confirm that nest boxes are in place (where required) in suitable locations adjacent to areas to be cleared, or suitable locations for installation have been identified • survey and confirm the presence of raptor nests within and adjacent to the clearing extents • document, mark and record the location of threatened flora/fauna • document, mark and record other habitat features (eg rock piles) to be retained if possible. The results of the pre-clearing surveys will be used to update and confirm the accuracy of sensitive area maps.	Detailed design and construction	Transmission line corridor (at relevant sites)
B23	Biodiversity exclusion zones	Biodiversity exclusion zones for retained vegetation and threatened species habitats will be confirmed by a suitably qualified ecologist and identified as 'No disturbance' zones prior to the commencement of clearing or any site activity that could damage the vegetation within the exclusion zone. These areas will be identified as a no-go zone within approved plans and on-site demarcation will be required. High visibility protection fencing will be erected on site including signage clearly identifying these areas as no-go zones. Requirements for the protection and management of no-go zones will be addressed as a part of the site induction. Biodiversity exclusion zones will be physically marked and demarcated, and included on sensitive area maps and project GIS/GPS systems, prior to clearing. Further information regarding priorities for biodiversity exclusion zones are detailed in *Technical Report 1 - Biodiversity Development Assessment Report*.	Detailed design and construction	Transmission line easement (at relevant sites)

Reference	Impact	Mitigation measure	Timing	Relevant location
B24	Biodiversity management training	All relevant project personnel involved in vegetation clearance, including relevant sub-contractors will be trained on biodiversity management protocols and the requirements for the project, through inductions, toolbox talks and targeted training, and provided with sensitive area maps (showing clearing boundaries and exclusion zones) and updates as required.	Construction	All locations
B25	Features of high biodiversity conservation significance	Features of high biodiversity conservation significance within the operational easement, including biodiversity exclusion zones identified during construction and retained habitat for threatened species, will be recorded in Transgrid's GIS. The GIS information will be reviewed during the planning of all maintenance or other future activities that could cause disturbance.	Construction and operation	All locations, as relevant
B26	Vegetation clearing and maintenance	Update and implement existing procedures and guidelines for operation and maintenance of the project that address the following: • vegetation clearing and maintenance commitments in the BDAR and EIS • avoiding access and disturbance in biodiversity exclusion zones identified during the construction • avoiding access and disturbance in areas of high biodiversity conservation significance • avoiding maintenance of vegetation that does not need to be maintained during operation. Provide training to relevant Transgrid operational workers and vegetation maintenance contractors regarding the operational and maintenance guidelines and procedures.	Operation	All locations
B27	Revegetation of disturbed areas	All disturbed lands/areas must be managed throughout the construction work (in accordance with the relevant Managing Urban Stormwater (Landcom, 2004) (Blue Book) or comparable best practice guidelines, including: • vegetation removal, restoration, and management • stockpiling, erosion and sediment management • stabilisation / rehabilitation of disturbed lands/areas must be undertaken within suitable timeframes • temporary erosion and sediment controls must be maintained (and not removed) until rehabilitation measures are providing effective stabilisation of disturbed lands/areas. Disturbed areas (including areas not required for operation) will be stabilised/rehabilitated to a standard either: • as agreed with the landowner • in accordance with the relevant Managing Urban Stormwater (Blue Book) or comparable best practice guidelines.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
B28	Vegetation clearing	Works for clearing and construction of access tracks will be carried out in such a manner that the least practicable disturbance to actual ground cover and contours is caused. Trees will be removed as close as possible to ground level and root balls will be left in situ wherever practicable. Areas of particular focus for minimising ground disturbance include the following: • Steep or Highly Erodible lands where slopes are in excess of 18 degrees from the horizontal. • Protected Riparian Land (PRL) defined as land within 20 m of the bed or bank of a prescribed stream. Generally, named watercourses are classed as protected riparian land; however, some unnamed watercourses may be classed as protected riparian land. • Waterfront land (40 m from the top of bank) • In areas where large rock outcrops are prevalent on the easement. Hazard trees identified from the LiDAR assessment will be flagged for removal, and any adjacent and important habitat trees and features identified for retention will be clearly marked and included in maps within the CEMP to avoid disturbance during the felling activities.	Construction	Transmission line corridor - Protected Lands or waterfront land
B29	Re-use of felled timber	Logs and tree hollows that could provide fauna habitat (the total length of wood at least 10 cm in diameter and at least 0.5 m long) will be relocated to adjacent woodland and/or suitable woodland locations where available/feasible. The opportunity to stockpile and supply felled trees for KFH rehabilitation or improvement work will be discussed with DPI Fisheries. Trees within the boundaries of State forests, Crown Lands, Travelling Stock Reserves, public roads or within 40 m of the bank of any river will be disposed of strictly in accordance with the requirements of the appropriate authorities. These requirements will be determined by the contractors before carrying out such work.	Construction	Transmission line corridor
B30	Access track construction	Access tracks will be used as necessary for the construction work and as far as is practicable, vehicle traffic shall be confined to these tracks. Track construction will be carried out to cause minimum disturbance to soil and vegetation both on and adjacent to the track. Tracks will be routed to follow the natural contour of the land as far as practicable to minimise the amount of cut and fill and soil disturbance. For any temporary access tracks, the disturbed surfaces and formed areas will be revegetated in accordance with the approved CEMP or *Managing Urban Stormwater: Soils and Construction - Volume 2C Unsealed Roads* (DECC, 2008a). In addition, other erosion control mechanisms will be put in place during the initial track construction work to contain any sediment that may erode from the disturbed surfaces.	Construction	Access tracks

Reference	Impact	Mitigation measure	Timing	Relevant location
B31	Light	Directional lighting will be used for any permanent lighting required (ie substation) to minimise light spill as much as possible in accordance with *Australian standard AS4282:2019*. Artificial lighting required during construction will be directed towards the work site and minimise light spill, to the extent practicable.	Detailed design and construction	All locations
B32	SAII entities	Impacts to SAII entities are to be addressed through the following measures: • Additional surveys scheduled for completion in spring 2023 to confirm presence/absence within habitat areas where species presence is assumed. • Route refinement and design avoidance during the detailed design to avoid and minimise impacts wherever practicable. Design refinements have been identified and will be incorporated into the project design where practicable to avoid impacts to the following four SAII entities: • *Glycine latrobeana* • *Diuris ochroma* • *Prasophyllum innubum* • *Pterostylis oreophila.*	Detailed design	All locations

8.7.4. Managing residual impacts or uncertainties

Residual biodiversity impacts would be offset in accordance with BAM calculations for both ecosystem and species credits and through implementation of the Biodiversity Offset Strategy for the project (refer to Section 8.7.5). BAM calculations carried out for *Technical Report 1 – Biodiversity Development Assessment Report* are based on the indicative disturbance area and is subject to ongoing refinement as part of detailed design and future construction planning which would enable confirmation of the final offset requirements.

Uncertainties and information gaps associated with the biodiversity assessment have been managed throughout the development of *Technical Report 1 – Biodiversity Development Assessment Report*, which has included, but is not limited to:

- using Light Detection and Ranging (LiDAR) survey incorporating high resolution aerial imagery to support vegetation and habitat mapping, vegetation height modelling and the development of avoidance strategies
- surveying lands that could not be directly accessed from adjacent public roads, existing transmission line easements and accessible private property
- assuming candidate species presence in inaccessible lands where potential habitat has been mapped
- taking into account sub-optimal weather conditions experienced during surveys and seasonality when making decisions around candidate species presence and absence
- adopting a conservative approach where assessment in accordance appropriate survey guidelines was not possible due to scale of the project, access, and timing constraints, such as assuming species presence or engaging a species expert
- applying the *Guideline for applying the Biodiversity Assessment Method at severely burnt sites* (DPIE, 2020d) to address the impact of the Dunns Road bushfire (refer to Section 8.3.9)
- consulting BCD including species-specific workshops, discussion of issues relating to mapping and analysis and presentation of datasets for review and comment.

Mitigation measures have been developed to further manage limitations associated with land access. This includes additional biodiversity surveys in areas that were not previously accessible and where impacts have been conservatively assessed.

8.7.5. Offsetting biodiversity impacts

8.7.5.1. Offset requirements

In accordance with the BAM, offset requirements are necessary to address any residual biodiversity impacts associated with the project. BAM calculations for both ecosystem and species credits have been determined by using the Biodiversity Assessment Method Credit Calculator (version 1.3.0.00) and includes:

- 10,997 ecosystem credits
- 134,578 species credits.

The offset requirements are based on the indicative disturbance area and include 17 species that were recorded during surveys for the biodiversity assessment and 78 species that were assumed present.

As the project would not result in a net loss of KFH, or significant impacts on threatened aquatic species, offsets for aquatic species and key fish habitats are not proposed under the FM Act.

As detailed in Section 8.6, the project has the potential for significant impacts on several MNES. Offsets are only required for significant residual impacts on MNES, once all measures to avoid, minimise and

mitigate impacts have been considered. As the project is subject to the assessment bilateral agreement between the Commonwealth of Australia and the State of NSW, the Biodiversity Offset Strategy can be used to assess and meet offsets for significant impacts on MNES. As such, the offset required for significant residual impacts on MNES are included in the ecosystem and species credits detailed above. Any significant residual impacts on MNES not addressed under the BOS would be addressed in accordance with the *EPBC Act Environmental Offsets Policy* (*Department of Sustainability, Environment, Water, Population and Communities*, 2012).

Technical Report 1 – Biodiversity Development Assessment Report provides further detail on the offset requirements for the project.

8.7.5.2. Biodiversity Offset Strategy

If refinements to the project design and construction methodology result in changes to biodiversity impacts, these will be assessed in accordance with the requirements of the BAM (DPIE, 2020a) by an accredited assessor. Actual clearing requirements will be compared with those documented within the *Technical Report 1 – Biodiversity Development Assessment Report* and offset obligations will be recalculated following completion of construction.

The final offset requirements would be met by implementing the Biodiversity Offset Strategy for the project. The strategy proposes a combination of the following offset delivery options, in order of preference:

- establishing Biodiversity Stewardship Site(s) on lands with like-for-like biodiversity values to those impacted by the project
- purchasing and retiring existing biodiversity credits currently available on the biodiversity credit register or via the Biodiversity Credits Supply Fund and Taskforce
- making a payment into the Biodiversity Conservation Fund for residual credits not sourced from the preferred approach to established Biodiversity Stewardship Agreements.

Technical Report 1 – Biodiversity Development Assessment Report provides further detail on the Biodiversity Offset Strategy for the project.

9. Aboriginal heritage

This chapter provides a detailed summary of the assessment of potential Aboriginal heritage impacts of the project. The full assessment is provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* (Navin Officer Heritage Consultants (NOHC), 2023a).

During the development of HumeLink and the preparation of the EIS, including the Aboriginal heritage assessment, Transgrid has undertaken extensive consultation with community and stakeholders. Engagement included consultation with Heritage NSW, relevant Local Aboriginal Land Councils (LALC), relevant councils, relevant Local Land Services (LLS) and Registered Aboriginal Parties (RAP) on matters such as survey coverage, survey methodology, test excavation methodology and field work since early 2020. The summary of consultation undertaken for Aboriginal heritage is detailed Chapter 6 (Engagement) and *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*. Transgrid will continue to engage with community and stakeholders on Aboriginal heritage through the detailed design, construction and operation of HumeLink.

9.1. Environmental Assessment Requirements

9.1.1. Secretary's Environmental Assessment Requirements

Table 9-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to Aboriginal heritage impacts of the project and where these requirements are addressed in this EIS. Table 9-2 outlines the Supplementary SEARs that provide relevant Commonwealth assessment requirements to address Aboriginal heritage impacts of the project.

Table 9-1 Secretary's Environmental Assessment Requirements – Aboriginal heritage

Reference	SEARs	Where principally addressed in the EIS
Heritage		
Key issues	The EIS must address the following matters: • an assessment of the impact to Aboriginal cultural heritage items (cultural and archaeological) in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) including results of archaeological test excavations (if required);	Sections 9.4 and 9.5 provide an assessment of Aboriginal heritage impacts during construction and operation respectively. Section 9.3.3.3 includes results of archaeological test excavations. Additional detail is also provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.
	• evidence of consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures), having regard to the *Aboriginal Cultural Heritage Consultation Requirements for Proponent*s (DECCW, 2010a);	Section 9.2.3 and Chapter 6 (Engagement) provides a summary of the Aboriginal stakeholder engagement carried out with the local Aboriginal community and other relevant stakeholders. *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* provides additional detail and evidence of consultation and how Aboriginal stakeholder engagement has informed the project development and the assessment and management of impacts.

Table 9-2 Supplementary SEARs relevant to Aboriginal heritage

Reference	Supplementary SEARs	Where principally addressed in the EIS
19.	The EIS must provide a detailed Heritage Impact Assessment conducted by an experienced and qualified heritage expert. The assessment must also include a visual impact assessment and detailed species assessment on potential impacts to the Bogong moth (which is a value of the heritage place). Whilst not an *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened species, the Bogong moth's assessment should follow the information requirements for EPBC listed species that is listed under paragraph 17.	*Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* provides the Aboriginal heritage assessment for the project including the list of experienced and qualified heritage experts involved in the preparation of the assessment. The species assessment of the Bogong Moth is provided in *Technical Report 1 – Biodiversity Development Assessment Report*, whilst *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* provides the findings of this assessment in the context of Aboriginal heritage values. In addition, Chapter 9 provides further detail on the Bogong Moth in relation to non-Aboriginal heritage values, including consideration of potential visual impacts on heritage items and places.

9.2. Assessment approach

9.2.1. Legislative and policy context

The primary legislation relevant to Aboriginal cultural heritage in NSW is the *National Parks and Wildlife Act 1974* (NP&W Act) and its supporting regulation, which provides for the management of Aboriginal land, objects, and places. Although an Aboriginal heritage impact permit would not be required for the project under Section 90 of the NP&W Act (refer to Chapter 5 (Statutory context)), an equivalent level of assessment and consultation has been carried out.

The *Native Title Act 1993* (Commonwealth) and NSW *Aboriginal Land Rights Act 1983* provide a framework for the protection of native title rights on certain Crown lands.

There are no Crown lands subject to a native title claim within the project footprint. The Gundungurra Indigenous Land Use Agreement (ILUA) is located at the eastern end of the project footprint and the Tumut Brungle ILUA is located in the centre of the project footprint around the Tumut area. However, the ILUAs do not recognise native title over these lands.

The Commonwealth EPBC Act aims to recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity, and to promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge. The EPBC Act establishes both the National Heritage List, which includes natural, Indigenous and historic places that are of outstanding heritage value to the nation, and the Commonwealth Heritage List, which includes places on Commonwealth lands and waters or under Commonwealth Government control that have Indigenous heritage significance. There are no listed Indigenous places in the project footprint (defined in Section 9.2.2) that are registered on either the National or Commonwealth heritage lists. However, Chapter 10 (Non-Aboriginal heritage) and *Technical Report 3 – Historic Heritage Impact Assessment* provide consideration and assessment of the Australian Alps National Parks and Reserves which has important Aboriginal context as part of its overall significance as a National Heritage place.

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act) provides for the preservation and protection of places, areas and objects of particular significance to Aboriginal and Torres Strait Islander people. The stated purpose of this Act is the "preservation and

protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginal peoples in accordance with Aboriginal tradition." The ATSIHP Act can prevail over state and territory laws in situations where a state or territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an area or object. No declarations relevant to the project footprint have been made under the ATSIHP Act.

Additional policies and guidelines that provide requirements to consider when assessing potential impacts on Aboriginal cultural heritage, including objects and places, that been followed include:

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a)
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage (OEH), 2011)
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites, 2013).

9.2.2. Methodology

9.2.2.1. Overview

The assessment methodology and approach to the Aboriginal cultural heritage assessment involved:

- conducting a search of the AHIMS database on 2 February 2023, applying a one kilometre wide buffer around the project footprint to obtain additional data on sites near the project footprint that would allow adequate understanding of the distribution of sites within the landscape
- reviewing environmental and landscape context and relevant archaeological and ethnohistoric sources including heritage registers and schedules, local histories, and archaeological reports relevant to assessing Aboriginal cultural heritage within the project footprint
- preparing a preliminary Aboriginal archaeological predictive model to categorise the project footprint into low, moderate and high sensitivity areas. The model was used to help prioritise field survey areas. It was based on a review of:
  - previously recorded AHIMS sites and archaeological investigations
  - topographic contours, slope and hydrology
  - land disturbance and land use
- carrying out archaeological field investigation including detailed survey and test excavations (refer to Section 9.2.2.2)
- carrying out Aboriginal stakeholder engagement including identifying, notifying, and registering Aboriginal people who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places in the project footprint
- assessing the significance of the recorded Aboriginal sites
- refining a predictive model – which was informed by the preliminary archaeological predictive model and field survey results – to help determine the potential for Aboriginal heritage sites to be present, and their likely nature and distribution
- assessing potential direct and indirect impacts on Aboriginal heritage based on the project footprint
- recommending mitigation and management measures to minimise the potential impacts identified.

Further detail on the methodology and approach to the Aboriginal cultural heritage assessment is provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

9.2.2.2. Field survey and test excavation methodology

The archaeological field survey and test excavation methodology have been developed and carried out in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).

The field survey involved physical inspection of the project footprint across all accessible properties. Due to landowner access restrictions, it was not possible to survey the entire length of the project footprint during EIS preparation. The predictive model will be used during detailed design to avoid and minimise impacts in unsurveyed areas and inform the approach to any further pre-construction surveys (refer to Section 9.6).

The aims of the field survey were to identify archaeological sites and potential archaeological deposits (PADs) not previously recorded, assess all areas of identified moderate and high archaeological sensitivity from the preliminary predictive model, sample areas of low archaeological sensitivity, and find, inspect, and assess the condition of known Aboriginal sites recorded on the AHIMS database. Similar methodology has previously been used on other large linear projects. This field survey methodology was presented to the RAPs and to Heritage NSW prior to fieldwork to seek their feedback and input. All feedback received was considered during the finalisation of the methodology prior to surveys.

Surveys were carried out by NOHC between November 2021 and January 2022, between March and April 2022, during August 2022 and between October and November 2022. The surveys involved RAPs with the following Aboriginal organisations being represented during the various field surveys:

- Wagga Wagga LALC
- Tumut/Brungle LALC
- Pejar LALC
- Onerwal LALC.

The archaeological test excavation program was carried out between October and November 2022. It aimed to characterise the nature and occurrence of subsurface archaeological resources within areas identified to contain PADs during the archaeological survey within the project footprint.

Test excavations were undertaken at three of the six PADs identified in the project footprint during the survey program. The remaining three PADs could not be accessed due to weather conditions and safety concerns. Test excavation would occur at these PADs if, following detailed design, they are to be directly impacted by the project. Transects were placed within the boundaries of the project footprint and specifically in areas considered to contain higher potential for subsurface deposits within the PAD following the parameters of the predictive model. Test pits for PADs were placed at intervals of 5 to 10 metres within transects less than 100 metres long. For transects over 100 metres long, test pits were placed at intervals of 10 to 20 metres.

Test excavations were also undertaken at 25 additional locations within the project footprint to provide additional data to validate the predictive model. At these additional sites, test pits were placed at intervals of 10 metres within transects. The additional sites were selected following consultation on the project methodology and were dependant on site access conditions.

Test pit excavations were carried out using hand tools such as mattocks, shovels, and trowels applying standard by-hand archaeological methodologies including vertical and horizontal recording of spit levels and sedimentary, cultural and stratigraphic features.

The field survey and test excavation phase has aimed to verify the accuracy of the predictive model and PAD identification to help assess the impact of the project on Aboriginal cultural heritage and to provide advice on mitigating that impact. The results of the test excavation program have been included in the final predictive model to further refine the model and allow for the characterisation of subsurface archaeological deposits within identified areas of high, moderate and low sensitivity.

9.2.3. Aboriginal cultural heritage consultation process

Consultation with Aboriginal people has been carried out in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a) as part of the Aboriginal heritage assessment process for the project. The aim of undertaking the consultation is to understand the cultural heritage values present in the project footprint, and the views and concerns of Aboriginal people about the project.

Consultation with the RAPs involved a four-stage process:

- Stage 1 – notification of the proposal and registration of interest. This included notifying Aboriginal parties of the project, including public notices as well as direct correspondence with a list of potential stakeholders, and inviting them to register their interest in being involved in consultation and part of the development of the project. Stage 1 was carried out in April 2021.
- Stage 2 – presentation of information about the proposed project. Information about the scope of the project and the cultural heritage assessment methodology, including the predictive model developed for the project, was presented to the RAPs. This was provided through written correspondence and was discussed with stakeholders during a visit to the project footprint. No written feedback on the predictive model was received.
- Stage 3 – gathering information about cultural significance. The Aboriginal organisations represented in the field during the various field surveys between November 2021 and December 2022 were the Wagga Wagga, Tumut/Brungle, Pejar, and Onerwal LALCs. At least two field representatives were present on each field team operating within their relevant LALC area.
- Stage 4 – review of draft cultural heritage assessment report. A draft copy of the ACHAR was provided to RAPs for comment on 9 March 2023.

As noted in the sections above, comments were received from RAPs at various stages of the project, most notably at the draft research methodology stage when respondents were invited to provide feedback. Questions raised by RAPs and discussed at this stage included questions around testing, and access to properties and specific questions regarding project impacts to PADs. One response pointed out the cultural importance of natural springs, creeks and rivers.

No responses to the draft report were received following the close of the review period. Those RAPs involved in field work generally expressed satisfaction with the work being undertaken. Representatives from Wagga Wagga LALC additionally commented that they were generally supportive of the HumeLink project as it was aligned with the development and integration of renewable energy into the grid which they felt was a positive step in caring for Country.

Heritage NSW was also notified during each stage of this process.

Technical Report 2 – Aboriginal Cultural Heritage Assessment Report provides further information on the consultation with Aboriginal people carried out for the project. Transgrid would continue to consult with the Aboriginal community throughout the project, including if any Aboriginal objects are unexpectedly found during construction (refer to Section 9.6).

9.3. Existing environment

9.3.1. Aboriginal heritage context

The project footprint stretches across the countries of the Wiradjuri, Ngarigo, Gundungurra and Ngunawal people. Wiradjuri country extends from Wagga Wagga to the east towards Tumut, and north to Gundagai. Gundungurra and Ngunawal are located north from Gundagai to the Goulburn Mulwaree region. Ngarigo country is largely in the south of the project footprint.

The Wiradjuri is the largest Aboriginal group in NSW, known as “the people of three rivers’, for the Wambool (the Macquarie River), the Kalari (the Lachlan River) and the Murrumbidjeri (the Murrumbidgee River) bordering their country. The Murrumbidgee River basin would have been a focus of occupation in the region, with the river supporting woodland and forest habitats housing a wide range of resources to support the Aboriginal population.

The Gundungurra and Ngunawal Aboriginal groups occupied smaller areas with borders likely fluid and varying over time. Early records from European exploration indicate the Yass region was occupied by the Wiradjuri and Ngunawal Aboriginal language groups and the Goulburn region was situated at the boundary of the Gundungurra to the north and the Ngunawal to the south.

Ngarigo country occupied over 15,000 square kilometres and included the tableland tract between the western slopes of the coastal ranges and the eastern fall of the Kosciuszko Plateau and the peaks of the Snowy and Kosciuszko Ranges. The drainage basin of the Snowy River was prominent within Ngarigo country.

A review of Aboriginal archaeological studies prepared for areas within and surrounding the project footprint provides context on past Aboriginal land use. The sites identified in previous studies included artefact scatters, isolated finds, scarred trees, archaeological landforms, stone procurement areas and PADs. A number of Aboriginal archaeological studies also identified cultural sites including ceremonial and seasonal pathways, a meeting place, camping area, and a resource gathering area. Minjary Mountain, about 4.8 kilometres to the north-west of the project footprint, within Minjary National Park was also identified as being significant as a viewing point to other surrounding areas and was associated with a men’s initiation site.

Further information on the Aboriginal heritage context and archaeological studies within and surrounding the project footprint can be found in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

9.3.2. Predictive model

It is possible to predict the types and topographic contexts of sites which may occur within the project footprint based on the results of previous surveys and analysis of archaeological records in similar landscape contexts.

The predictive model identified artefact scatters to be the most likely site type to occur within the project footprint. Other sites with a moderate to high potential of occurring within the project footprint include isolated finds and modified trees. Isolated finds may occur anywhere in the landscape while modified trees are more likely to occur anywhere mature native trees have been retained, eg riparian corridors and isolated shade trees on agricultural land. Other sites, such as burials or ceremonial sites, have a lower potential of occurrence. Table 9-3 summarises the outcomes of the predictive model in each Local Government Area (LGA).

Table 9-3 Predicted site types based on LGA

LGA	Predicted site type
Wagga Wagga City and Cootamundra-Gundagai Regional	• Artefact scatters • Isolated finds • Modified trees
Yass Valley and Upper Lachlan Shire	• Artefact scatters • Isolated finds • Modified trees • PADs
Snowy Valleys	• Artefact scatters • Isolated finds • Modified trees • PADs • Burial • Stone quarry • Ceremonial site • Stone arrangements

9.3.3. Aboriginal sites and archaeology

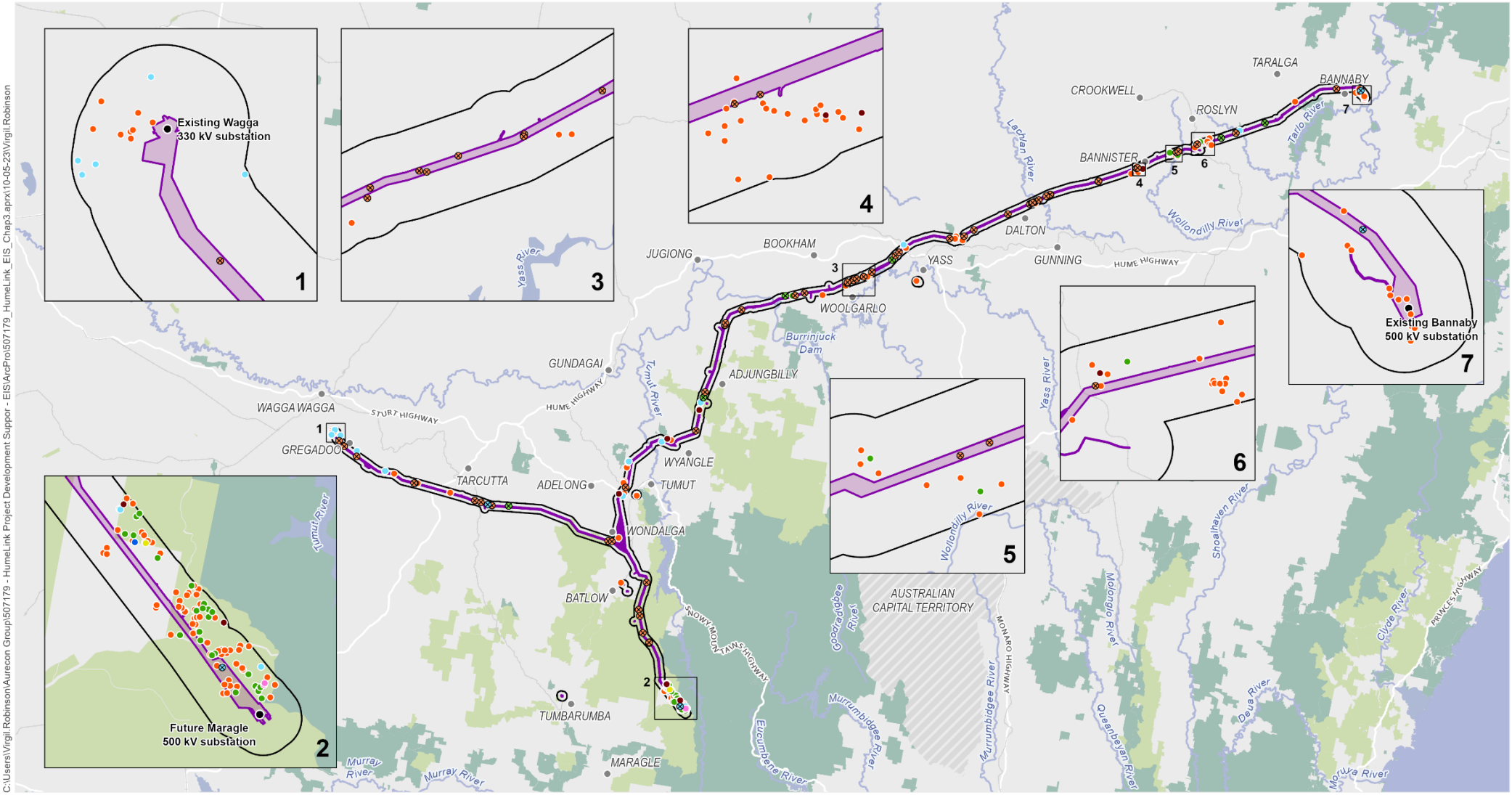
9.3.3.1. Previously recorded Aboriginal sites

A total of 235 Aboriginal heritage items were identified from the AHIMS database search within a one kilometre buffer from the edge of the project footprint. The AHIMS sites included stone arrangements, PADs, artefact scatters, modified carved trees / modified trees, open camp sites, and stone quarries.

Of these, 21 Aboriginal heritage items are located within the project footprint. A summary of the results within the project footprint is provided in Table 9-4. Figure 9-1 provides the general location of the previously recorded sites along with new sites identified from the field surveys carried out as part of the Aboriginal cultural heritage assessment.

Table 9-4 Summary of AHIMS sites within the project footprint

Site type	Number of sites	Frequency (%)
Stone artefact sites (isolated finds and scatters)	19	90.5
PAD	2	9.5
Total	**21**	**100**



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

1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 9-1: Previously recorded and new Aboriginal heritage sites and PADs

Of the 235 sites identified from the AHIMS database search, 137 are located near the southern most extent of the project north of the future Maragle 500 kV substation. Two ceremonial sites have been identified about 500 to 800 metres from the project footprint. They are located in the Tumut area and near the future Maragle 500 kV substation.

Of the 21 previously identified Aboriginal heritage sites within the project footprint, three sites were visited and located during the survey program. The sites are:

- BSF-05-46/PAD (J195) (AHIMS site number 56-6-0262) – PAD associated with an open campsite
- Dalton 7 (AHIMS site number 51-5-0202) – artefact scatter
- Gullen Solar Farm 12 (AHIMS site number 51-5-0253) – artefact scatter.

Gullen Solar Farm 13 (AHIMS #51-5-0254) site, previously recorded within the project footprint, was visited but could not be located during the archaeological field survey program.

Further details of the sites revisited is provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

9.3.3.2. New Aboriginal heritage sites and PADs

The archaeological field survey program identified 63 previously unrecorded Aboriginal heritage sites, which comprise:

- 27 artefact scatters
- 33 isolated finds
- three modified trees.

Six PADs have been identified in the project footprint. Three of these PADs were identified as having one or more Aboriginal sites associated with them.

Figure 9-1 provides the locations of the previously unrecorded Aboriginal heritage sites.

9.3.3.3. Test excavation results

Areas of a PAD that are not associated with surface artefacts can only be assessed for archaeological significance through subsurface archaeological testing. In terms of significance, the assessment of a PAD relates to its potential or likelihood of yielding significant cultural information through archaeological research.

Six PADs were identified across the project footprint during field surveys for the project. Archaeological subsurface test excavations were undertaken at three of these PADs. The other three PADs could not be tested due to access constraints and substantial wet weather. The results of these test excavations are provided in Table 9-5. The three PADs unable to be tested have been identified as having moderate to high archaeological potential. Additional test excavations would be carried out at PADs where project activities are confirmed during detailed design to have a direct impact and test excavations have not already been completed.

The two previously recorded PADs within the project footprint have previously been subject to subsurface test excavation as part of the Snowy 2.0 Transmission Connection project.

Table 9-5 Subsurface test excavation results for PAD site status

Test site	Assessment following archaeological subsurface testing	Archaeological potential
HL-PAD-01	Test excavations confirmed that the PAD is a site; that is, it contains evidence of Aboriginal occupation. Excavations revealed Aboriginal objects and intact deposits and although the assemblage from test excavations was small and of no inherent particular scientific significance, it is a strong indicator that further excavation is likely to yield more archaeological material that may yield important cultural material. The findings indicate a moderate to high potential that this PAD contains subsurface archaeological deposits.	Moderate to high
HL-PAD-05	Test excavation of this PAD confirmed the presence of archaeological material and indicated that there is potential for further archaeological material. The archaeological excavations represented a small sample of the area of this PAD, and the remaining portion of this PAD must still be regarded as having potential to contain Aboriginal objects/deposits. The findings indicate the presence of subsurface archaeological deposits within this PAD.	Moderate
HL-PAD-07	Test excavation confirmed there is a site within this PAD and indicated that there is potential for further archaeological material. There is moderate potential to contain intact subsurface archaeological deposits in this PAD. The findings indicate the presence of subsurface archaeological deposits within this PAD.	Moderate

In addition to the three PADs tested, 25 additional locations across the project footprint were tested to inform the predictive model. A total of 203 artefacts were recovered during the archaeological testing program from 14 of the total sites excavated (including the three PADs and 25 additional locations). Archaeological material was not identified in all the areas investigated. Artefact density and distribution also varied across the different sites investigated.

While the results were generally consistent with the predicted conditions of the areas investigated, the level of previous ground disturbance in test excavation areas could not be definitively determined. Ground disturbances significantly impact the identification of cultural material within the areas assessed and the condition and preservation of cultural material. The refined predictive model has been shown to be a reliable tool to identify potential areas with cultural and archaeological material.

9.3.4. Assessment of significance

An assessment of significance for the recorded Aboriginal sites was undertaken in accordance with the criteria of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013* (Australia ICOMOS, 2013). This assessment of significance considers the historic value, scientific (archaeological) value, aesthetic value and the social (cultural) value of a place.

Aboriginal cultural significance was assessed through consultation with the RAPs during the archaeological survey and consultation process.

9.3.4.1. Historic value

No information has been provided by Aboriginal stakeholders to suggest the project footprint is historically important in terms of persons, events, phases or activities in the Aboriginal community. This is likely due to the fact that the project footprint does not impact known Aboriginal reserves or early historical properties where documented significant historical interactions with Aboriginal people occurred. If evidence of historically significant information relevant to the project footprint becomes available, it would be discussed with the relevant Aboriginal stakeholders.

9.3.4.2. Scientific (archaeological) value

Archaeological sites recorded during the archaeological survey and previously recorded sites that were revisited within the project footprint have been placed into the following assessment categories:

- previously recorded sites not accessed so not able to be confirmed
- cannot assess the scientific significance prior to excavation
- low scientific significance
- moderate (local) scientific significance
- moderate to high (local) scientific significance.

No sites have been assessed to have national or high (local) scientific significance.

Following the results of the archaeological test excavation program any portions of the PADs that yield artefacts or cultural material have been assessed from a scientific perspective. The areas of PADs, which have not been tested or PADs not subject to archaeological test excavations at all are still considered a PAD.

The assessment found that 69 sites have low scientific significance. These sites have low numbers of artefacts and little potential to provide data that would substantially add to the understanding of Aboriginal history and land use in the local area, beyond the information they have already provided through being discovered and recorded. All previously recorded sites were identified as having low scientific significance.

In addition, 15 sites have been identified as having moderate (local) scientific significance. These sites are associated with areas of moderate to high or high potential for subsurface archaeological deposits and rarer site types such as modified trees. Any subsurface deposits at these sites are predicted to contain a higher number of artefacts compared to the other sites in the project footprint and, therefore, have potential to provide a large enough sample to derive statements on the technological systems being employed by Aboriginal groups living in this region.

No sites have been assessed as having national or high scientific significance.

9.3.4.3. Aesthetic value

As noted in the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage* (OEH, 2011), aesthetic value is often closely associated with social values. Culturally significant places are of high aesthetic value to the local Aboriginal community and expectations are that any development in the area would be sympathetic to such vistas. To date, RAPs have not identified any cultural landscape values or aesthetic values in the project footprint.

9.3.4.4. Social (or cultural) value

All archaeological objects and sites have cultural value for present-day Aboriginal people, as they were created by ancestral Aboriginal people and provide tangible evidence of past occupation of the landscape. All sites have cultural significance to present-day Aboriginal groups as manifestations of their ancestors' past occupation of the landscape. No objects or places have been identified as having social (or cultural) value during the field survey that have not already been identified in the RAPs. Some objects and places might have cultural value that were not communicated by RAPs during the field surveys. This could be the case for objects or places that are associated with information that is culturally restricted.

One potentially culturally significant location, Derringullen Creek Women's Site, has been identified in the project footprint. This area has been identified by a RAP as an important traditional women's site.

Five unmodified trees were also identified by RAPs during field surveys. The RAPs that identified these trees reported that they felt these trees had cultural importance. These trees are not 'objects' as defined by the NPW Act.

Further consideration of the potential to avoid direct or indirect impacts on the identified Aboriginal sites of cultural value will be carried out during detailed design.

9.4. Potential impacts – construction

Impacts on Aboriginal heritage items from construction of the project could include:

- direct disturbance to all surface and/or subsurface features of an item that would generally result in a total loss of heritage value
- partial direct disturbance, where there would be direct impacts on only some of the surface and/or subsurface features of an item, generally resulting in partial loss of value
- potential direct disturbance (total or partial), where construction takes place adjacent to an item
- indirect impacts, including impacts on the views to and from heritage items.

Construction activities that have the potential to cause direct impact to heritage items in the project footprint include:

- establishment work such as clearing of vegetation
- construction of transmission line structures
- construction of the proposed Gugaa 500 kV substation
- modification of the Bannaby 500 kV substation and Wagga 330 kV substation
- construction of the telecommunications hut
- construction of the new and upgraded access track and roads
- installation of buried cabling from the 500 kV transmission line structures to Rye Park Wind Farm substation
- establishment of the worker accommodation facility and construction compound.

There are 90 Aboriginal heritage sites (including eight PADs) located within the project footprint that may be directly or indirectly impacted by the project. The majority of the sites are stone artefact occurrences including artefact scatters and isolated finds. However, this assessment is considered a worst-case scenario and is based on direct impacts occurring throughout the project footprint. It is likely that the final directly impacted area would be much smaller than the project footprint assessed. The transmission line easement would generally occupy only 70 metres of the 200 metre wide project footprint and only a portion of the easement would be disturbed during construction and operation. In addition, not all the land within the transmission line easement would be directly disturbed during construction. The number of sites to be impacted would be confirmed during finalisation of the design and construction methodology, which would continue to identify opportunities to avoid or minimise impacts.

9.5. Potential impacts – operation

Activities during operation that may have an impact on Aboriginal heritage items may include:

- clearing/trimming of vegetation within the easement
- maintenance of the access track
- maintenance of the transmission line structure and line including heavy machinery placement
- maintenance of stormwater drainage systems.

Operational impacts are likely to be indirect and are likely to be minimal. Mitigation measures included in Section 9.6 would manage this potential risk of impact so that any impacts would be minimal to negligible.

9.6. Management of impacts

9.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). For construction, this would include a Heritage Management Plan (HMP) as part of the CEMP. This sub-plan would be based on the final construction methodology, and would detail (as a minimum):

- appropriate heritage mitigation measures, including identification, protection and/or management of heritage items/sites within or adjacent to construction areas (including additional investigations, recordings, or measures to protect items/sites that would not be directly or partially directly impacted in the vicinity of construction works)
- procedures for unexpected finds, including procedures for dealing with human remains
- heritage monitoring and compliance management
- induction requirements for construction workers.

Aboriginal heritage sites would be mapped and recorded on GIS by Transgrid in accordance with the mitigation measures listed in Table 9-6 to minimise the risk of impacts to them during operation.

9.6.2. Avoidance and minimisation of impacts

The archaeological field survey and test excavations, engagement with the RAPs and preparation of an Aboriginal cultural heritage assessment have outlined the impacts on Aboriginal cultural heritage and provided advice on mitigating this impact. The project aims to avoid heritage items as a first principle and where impacts cannot be avoided, the proposed salvage of surface artefacts and subsurface deposits, represents a precautionary measure against the harm to archaeological material at these locations. The recorded finds from these actions would inform an understanding of past human behaviour and the subsequent written record created through the reporting process would create new knowledge. The knowledge generated through the reporting process acts as a measure to mitigate harm.

9.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts on Aboriginal heritage are listed in Table 9-6.

Table 9-6 Summary of Aboriginal heritage mitigation measures

Ref	Impact	Mitigation measure	Timing	Relevant location
AH1	Impact to Aboriginal sites	The Aboriginal community consultation process for this project will continue until completion of construction.	Detailed design and construction	All locations
AH2	Impact to Aboriginal sites	The finalisation of the project design and construction methodology, and associated final disturbance areas, will be developed to avoid harm to sites of moderate or above Aboriginal heritage significance as far as practical. The objective is to further reduce potential impacts through transmission line structure location and design refinement of proposed infrastructure and construction methodology. Avoidance and minimisation of harm to sites and PADs will be prioritised.	Detailed design	All locations
AH3	Impact to Aboriginal sites in unassessed areas of the project footprint	Additional assessment will occur in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (2010b) for areas where ground disturbing activities are required in locations outside of the previously assessed area. Where required, additional heritage surveys will be carried out with the RAPs prior to ground disturbing activities occurring in any such areas (including areas where only visual inspection has been undertaken). If no Aboriginal objects are found or if Aboriginal objects are found and they would not be impacted, then a letter report will be prepared by an archaeologist that documents the findings and gives clearance to proceed. Where Aboriginal objects, scarred trees or area of PAD are located in unassessed areas and would be directly impacted, addendum report/s to *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* will be prepared. The report/s will: • detail findings of the survey activities • detail where test excavation is required • outline any additional mitigation strategies beyond those required • be presented to the RAPs for comment. Final reports will be provided to RAPs and to Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Detailed design	All locations (outside of the previously assessed area)
AH4	Impact to Aboriginal sites of cultural value	Identified Aboriginal sites of cultural value, will be avoided by the project where feasible. Further consideration of the potential to avoid direct or indirect impacts on the identified Aboriginal sites of cultural value will be carried out during detailed design.	Detailed design	Aboriginal sites of cultural value

Ref	Impact	Mitigation measure	Timing	Relevant location
AH5	Impact to Aboriginal sites – PADs	An archaeological subsurface test excavation program will be carried out in parts of any PADs where project activities would have direct impact and a test excavation program has not already been completed in the area of impact. Direct impacts include grading of tracks and construction work sites, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	PAD areas not already tested
AH6	Impacts to areas of high Aboriginal archaeological sensitivity	Where detailed design confirms there would be direct impacts in areas with high archaeological sensitivity that have not been previously subject to test excavations, a desktop assessment will be completed to determine the level of previous impact from past ground disturbing activities. If it is determined that the area has undergone low previous impact then an archaeological subsurface test excavation program will be carried out. Direct impacts include grading of tracks and construction areas, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	Areas of high sensitivity not already tested where project activities would have direct impact
AH7	Impacts to areas of moderate Aboriginal archaeological sensitivity	A field and desktop assessment will be completed in areas assessed as having moderate archaeological sensitivity where detailed design has confirmed project activities would have direct impact and a test excavation program has not already been completed in the area of impact. This is to determine the level of previous impact from past ground disturbing activities. If it is determined that the area has undergone low previous impact then an archaeological subsurface test excavation program will be carried out. Direct impacts include grading of tracks and construction areas, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	Areas of moderate sensitivity not already tested where project activities would have direct impact
AH8	Impact to Aboriginal sites – Modified trees	Harm to modified trees (including those of cultural significance) will be avoided where possible through design development and construction planning. Modified trees will only be removed to directly facilitate construction of permanent infrastructure and/or to meet Vegetation Clearance Requirements for the transmission line. If the removal of a scarred tree (a type of modified tree) cannot be avoided, the tree will be subject to 3D scanning. Reports will be provided to RAPs and Heritage NSW. Following this, the scarred trunk will be salvaged.	Detailed design	Modified trees
AH9	Impact to Aboriginal sites – Isolated Finds, Artefact scatters and PADs	All portions of artefact scatters and isolated finds that will be directly impacted will require surface collection and salvage prior to construction commencement in those areas. Additionally, based on the outcomes of the test excavations, salvage excavations will occur in accordance with the Code of Practice.	Detailed design	Directly impacted sites and PADs

Ref	Impact	Mitigation measure	Timing	Relevant location
AH10	Indirect impact to adjacent heritage items	The locations of known Aboriginal heritage sites within and adjacent to the project footprint and the relevant protocols to avoid and manage any potential harm to the items will be communicated through the Heritage Management Plan to all relevant construction workers prior to construction commencing in that area.	Detailed design and construction	Transmission line.
AH11	Impact to Aboriginal sites	Cultural heritage awareness training will be carried out for all construction workers working on the project prior to the construction workers participating in construction activities. The training shall cover sites of heritage significance within and adjacent to project work sites and protocols that must be complied with to minimise and manage potential impacts to those sites.	Construction	All locations
AH12	Unexpected finds	If at any time during construction, any items of potential Aboriginal heritage archaeological significance, or human remains are discovered, they will be managed in accordance with an unexpected finds protocol that is aligned with the protocol in Attachment 6 of *Technical Report 2 - Aboriginal Cultural Heritage Assessment Report*.	Construction	All locations
AH13	Retrieved archaeological material	Retrieved archaeological materials will be stored in appropriate facilities confirmed in consultation with the RAPs.	Construction	As relevant
AH14	Post construction impacts to heritage items by maintenance activities	Sites of heritage significance that would remain in-situ within the transmission line easement and along access tracks will be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts which may occur during maintenance activities.	Operation	Transmission line, substations and access tracks

9.6.4. Managing residual impacts or uncertainties

Following the implementation of mitigation measures identified in Table 9-6, further impacts on Aboriginal heritage items identified in this assessment are not anticipated.

The Aboriginal cultural heritage assessment is based on several assumptions to develop an understanding of potential impacts on heritage and retain flexibility during design refinement. This includes consideration of the area of temporary construction disturbance. During detailed design and further construction planning, the final location of transmission line structures, construction compounds, and other ancillary facilities would be determined with the aim of avoiding or minimising impacts on all areas assessed as having heritage significance, where practical.

As noted in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*, the full length of the project footprint could not be physically surveyed due to access restrictions. As such, there remains the possibility that potential unrecorded Aboriginal heritage sites and/or PADs were not identified. However, the potential risk for impact to such sites is considered low and manageable with the implementation of the unexpected finds protocol detailed in mitigation measure AH12, additional heritage surveys to be undertaken prior to ground disturbance activities in accordance with AH3 and consideration of the predictive model.

10. Non-Aboriginal heritage

This chapter provides a detailed summary of the assessment of potential non-Aboriginal heritage impacts of the project. The full assessment is provided in *Technical Report 3 – Historic Heritage Impact Assessment* (Navin Officer Heritage Consultants (NOHC), 2023b).

During the development of HumeLink and the preparation of the EIS, including the non-Aboriginal heritage assessment, Transgrid has undertaken extensive consultation with community and stakeholders. Engagement included consultation with Heritage NSW on matters such as survey coverage and the Commonwealth Department of Climate Change, Energy, Environment and Water (DCCEEW) on places of national heritage significance and has been carried out since early 2020. The summary of consultation undertaken for non-Aboriginal heritage is detailed Chapter 6 (Engagement) with specific feedback provided in Appendix C (Engagement Outcomes Report). Transgrid will continue to engage with community and stakeholders on non-Aboriginal heritage through the detailed design, construction and operation of HumeLink.

10.1. Environmental Assessment Requirements

10.1.1. Secretary's Environmental Assessment Requirements

Table 10-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to non-Aboriginal heritage impacts of the project and where these requirements are addressed in the EIS. Table 10-2 outlines the Supplementary SEARs that provide relevant Commonwealth assessment requirements to address non-Aboriginal heritage impacts of the project.

Table 10-1 Secretary's Environmental Assessment Requirements – non-Aboriginal heritage

Reference	SEARs	Where principally addressed in the EIS
Non-Aboriginal heritage		
Key issues	The EIS must address the following matters: • Assess the impact to historic heritage having regard to the NSW Heritage manual	Sections 10.4 and 10.5 and *Technical Report 3 – Historic Heritage Impact Assessment* provide an assessment of non-Aboriginal heritage impacts.

Table 10-2 Supplementary SEARs relevant to non-Aboriginal heritage

Reference	Supplementary SEARs	Where principally addressed in the EIS
19.	The EIS must provide a detailed Heritage Impact Assessment conducted by an experienced and qualified heritage expert. The assessment must also include a visual impact assessment and detailed species assessment on potential impacts to the Bogong moth (which is a value of the heritage place). Whilst not an *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened species, the Bogong moth's assessment should follow the information requirements for EPBC listed species that is listed under paragraph 17.	*Technical Report 3 – Historic Heritage Impact Assessment* provides the non-Aboriginal heritage assessment for the project including the list of experienced and qualified heritage experts involved in the preparation of the assessment. Sections 10.4 and 10.3.2 and *Technical Report 3 – Historic Heritage Impact Assessment* provide an assessment of non-Aboriginal heritage impacts on the National Heritage places listed in Appendix A of the supplementary SEARs and the Bogong moth. The assessment has considered the potential for visual impacts on heritage items and places. In addition, a species assessment of the Bogong Moth is provided in *Technical Report 1 – Biodiversity Development Assessment Report* with further comment on the Bogong Moth provided in Section 10.3.1 and *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.

10.2. Assessment approach

10.2.1. Legislative and policy context

The *Heritage Act 1977* (Heritage Act) is the primary piece of State legislation affording protection to all items of environmental heritage (natural and cultural) in NSW. Under the Heritage Act, “items of environmental heritage” include places, buildings, works, relics, moveable objects and precincts identified as having heritage significance based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. The Heritage Act establishes the State Heritage Register (SHR) for items of identified heritage at a level of State significance and provides the associated heritage assessment criteria for assessing items of State or local heritage significance.

The Commonwealth EPBC Act applies to those items which are of World, Commonwealth or National heritage significance. As discussed in Chapter 5 (Statutory context and project need), the project has been determined to be a controlled action with respect to potential impacts on National Heritage places.

The assessment of potential impacts on non-Aboriginal heritage was developed in accordance with principles of *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013* (Australia ICOMOS, 2013), and the following guidelines:

- *NSW Heritage Manual* (NSW Heritage Office, 1996)
- *Assessing Heritage Significance* (NSW Heritage Office, 2001)
- *Statements of Heritage Impact* (NSW Heritage Office & Department of Urban Affairs and Planning, 2002)
- *Assessing Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch, Department of Planning, 2009).

10.2.2. Methodology

The non-Aboriginal heritage assessment included:

- defining the non-Aboriginal heritage study area by applying a one kilometre wide buffer to the project footprint to identify any non-Aboriginal heritage items within the vicinity of the project
- reviewing the legislation and policy context relevant to assessing non-Aboriginal heritage
- reviewing a range of archaeological and historical data for the non-Aboriginal heritage study area, including heritage registers and schedules, local histories, and archaeological reports
- searching the following statutory heritage registers and schedules:
    - World Heritage List
    - National Heritage List
    - Commonwealth Heritage List
    - State Heritage Register
    - Section 170 Heritage and Conservation Register(s) within the State Heritage Inventory (NSW Heritage)
    - environmental heritage schedules from the Local Environmental Plans (LEPs) for Yass Valley, Wagga Wagga City, Snowy Valleys, Upper Lachlan Shire, and Cootamundra-Gundagai Local Government Areas (LGAs)
- conducting field surveys from November 2021 to January 2022, from March to April 2022, in August 2022 and from October to November 2022 within the project footprint

- assessing potential direct and indirect impacts on non-Aboriginal heritage based on the project footprint
- recommending mitigation and management measures to minimise the potential impacts identified.

Further detail on the methodology for the non-Aboriginal heritage assessment is provided in *Technical Report 3 – Historic Heritage Impact Assessment*.

10.3. Existing environment

10.3.1. Historical context

The project is located within the lands of the Wiradjuri, Ngarigo, Gundungurra and Ngunnawal people:

- Wiradjuri country extends from Wagga Wagga to the east, and north to Gundagai and is dominated by the Murrumbidgee River and its tributaries.
- Ngarigo country is largely in the south of the non-Aboriginal heritage study area, located between the western slopes of the coastal ranges and the eastern fall of the Kosciuszko Plateau and the peaks of the Snowy and Kosciuszko ranges.
- Gundungurra and Ngunnawal are located north from Gundagai to the Goulburn-Mulwaree region. Prior to European exploration and occupation, Gundungurra and Ngunnawal country were predominantly open forests.

The Bogong moth (*Agrotis infusa*) features as an important shared food source for the Wiradjuri, Ngarigo Gundungurra and Ngunnawal people. The annual Bogong moth migration in summer sees the moths migrate towards the Australian Alps where they are dormant at high altitudes in large numbers. Wiradjuri, Ngarigo, Gundungurra and Ngunnawal people joined other groups in the high ranges to feast on the moths during this time. These gatherings were also important for conducting ceremonies, and maintaining political, trade and social links between different language groups (Department of Planning, Industry, and the Environment (DPIE), 2020f).

European exploration of the Southern Highlands and Riverina regions began in the 1820s to 1830s which led to a disruption of the traditional ways of life of the Wiradjuri, Ngarigo, Gundungurra and Ngunnawal. Expeditions originating from the Sydney region continued further south of Goulburn-Mulwaree LGA during this period. Hamilton Hume and William Hovell's expedition from Gunning to Port Phillip (Melbourne) in 1824 was the first overland expedition to Victoria from the Sydney region by Europeans. From the 1830s to the mid-1840s, livestock production became increasingly widespread throughout the area with land fronting the Murrumbidgee River and its tributaries becoming occupied by pastoralists. This led to clearing of forests, the sinking of wells and construction of dams and systematic fencing.

Occupation by pastoralists eventually led to further settlement of the Southern Highlands and Riverina regions, which saw the establishment of roads, towns and inns, and an influx of convict workers, who built the roads and shepherded stock. The establishment of transport routes and early roads such as the Great South Road/Hume Highway further influenced the pattern of settlement and the economic and social development of the regions into the late 1800s.

The discovery of gold and subsequent gold rush of the 1850s was also fundamental to the pattern of settlement and the economic and social development within the non-Aboriginal heritage study area and surrounding regions. The gold rush saw a rapid population increase of European and Chinese gold miners which led to many new settlements being established or existing settlements being expanded as supply points and service centres for miners. Many towns and localities in the Snowy Valleys LGA have strong ties to the gold rush.

The Snowy Mountains Scheme is a more recent development that has contributed to the historical context of the non-Aboriginal heritage study area. The scheme was constructed to provide hydroelectric power and irrigation water to NSW and Victoria. Construction commenced in 1949 and took 25 years to complete, ending in 1974. As many as 60,000 European Displaced Persons became directly involved with the scheme following World War II. Camps were set up at Jindabyne and near Kiandra as bases for road construction teams, who completed over 1,600 kilometres of roads and tracks. Some 120 work camps and towns were built as part of the scheme, housing an estimated 100,000 men and many families.

Conservation campaigns have also featured in the history of the non-Aboriginal heritage study area and surrounding regions. Kosciuszko National Park to the east of the non-Aboriginal heritage study area is the largest national park in NSW and one of the largest conservation reserves in Australia (DPIE, 2020f). The park was originally reserved as the Snowy Mountains National Chase in 1906 following increased scientific interest and tourism in the area in the early 1900s. Subsequent campaigns for greater protection against grazing-related erosion saw the park established as the Kosciuszko State Park in 1944. Rehabilitation and revegetation of impacted areas commenced in 1959 but it was not until 1969 that grazing was finally abolished within the park. By this time, Kosciuszko State Park was renamed Kosciuszko National Park under the then NSW *National Parks and Wildlife Act 1967*. In 1977 the park was declared a World Biosphere Reserve under the UNESCO Man and the Biosphere program.

Kosciuszko National Park also provides important habitat for the Bogong moth with their seasonal presence being considered an internationally significant feature of the park (DPIE, 2020f).

10.3.2. Listed heritage items and National Heritage places

Searches of the statutory heritage registers and schedules detailed in Section 10.2.2 identified three items listed as having heritage significance within the project footprint. These are all locally listed on the Wagga Wagga LEP. In addition, two places from the Register of the National Estate (RNE) were identified within the project footprint, Kiley's Run (ID 16005) and Derringullen Creek Area (ID 1078). While the RNE is a non-statutory list, it has been considered as it provides an indication of places that may be of value to the community.

There are two places on the National Heritage List (NHL) partly within the non-Aboriginal heritage study area, but not within the project footprint: the Australian Alps National Parks and Reserves and the Snowy Mountains Scheme (the Snowy Mountains Scheme is also listed on the RNE). In addition, one State listed heritage item, 20 locally listed heritage items and three RNE listed items were identified within the non-Aboriginal heritage study area but not within the project footprint.

No items from the Commonwealth Heritage List or World Heritage List were identified within the project footprint or non-Aboriginal heritage study area.

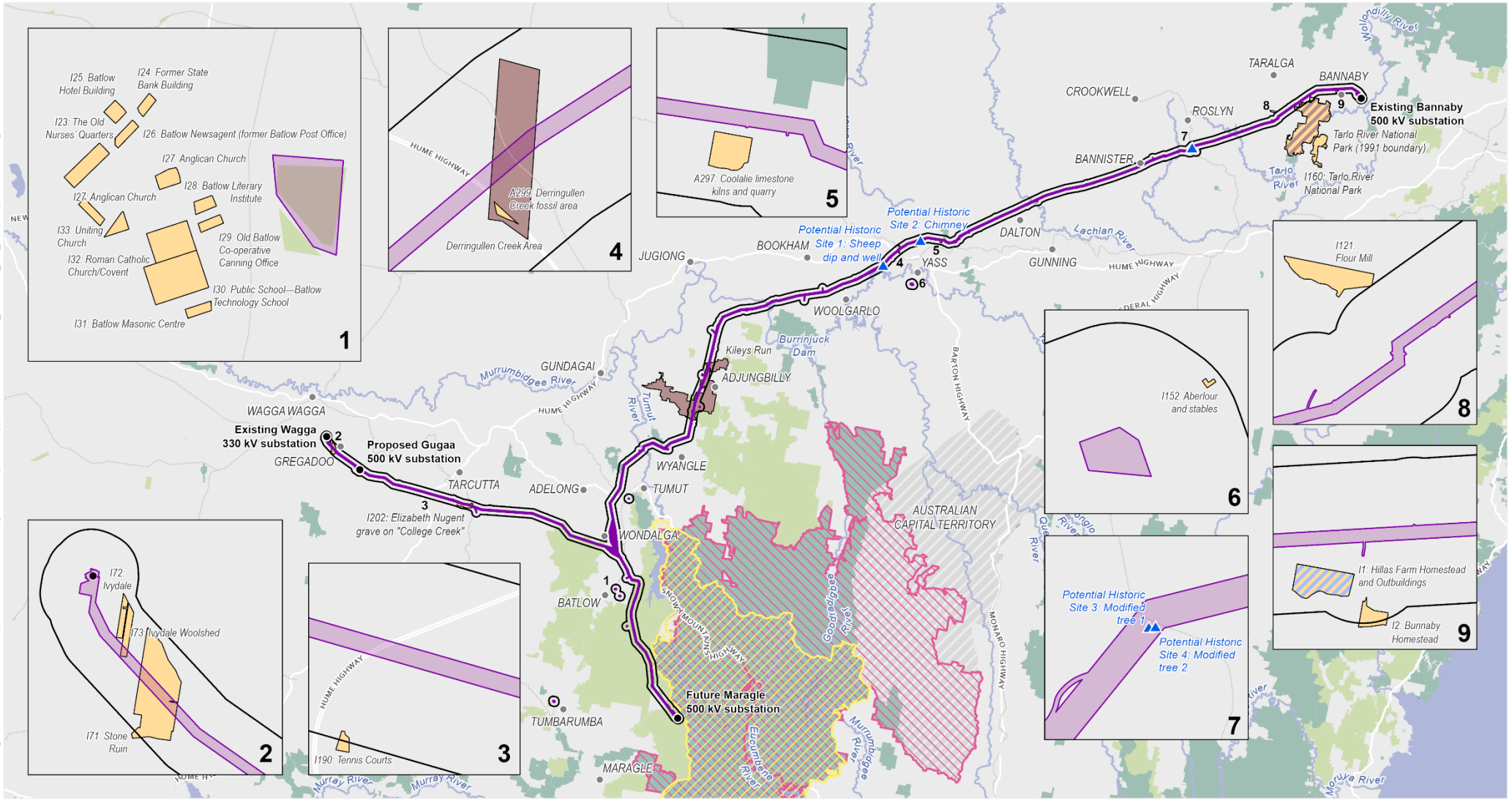
Table 10-3 and Figure 10-1 provide further detail on the listed heritage items within the project footprint and non-Aboriginal heritage study area.

Table 10-3 Listed heritage items within the project footprint and non-Aboriginal heritage study area

Item name	Item no.	Listing	Significance	Description
Within the project footprint				
Elizabeth Nugent grave on 'College Creek'	I1202	Wagga Wagga LEP 2010	Local	Elizabeth Nugent grave on 'College Creek' is located at 1615 Humula Road, Tarcutta. The item is described as a broken stone headstone.
Ivydale Woolshed	I73	Wagga Wagga LEP 2010	Local	Ivydale Woolshed is located at 9 Ivydale Road, Gregadoo. The item is described as a woolshed/shearing shed.
Stone ruin	I71	Wagga Wagga LEP 2010	Local	Stone Ruin is located at 1149 Gregadoo East Road, Gregadoo. The item is described as a two-room cottage of granite blocks with a brick chimney. This cottage is a remnant of a selector's cottage, built following the *Selection Act of 1874*.
Kiley's Run	16005	RNE	Indicative place on the RNE	Kiley's Run, also known as Red Hill Station, is located about 2 km west of Adjungbilly. The property contains a homestead, shearing shed, and other buildings. Forestry Corporation of NSW has prepared a Conservation Management Plan for the property in response to its historic value and to guide basic restoration.
Derringullen Creek Area	1078	RNE	Registered	The Derringullen Creek section is one of the State's classic fossiliferous sites. The area includes the type sections of the Tullerah sandstone member and the Gum's Road limestone member of the Silverdale formation, and the Excursion Creek sandstone member, Laidlaw formation. The site has considerable educational value.
Within the non-Aboriginal heritage study area but not the project footprint				
Snowy Mountains Scheme	105919 and 1058	NHL (ID 105919) and RNE (ID 1058)	National	Constructed between 1949 and 1974, the Snowy Mountains Scheme was the largest public works engineering scheme undertaken in Australia. The scheme is made up of 225 km of tunnels, pipelines and aqueducts, 16 major dams, nine power stations and a pumping station. The scheme is acknowledged as the biggest nation-building project in Australia's history. The Snowy Mountains Scheme is a dual-purpose hydroelectric and irrigation development. It diverts water from the easterly flowing streams to the west of the Great Dividing Range through a series of trans-mountain tunnels and in so doing generates electricity in periods of peak energy demand and provides water for irrigation.
Australian Alps National Parks and Reserves	105891	NHL	National	The Australian Alps National Parks and Reserves are part of a unique Australian mountainous region. Human interaction with the region has been distinctive in its response to the challenges and opportunities presented by this unique environment. The Australian Alps National Parks and Reserves contains Indigenous history of Bogong Moth feasting. Over the past decade, there has been a rapid decline in Bogong Moth numbers related to the larvae of Bogong Moth ingesting arsenate from agricultural sprays and increased artificial light hampering migration efforts. For further details on the Bogong Moth refer to *Technical Report 1 – Biodiversity Development Assessment Report*.

Item name	Item no.	Listing	Significance	Description
Hillas Farm Homestead and Outbuildings	00301 and I1	SHR (ID 00301) and Upper Lachlan LEP (ID I1)	State and local	This is an expansive rural homestead complex with the homestead made of lathe and plaster. The homestead was constructed by John and George Hillas, from 1828-40, in timber, being single storey, with a verandah. One end is taller, with a steeper pitched roof, and an attic storey (ibid, 2008, 189: Figures 195, 196) (LEP, 2010).
'Bunnaby' Homestead	I2	Upper Lachlan LEP 2010	Local	*Bunnaby* Homestead was constructed by John and George Hillas from 1828 to 1840, for which the town is named. It is located at 77 Hanworth Road (adjacent to Hillas Farm), Bannaby.
Tarlo River National Park	I160	Upper Lachlan LEP 2010	Local	Tarlo River National Park is located in Tarlo and accessed via Taralga Road, Tarlo.
Ivydale	I72	Wagga Wagga LEP 2010	Local	Ivydale woolshed is located at 10 Ivydale Road, Gregadoo. The item is a homestead.
Tennis Court	I190	Wagga Wagga LEP 2010	Local	The tennis court is located at Keajura Road, Tarcutta.
Coolalie limestone kilns and quarry	A297	Yass Valley LEP 2013	Local	The Coolalie limestone kilns and quarry is located at Bango Lane, Yass.
Derringullen Creek fossil area	A299	Yass Valley LEP 2013	Local	The Derringullen Creek fossil area is located on the Hume Highway, Yass.
Aberlour and stables	I152	Yass Valley LEP 2013	Local	Aberlour and stables is located at 50 Cobham Street and 20 Victoria St, Yass.
Old Batlow Co-operative Canning Office	I29	Tumut LEP 2012	Local	Old Batlow Co-operative Canning Office located at 67 Pioneer St, Batlow.
Batlow Hotel Building	I25	Tumut LEP 2012	Local	The Batlow Hotel is located at 12 Pioneer St, Batlow.
Batlow Newsagent (former Batlow Post Office)	I26	Tumut LEP 2012	Local	Reedy Flat Post Office opened on 1 August 1873 and was renamed Batlow in 1889. It is located at 14-16 Pioneer St, Batlow.
Public School Batlow Technology School	I30	Tumut LEP 2012	Local	Public School Batlow Technology School is located at 80 Pioneer St, Batlow.
Former State Bank Building	I24	Tumut LEP 2012	Local	Former State Bank Building is located at 19 Pioneer St, Batlow.
Uniting Church	I33	Tumut LEP 2012	Local	Uniting Church is located at 16 Selwyn Street, Batlow.
The Old Nurses Quarters	I23	Tumut LEP 2012	Local	The Old Nurses Quarters is located at 7 Mayday Road, Batlow.
Batlow Masonic Centre	I31	Tumut LEP 2012	Local	The Batlow Masonic Centre is located at 90 Pioneer Street, Batlow.
Batlow Museum (former Church)	I22	Tumut LEP 2012	Local	Batlow Museum (former Church) is located at 12 Batlow Road, Batlow.
Batlow Literary Institute	I28	Tumut LEP 2012	Local	Batlow Literary Institute is located at 45 Pioneer Street, Batlow.

Item name	Item no.	Listing	Significance	Description
Roman Catholic Church/Convent	I32	Tumut LEP 2012	Local	Roman Catholic Church/Convent is located at 7 Selwyn Street, Batlow.
Anglican Church	I27	Tumut LEP 2012	Local	Anglican Church is located at 30-34 Pioneer Street, Batlow.
Kosciuszko National Park (1981 boundary)	659	RNE	Registered	Kosciuszko National Park includes extensive alpine and subalpine environments with Australia's highest peaks. Vegetation includes wet and dry sclerophyll forest, gallery and savannah woodland, low woodland, open shrub, open and closed heath, low scrubland, grassland herbland, fen, bog, tussock grassland. It includes wilderness areas of high landscape value and historic Kiandra where gold was discovered in 1859.
Tarlo River National Park (1991 boundary)	1141	RNE	Registered	This National Park is of significance as it provides a viable and comparatively extensive sample of *Eucalyptus rossii*, *E. macrorhyncha* dominated dry sclerophyll open forests and woodlands. These have developed, along with strips of river she oak gallery forest, shrublands and herbfields, on an elevated and dissected terrain block which forms the locally significant landscape feature of the Cookbundoon Range. The landforms preserve evidence of a complex geological history and are associated with the major orogenies which resulted in the development of the central highland fold belt. The park represents a major regional stronghold and genetic reservoir for plant and animal species.



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

1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 10-1: Location of listed and previously unrecorded heritage in the non-Aboriginal heritage study area

10.3.3. Previously unrecorded heritage

The field surveys detailed in Section 10.2.2 identified four potential historic heritage items within the project footprint. Further detail on these items is provided below and the items are shown on Figure 10-1. Further details on the sites and the criteria to meet heritage significance as per *Assessing Heritage Significance* (NSW Heritage Office, 2001), which is provided in *Technical Report 3 – Historic Heritage Impact Assessment.*

10.3.3.1. Potential Historic Site 1: Sheep dip and well

This potential site is located on Black Range Road, Bowning and comprises a hand-dug well, sheep dip and associated footings. The well is covered by corrugated iron and timbers. The sheep dip is constructed of concrete and local stone and is around 6.25 metres by five metres in an “L” shape. About seven metres south-east of the sheep dip is evidence of the footings of a structure comprised of cut stone.

This location, in particular the well, has some potential to contain archaeological deposits. However, the background research undertaken has not determined the potential age of this item nor any association with the history of the property. Therefore, it is unlikely that this site would meet any of the criteria for heritage significance.

10.3.3.2. Potential Historic Site 2: Chimney

This potential site is located on Cooks Hill Road, Bango and comprises a dilapidated fireplace with an iron firepit and scattered bricks. It is dilapidated but largely intact with the bricks likely dating from late 19th century to early 20th century.

This potential heritage item comprises a brick and sandy mortar fireplace. Background research undertaken has not determined the potential age of this item nor any association with known people or places. Therefore, it is unlikely that this site would meet any of the criteria for heritage significance.

10.3.3.3. Potential Historic Sites 3 and 4: Modified trees 1 and 2

The potential sites are located on Woodhouselee Road, Woodhouselee and are modified trees located on a mid-slope of a mid-valley where the surrounding canopy is in the range of four to 10 metres high. The trees are marked with survey blazes and are likely associated with the survey of the Crookwell Railway Line and adjacent property boundaries. It is unlikely that these sites would meet any of the criteria for heritage significance.

10.4. Potential impacts – construction

Impacts on historic heritage items from construction of the project may include:

- direct disturbance to all surface and/or subsurface features of an item that would generally result in a total loss of heritage value
- partial direct disturbance, where there would be direct impacts on only some of the surface and/or subsurface features of an item, generally resulting in partial loss of value
- potential direct disturbance (total or partial), where construction takes place adjacent to an item
- indirect impacts, including impacts on the views to and from heritage items.

The project components and activities that have been assessed to have the potential to cause direct impacts in the project footprint include:

- establishment work such as clearing of vegetation
- construction of transmission line structures
- construction of the proposed Gugaa 500 kV substation
- modification of the Bannaby 500 kV substation and Wagga 330 kV substation
- construction of the telecommunications hut
- construction of the new and upgraded access track and roads
- installation of buried cabling from the 500 kV transmission line structures to Rye Park Wind Farm substation
- establishment of the worker accommodation facility and construction compound.

Indirect impacts, depending on the site type, site context, and its archaeological and cultural significance, may not result in a loss of heritage value. Indirect impacts may occur to areas beyond the project footprint, but the impact would depend on several factors, such as spatial extent of the site, nature of the site, depth of deposits, and the work being conducted adjacent to these areas. The mitigation measures detailed in Section 10.6.3 would minimise the potential for indirect impacts that could potentially result in a loss of heritage values due to physical disturbance.

A summary of the listed and previously unrecorded heritage items identified above, and the potential impacts during construction of the project, are outlined in Table 10-4. All items identified in Table 10-4 within the project footprint are of low heritage significance (ie no items of state or national significance). Further details on the criteria to meet heritage significance are provided in *Technical Report 3 – Historic Heritage Impact Assessment.*

Table 10-4 Impact assessment of non-Aboriginal heritage items during construction

Site name	Would project impact the significance of an item?	Impact to item
Within the project footprint		
Potential Historic Site 1: Sheep dip and well	No as the item has no heritage significance	Located partially within the project footprint within the transmission line portion of the project footprint. Therefore, part of this item may be directly impacted by the project.
Potential Historic Site 2: Chimney	No as the item has no heritage significance	This item is located wholly within the project footprint and within the transmission line portion of the project footprint. The whole of this item may be directly impacted by the project.
Potential Historic Site 3: Modified tree 1	No as the item has no heritage significance	This item is located wholly within the project footprint and within the transmission line portion of the project footprint. The whole of this item may be directly impacted by the project.
Potential Historic Site 4: Modified tree 2	No as the item has no heritage significance	This item is located wholly within the project footprint and within the transmission line portion of the project footprint. The whole of this item may be directly impacted by the project.
Ivydale Woolshed	No	The heritage listed curtilage of this item is partially within the project footprint, however Ivydale Homestead is approximately 900 m from the project footprint. This item is within the transmission line portion of the project footprint.

Site name	Would project impact the significance of an item?	Impact to item
Stone ruin	No	The heritage listed curtilage of this item is partially within the project footprint, however the stone ruin itself is approximately 500 m east of the project footprint. This item is within the transmission line portion of the project footprint.
Elizabeth Nugent grave on 'College Creek'	No	The project footprint impacts the listed curtilage however the exact location of the historic item is 430 m north-east of the project footprint. This item is within the transmission line portion of the project footprint.
Kiley's Run	No	The heritage listed curtilage of this item is partially within the project footprint, however the historic item itself is outside of the project footprint. This item is within the transmission line portion of the project footprint.
Derringullen Creek Area	No	The heritage listed curtilage of this item would be located partially within the project footprint, however the currently listed portion of the historic item itself is outside of the project footprint. This item is within the transmission line portion of the project footprint.
Within the non-Aboriginal heritage study area and not the project footprint		
Snowy Mountains Scheme	Negligible	The project footprint is located in close proximity to this item. As a result there may be indirect visual impact from the project, for example from vegetation clearance and the proximity of transmission line structures. The closest project component is the project transmission line. The item is located 80 m from the project footprint.
Australian Alps National Parks and Reserves National	Negligible	The project footprint is located in close proximity to this item; there may be indirect visual impact from the project on this item for example from vegetation clearance and the proximity of transmission line structures. The closest project component is the project transmission line. The item is located 80 m from the project footprint.
Hillas Farm Homestead and Outbuildings	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 375 m from the project footprint.
Ivydale	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 920 m from the project footprint.
Tennis Court	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 860 m from the project footprint.
Old Batlow Co-operative Canning Office	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 140 m from the project footprint.
Batlow Hotel Building	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 400 m from the project footprint.
Batlow Newsagent (former Batlow Post Office)	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 360 m from the project footprint.
Public School Batlow Technology School	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 200 m from the project footprint.
Former State Bank Building	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 360 m from the project footprint.

Site name	Would project impact the significance of an item?	Impact to item
Uniting Church	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 330 m from the project footprint.
The Old Nurses Quarters	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 400 m from the project footprint.
Batlow Masonic Centre	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 240 m from the project footprint.
Batlow Museum (former Church)	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 400 m from the project footprint.
Batlow Literary Institute	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 160 m from the project footprint.
Roman Catholic Church/Convent	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 200 m from the project footprint.
Anglican Church	No	There would be no impact to this item from the project. The closest project component is the Memorial Avenue compound (C14). The item is located 240 m from the project footprint.
Aberlour and stables	No	There would be no impact to this item from the project. The closest project component is the Yass substation compound (C10). The item is located 810 m from the project footprint.
Coolalie limestone kilns and quarry	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 130 m from the project footprint.
Derringullen Creek fossil area	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 170 m from the project footprint.
'Bunnaby' Homestead	No	There would be no impact to this item from the project. The closest project component is the project transmission line. The item is located 900 m from the project footprint.
Tarlo River National Park	Negligible	The project footprint is located in close proximity to this item; there may be indirect visual impact from the project on this item. The closest project component is the project transmission line. The item is located 10 m from the project footprint.
Tarlo River National Park (1991 boundary)		

10.5. Potential impacts – operation

Potential impacts on non-Aboriginal heritage during operation would predominantly relate to indirect visual impacts from the presence of permanent elements of the project, including transmission line structures, substations and the telecommunications hut. The indirect visual impacts of the project are considered above in Table 10-4.

Maintenance activities required for operation of the project would not result in disturbance of additional areas compared to those assessed during construction. As such, no additional direct or partial direct disturbance impacts to non-Aboriginal heritage would occur during operation of the project.

The mitigation measures outlined in Section 10.6 would be applied to minimise the risk of inadvertent impacts to historic items from maintenance activities such as:

- vegetation clearing/trimming within the easement
- access track maintenance
- transmission line structure and line maintenance
- stormwater drainage systems maintenance.

Impacts during operation would be managed through relevant Transgrid systems and procedures.

10.6. Management of impacts

10.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). For construction, this would include preparation and implementation of a Heritage Management Plan (HMP) as part of the Construction Environmental Management Plan (CEMP).

10.6.2. Avoidance and minimisation of impacts

The project footprint has been refined since the HumeLink Scoping Report to avoid direct impacts to the Snowy Mountain Scheme and the Australian Alps National Parks and Reserves. Five heritage listed items and four newly recorded historic sites are within the project footprint. For five of these items only the listed curtilage is within the project footprint with the historic item itself located outside of the project footprint. The project aims to avoid historic items as a first principle with infrastructure being sited through detailed design. Four potential sites (potential Historic Sites 1 to 4) have been assessed to have no heritage significance and pose no constraints to the project.

10.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts to non-Aboriginal heritage are listed in Table 10-5.

Table 10-5 Mitigation measures – non-Aboriginal heritage

Ref	Impact	Mitigation measure	Timing	Relevant location
NAH1	Unexpected finds	If at any time during construction, any items of potential historic heritage archaeological significance, or human remains are discovered, they will be managed in accordance with an unexpected finds protocol that is aligned with the protocol in *Technical Report 3 – Historic Heritage Impact Assessment*.	Construction	All locations
NAH2	Impact to unsurveyed areas	Additional heritage surveys will be carried out prior to ground disturbing activities in areas which were previously inaccessible and/or where only visual inspection has been undertaken. Whether or not historic items are found, a letter report will be prepared by a heritage specialist for all additional surveyed areas that documents the findings. Where historic items are located and would be impacted, a draft survey addendum report/s to this report will be prepared for the survey areas. The report(s) will: • detail findings of the survey activities • detail where test excavation is required • outline any additional mitigation strategies beyond those required. Final reports will be provided Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Detailed design	All locations (outside of the previously surveyed heritage survey area)
NAH3	Post construction impacts to heritage items	Features/items of heritage significance that would remain in-situ within the transmission line easement and along access tracks will be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts to occur during maintenance activities.	Operation	All permanent work

10.6.4. Managing residual impacts or uncertainties

As noted in *Technical Report 3 – Historic Heritage Impact Assessment*, the full length of the project footprint could not be physically surveyed due to property access constraints. Areas that were surveyed are shown in *Technical Report 3 – Historic Heritage Impact Assessment*. Where access was not possible, the area was viewed from the nearest available public vantage point, such as a road, as well as using aerial maps, parish maps and photographs. As such, there remains the possibility that potential unrecorded historic sites and/or features of heritage significance were not identified. However, the potential risk for impacts on additional previously unrecorded sites is considered low and manageable with the implementation of the unexpected finds protocol detailed in mitigation measure NAH1 and additional heritage surveys to be undertaken prior to ground disturbance activities in accordance with mitigation measure NAH2. Moreover, the project footprint avoids towns and dwellings, where practicable. As such, the potential to find additional items of historic significance is low.

11. Land use and property

This chapter provides a detailed summary of potential land use and property impacts of the project. The full assessment is provided in *Technical Report 4 – Agricultural Impact Assessment* (Tremain Ivey Advisory, 2023) and *Technical Report 5 – Land Use and Property Impact Assessment* (HillPDA, 2023a).

11.1. Environmental Assessment Requirements

11.1.1. Secretary's Environmental Assessment Requirements

Table 11-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to land use and property impacts and where these requirements are addressed in this EIS.

Table 11-1 Secretary's Environmental Assessment Requirements – Land use and property

Reference	SEARs	Where principally addressed in the EIS
Land		
Key issues	The EIS must address the following matters: • an assessment of impacts of the project on soils and land capability of the site and surrounds;	Section 11.4 and Section 11.5 provide the assessment of construction and operational impacts on land capability within the project footprint and surrounds with further detail provided in *Technical Report 4 – Agricultural Impact Assessment* and *Technical Report 5 – Land Use and Property Impact Assessment.*
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site); and	Chapter 16 (Soils, geology and contamination) provides the assessment of the risk of soil contamination including naturally occurring asbestos.
	• assessment of impact of the project on agricultural land, land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State Forests, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors.	Section 11.4 and Section 11.5 provide the assessment of construction and operational impacts on agricultural land, land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State forests, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors. Further detail is provided in *Technical Report 4 – Agricultural Impact Assessment* and *Technical Report 5 – Land Use and Property Impact Assessment*.
Hazards		
Key issues	The EIS must address the following matters: • assess potential impacts on aviation safety, including: - defined air traffic routes, aircraft operating heights, approach / departure procedures, radar interference, communication systems, navigation aids, use of emergency helicopter access, aerial baiting and culling in the National Parks, safe and efficient aerial application of agricultural fertilisers and pesticide - identify aerodromes within 30 km of the transmission line and consider the impact to nearby aerodromes and aircraft landing areas; and - address impacts on obstacle limitation surfaces.	Section 11.4 and Section 11.5 provide an assessment of impacts on safe and efficient aerial application of agricultural fertilisers and pesticide, with further detail provided in *Technical Report 5 – Land Use and Property Impact Assessment*. Chapter 19 (Hazards and risks) provides further assessment of impacts of the project on aviation safety including identifying any impacts on aerodromes within 30 km of the transmission line and obstacle limitation surfaces.

11.2. Assessment approach

11.2.1. Legislative and policy context

Key legislation considered as part of the assessment of land use and property impacts included:

- *Aboriginal Land Rights Act 1983* – provides for land rights for Aboriginal people in NSW by facilitating the creation of representative Aboriginal Land Councils, and for Crown land to be vested in those Councils.
- *Biosecurity Act 2015* – complements the *Biosecurity Act 2015* (Commonwealth) and provides a framework for the prevention, elimination and minimisation of biosecurity risks on public and private land in NSW (refer to Sections 11.4.2.3 and 11.5.2.3 for a discussion on biosecurity risks).
- *Crown Land Management Act 2016* – provides management principles for Crown land in NSW and acquisition requirements.
- *Forestry Act 2012* – establishes the Forestry Corporation of NSW (FCNSW) to manage forestry operations on Crown land or land owned by FCNSW (refer to Sections 11.4.3 and 11.5.3 for a discussion on impacts on forestry).
- *Land Acquisition (Just Terms Compensation) Act 1991* – provides a mechanism for the acquisition of land and the payment of compensation on just terms. Acquisition and compensation is carried in accordance with the *Property Acquisition Standards* (NSW Department of Finance, Services and Innovation, 2019) and has regard to market value of the land and the potential impacts of the proposed infrastructure on the property (including easements) (refer to Section 11.5.1.1 for a discussion on acquisition requirements).
- *Local Land Services Act 2013* – establishes the Local Land Services (LLS) to manage programs and advisory services associated with agricultural production, biosecurity, natural resource management, emergency management and Travelling Stock Reserves (TSRs) (refer to Sections 11.4.2 and 11.5.2 for a discussion on impacts on agricultural production, biosecurity and TSRs).
- *National Parks and Wildlife Act 1974* – is the main legislation for the establishment and management of protected areas in NSW. Protected areas include national parks, nature reserves, wilderness areas, Aboriginal areas or state conservation areas. The project does not directly impact on any national parks, nature reserves, wilderness areas, Aboriginal areas or state conservation areas (refer to Sections 11.4.4 and 11.5.4 for consideration of indirect impacts).
- *Native Title 1993* (Commonwealth) – recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters and provides recognition and protection of native title and establishes ways in which future dealings affecting native title may proceed (refer to Section 11.3.1.3 for consideration of native title within the project footprint).
- State Environmental Planning Policy (Primary Production) 2021 – provides planning provisions to manage primary production and rural development and protect agricultural land of state and regional significance, including through establishing biophysical strategic agricultural land (BSAL) and draft State significant agricultural land (SSAL) mapping (refer to Section 11.3.4 for BSAL and draft SSAL mapping within the project footprint).
- Various local environmental plans (LEPs) applicable to the Local Government Areas (LGAs) that the project traverses. LEPs establish the land uses zones and objectives that have been considered as part of the assessment of land use and property impacts undertaken for the project. The LEPs considered in the assessment include:
    - Gundagai LEP 2011
    - Tumbarumba LEP 2010
    - Tumut LEP 2012

- Upper Lachlan LEP 2010
- Wagga Wagga LEP 2010
- Yass Valley LEP 2013.

In addition to the legislation detailed above, the assessment of land use and property impacts included consideration of the following key policies, plans, and guidelines:

- *Land Use Conflict Risk Assessment Guide* (Department of Primary Industries (DPI), 2011a)
- *Riverina Murray Regional Plan 2041* (DPE, 2023)
- *South East and Tablelands Regional Plan 2036* (DPE, 2017)
- *The Tablelands 2016-2036 Regional Community Strategic Plan* (Cardno, 2017)
- local strategic planning statements for Wagga Wagga City (2021), Snowy Valleys (2020), Cootamundra-Gundagai Regional (2020), Upper Lachlan (2020) and Yass Valley (2020) LGAs
- *The land and soil capability assessment scheme (Second approximation): A general rural land evaluation system for New South Wales* (LSC Assessment Scheme) (Office of Environment and Heritage (OEH), 2012)
- *Agricultural Land Use Mapping Resources in NSW: User's guide* (DPI, 2017)
- *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (OEH, 2013)
- *Developments adjacent to National Parks and Wildlife Service lands: Guidelines for consent and planning authorities* (National Parks and Wildlife Service, 2020)
- *Property Acquisition Standards* (Department of Finance, Services and Innovation, 2019).

Technical Report 4 – Agricultural Impact Assessment and *Technical Report 5 – Land Use and Property Impact Assessment* provide the full list of legislation, policies, plans, and guidelines referred to in the assessment of land use and property impacts.

11.2.2. Methodology

The approach to assessment of land use and property impacts involved an overall land use and property impact assessment as well as a more specific assessment of agricultural land impacts due to the importance of this land use within the project footprint.

11.2.2.1. Land use and property impact assessment

The land use and property impact assessment involved:

- developing the land use and property study area comprising the Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley LGAs
- reviewing the legislation and policy context
- reviewing engagement outcomes to date relating to property and land use issues
- carrying out site inspections from publicly accessible land along the project footprint
- analysing data sources to quantify impacts
- reviewing potential future property and land use changes
- assessing potential impacts on land use and property based on the project footprint by applying the *Land Use Conflict Risk Assessment Guide* (DPI, 2011a)
- identifying mitigation and management measures to minimise the potential impacts identified.

The land use and property study area is made up of the entirety of the five LGAs in which the project footprint is located: Wagga Wagga City LGA, Snowy Valleys LGA, Cootamundra-Gundagai Regional LGA, Upper Lachlan Shire LGA and Yass Valley LGA (refer to Figure 11-1). The project footprint and land use and property study area allow for an understanding of direct and regional impacts on property and land use

within these LGAs. The project footprint has been used to determine the direct land use and property impacts, and the land use and property study area has been used to determine any potential impacts within the wider region.

In addition, the land use and property impact assessment has used an indicative concept design within the project footprint to estimate the likely land use impact areas during construction and operation. Further detail on the construction and operational elements of the indicative concept design is provided in Chapter 3 (Project description – infrastructure and operation) and Chapter 4 (Project description – construction) and the assessment approach is provided in Chapter 7 (Approach to assessment of impacts).

Further detail on the methodology for the land use and property impact assessment is provided in *Technical Report 5 – Land Use and Property Impact Assessment*.

11.2.2.2. Agricultural land impact assessment

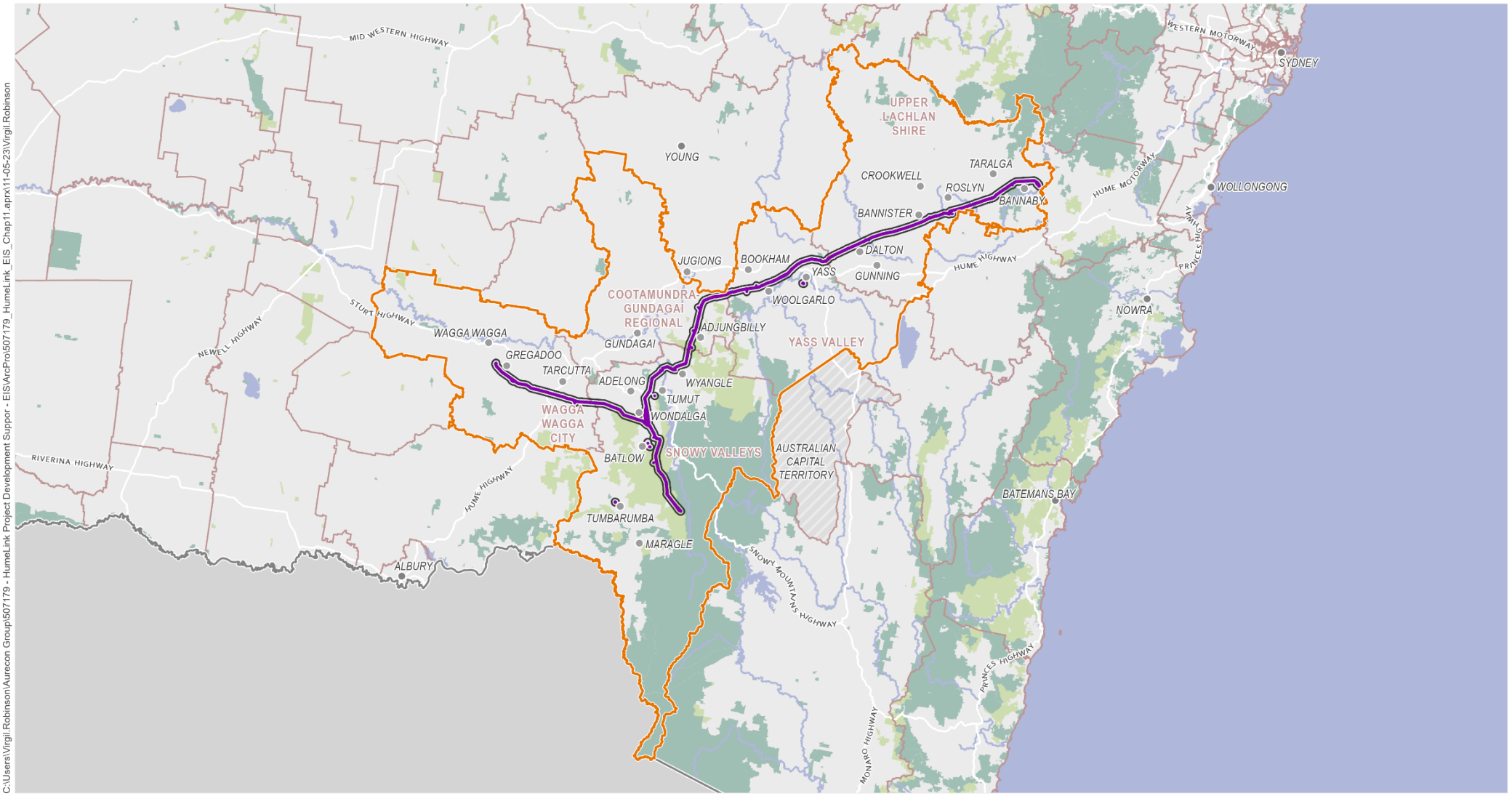
The agricultural land impact assessment involved:

- defining the agricultural study area
- reviewing the legislation and policy context
- reviewing existing mapping, aerial photography and literature to describe the existing environment and geographical factors, biosecurity issues, land and soil capability and agricultural productivity
- engaging with seven representative agricultural enterprises on 23 and 24 November 2021 and 11 May 2022, including property inspections to understand landowner perspectives of the potential impacts on agricultural land
- engaging with representatives from Riverina LLS, South East LLS, Wagga Wagga City Council, Snowy Valleys Council, Yass Valley Council, Cootamundra-Gundagai Regional Council and Upper Lachlan Shire Council to identify the main biosecurity risks associated with the project and potential mitigation measures
- assessing potential impacts on agricultural land and operations as a result of the construction and operation of the project
- identifying mitigation and management measures to minimise the potential impacts identified.

The agricultural study area consists of the project footprint with a 1.5 kilometre buffer, which encompasses the agricultural lands likely to be directly and indirectly affected by the project (refer to Figure 11-1). The project footprint is generally used to determine the direct impacts on agricultural land, and the 1.5 kilometre buffer is used to consider indirect impacts.

However, consistent with the land use and property impact assessment, the agricultural land impact assessment has also used an indicative concept design within the project footprint to estimate likely areas of agricultural land that would be impacted during construction and operation. In addition to the agricultural study area, the five LGAs in which the project footprint is located (ie land use and property study area) have also been used in the agricultural land impact assessment to provide context for the understanding of agricultural land uses surrounding the project.

Further detail on the methodology for the agricultural land impact assessment is provided in *Technical Report 4 – Agricultural Impact Assessment*.



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

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0 40 80km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-1: Land use and property and agricultural study areas

11.3. Existing environment

11.3.1. Property and ownership

11.3.1.1. Overview

There is a wide range of property infrastructure within the project footprint including dwellings and farm infrastructure (eg sheds, silos, and water tanks). The majority of property within the project footprint is freehold land, which comprises about 84.5 per cent of the project footprint over 678 lots. NSW government and Crown land each comprise about 5.9 per cent of the project footprint. There is no Commonwealth government owned land within the project footprint. Figure 11-2 provides an overview of the property ownership within and surrounding the project footprint.

11.3.1.2. Crown land

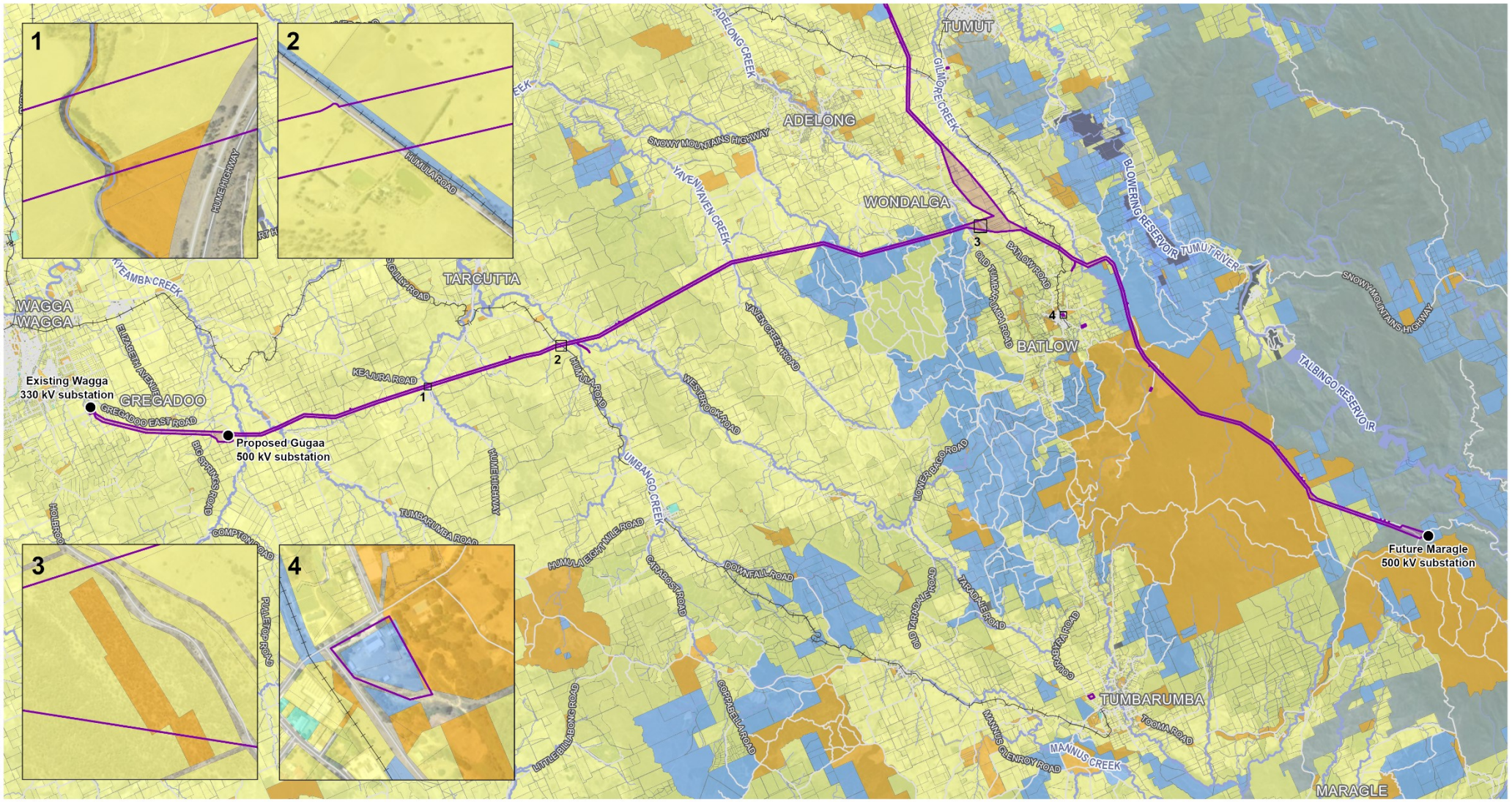
The project footprint contains 508 hectares of Crown land. The majority of Crown land within the project footprint is located south of Batlow and is associated with Bago State Forest (refer to Section 11.3.5). Other areas of Crown land intersected by the project footprint are located generally between Wondalga and Chatsbury in the east. Other smaller areas are generally associated with TSRs (refer to Section 11.3.4.4).

11.3.1.3. Native title and Indigenous Land Use Agreements

At the time of preparing the EIS, no land within the project footprint was found to be the subject of an application or determination made under the *Native Title Act 1993*. In addition, no Aboriginal land claims made under the *Aboriginal Land Rights Act 1983* have been identified within the project footprint. However, the project footprint intersects areas associated with the Tumut Brungle Indigenous Land Use Agreement (ILUA) (Tumut Brungle ILUA) and Gundungurra Indigenous Land Use Agreement 2014 (Gundungurra ILUA).

The Tumut Brungle ILUA was registered in 1999 and is an agreement between Adelong Consolidated Gold Mines, the NSW Aboriginal Land Council and representatives of the Walgalu and Wiradjuri people. The Tumut Brungle ILUA covers an area of 850,000 hectares and allows Adelong Consolidated Gold Mines to conduct mining operations for a minimum of 20 years within the area subject to the ILUA. The ILUA authorises operations, which may be inconsistent with native title rights and interests under the *Native Title Act 1993* but does not extinguish these interests. However, as the Tumut Brungle ILUA only applies to the operations of Adelong Consolidated Gold Mines within the area subject to agreement, it is not relevant to the project.

The Gundungurra ILUA is an agreement between the Gundungarra people, the Gundungurra Tribal Council Aboriginal Corporation, Gundungurra Aboriginal Heritage Association and the NSW Government and covers an area of 694,200 hectares. The Gundungurra ILUA does not recognise native title over the land within the ILUA with the Gundungurra people agreeing to withdraw their native title claim. However, the ILUA provides the Gundungurra people an opportunity to be consulted on the management of national parks, state conservation areas and FCNSW lands within the ILUA. The area of the Gundungurra ILUA intersected by the project footprint is generally located in the eastern section of the project between Bannister and the Bannaby 500 kV substation. No national parks, state conservation areas and FCNSW lands within the area of the Gundungurra ILUA are located within the project footprint.



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

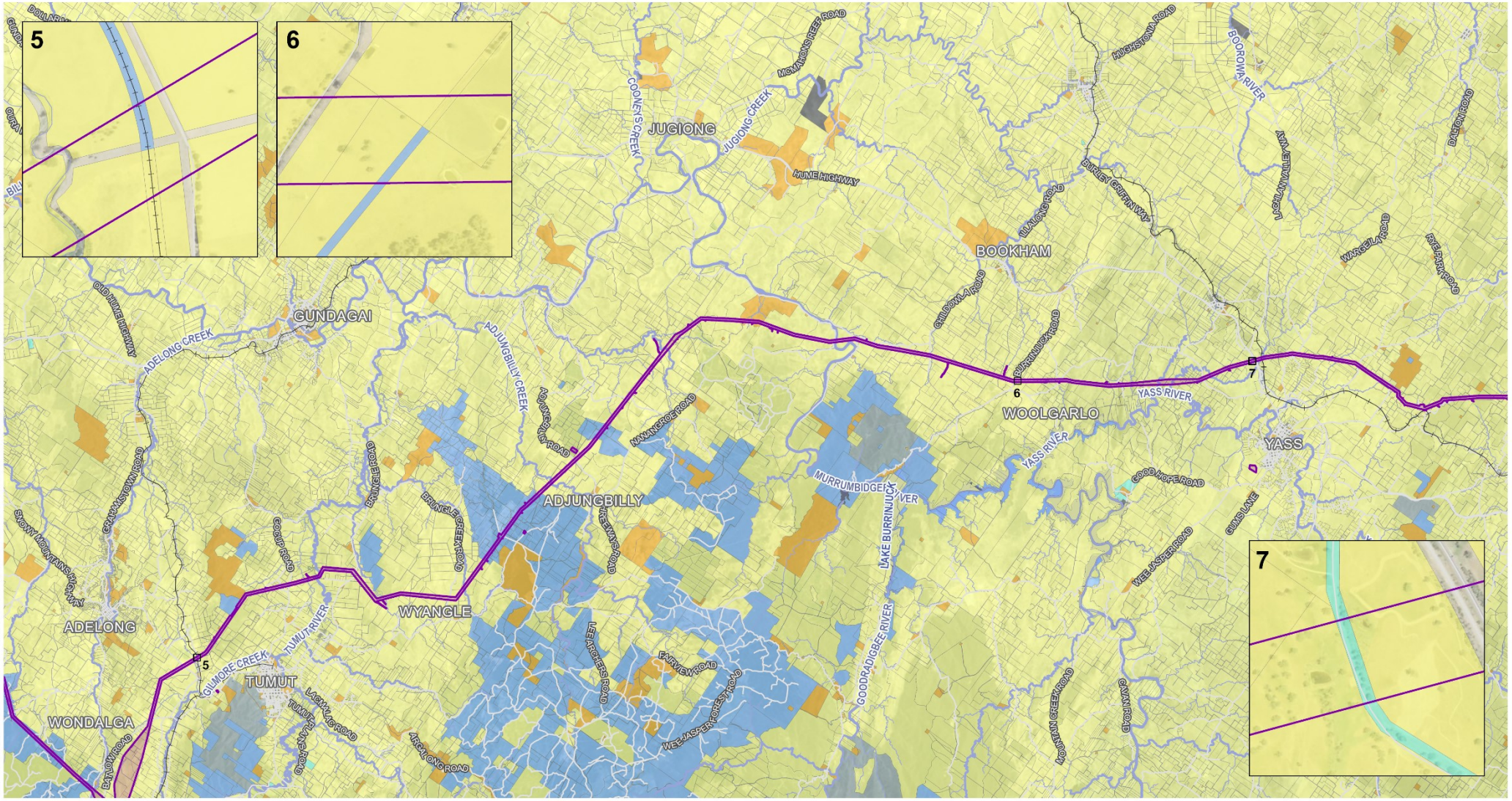
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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-2a: Property ownership



Project footprint
Railway
Watercourse
Substation
Controlling Authority
Crown
Freehold
Local Government Authority
NSW Government
Shared Crown / Council
Other

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

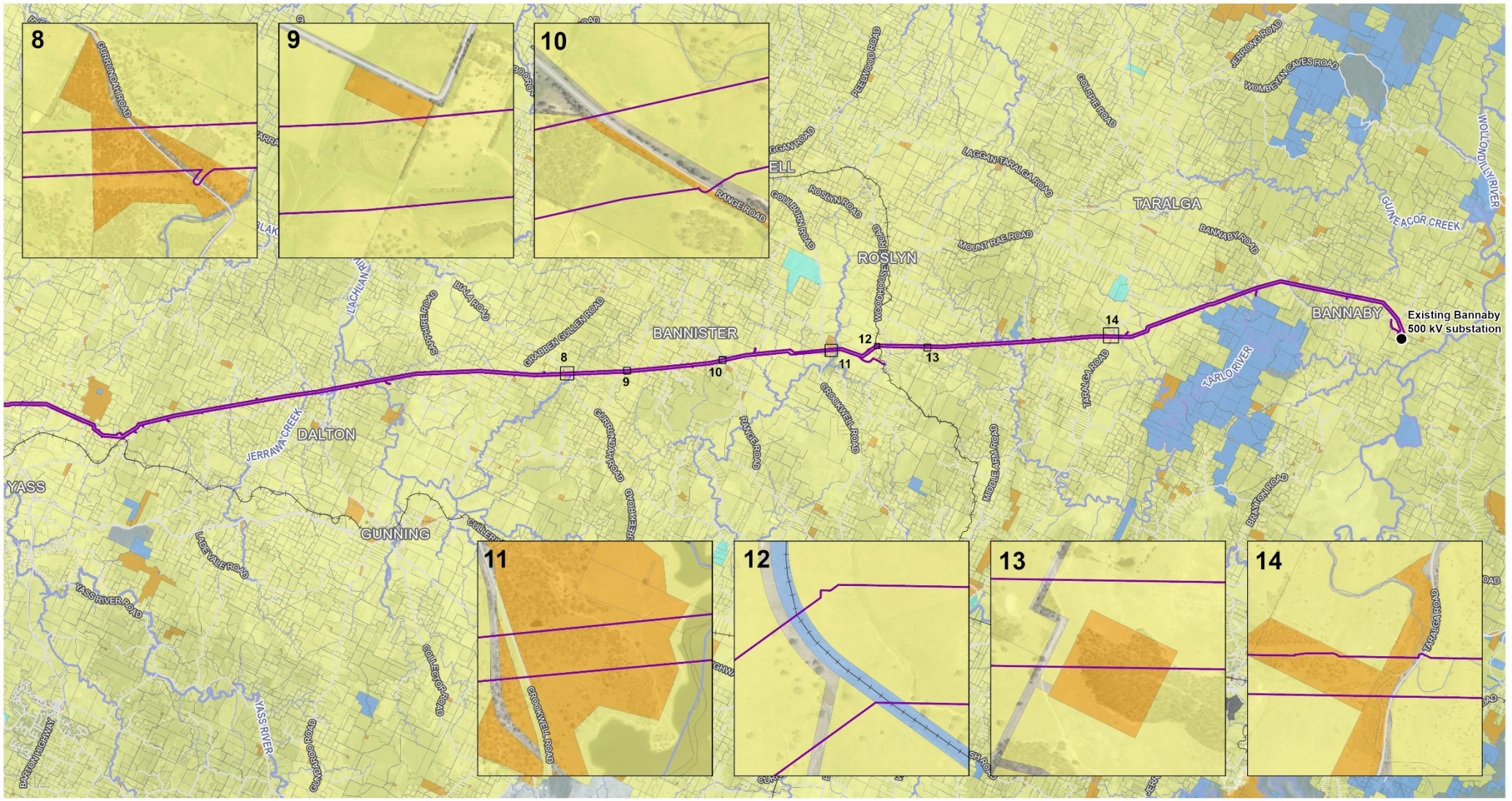
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Projection: GDA 1994 MGA Zone 55

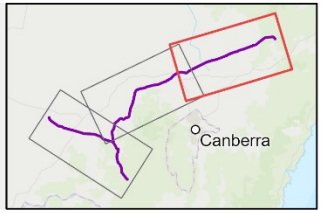
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FIGURE 11-2b: Property ownership

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Project footprint
Railway
Watercourse
Substation
Controlling Authority
Crown
Freehold
Local Government Authority
NSW Government
Shared Crown / Council
Other



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

1:310,000
0 7 14 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-2c: Property ownership

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11.3.2. Land use classification

Table 11-2 provides a summary of the land uses in the project footprint based on the Australian Land Use and Management (ALUM) classification system (Australian Bureau of Agricultural and Resource Economics and Sciences, 2016). The ALUM classification system provides land use classes at primary, secondary, and tertiary level. For the purposes of this assessment, the ALUM secondary land use classes have been used to analyse land uses in the land use and property study area and project footprint.

Figure 11-3 shows an overview of the land uses within and surrounding the project footprint.

Agricultural and primary production is the largest primary land use class in the land use and property study area and the project footprint. It comprises about 78.2 per cent of the land use and property study area and 96.7 per cent of the project footprint. The main secondary land use classes in the land use and property study area within agriculture and primary production include grazing modified pastures (29.3 per cent), grazing native vegetation (23.9 per cent), cropping (16.1 per cent) and production native forestry (ie State forests) (7.3 per cent).

Natural environment is the second largest primary land use class within the land use and property study area. It comprises about 17.1 per cent of the land use and property study area, of which nature conservation land use areas (eg national parks and nature reserves) comprise 16.5 per cent. There is no nature conservation land within the project footprint.

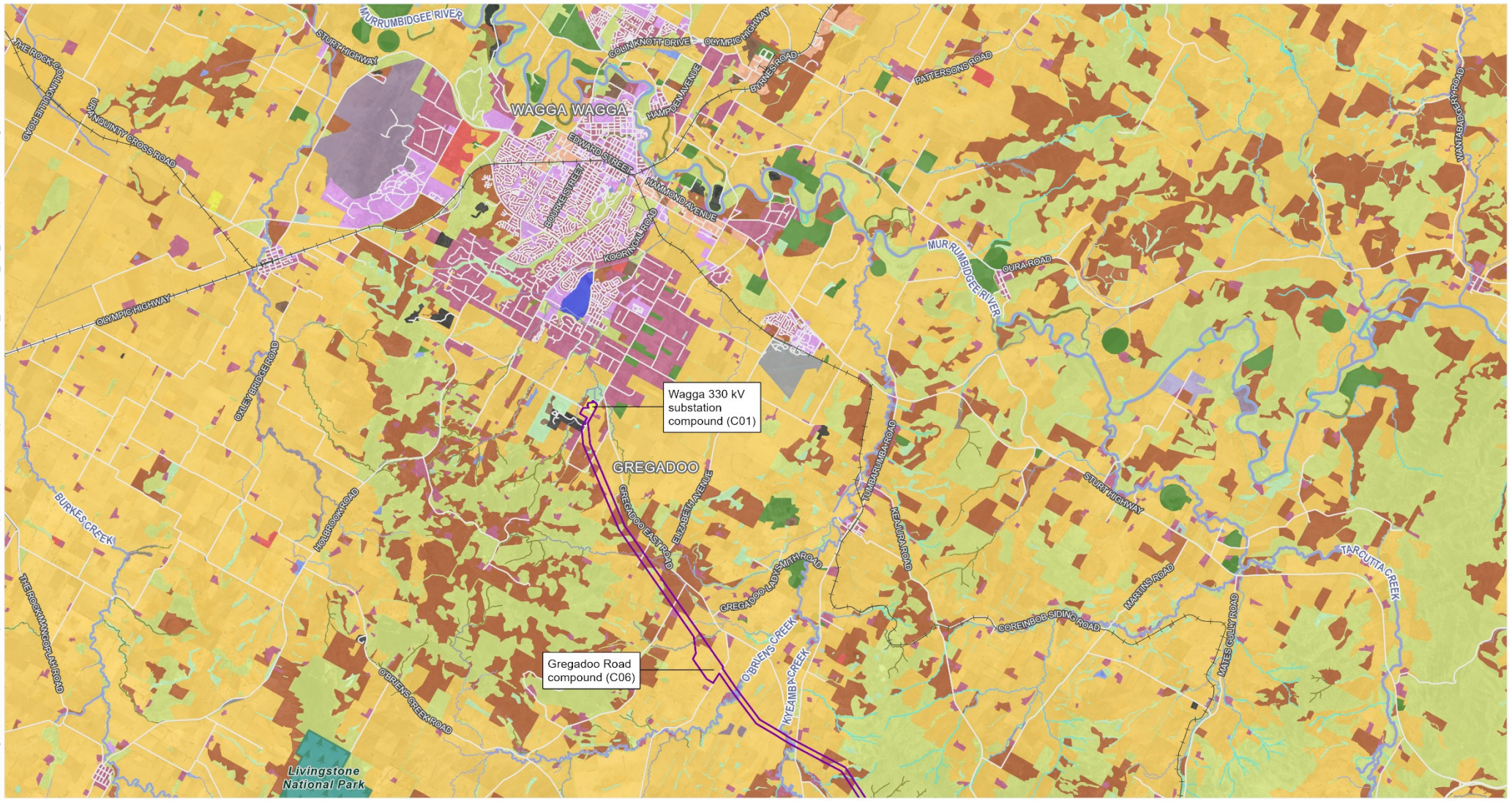
Table 11-2 provides a summary of the land uses in the project footprint based on the ALUM classification system (Australian Bureau of Agricultural and Resource Economics and Sciences, 2016). Figure 11-2 shows an overview of the land uses within and surrounding the project footprint. Further detail is provided in *Technical Report 5 – Land Use and Property Impact Assessment*.

Table 11-2 Summary of land use classes in the project footprint

ALUM land use classification	Approximate area within land use and property study area (ha)	Proportion of the land use and property study area (%)	Approximate area within project footprint (ha)	Proportion of the project footprint (%)
Agricultural and primary production				
2.1.0 Grazing native vegetation	698,533	24.2	2,171.9	25.4
2.2.0 Production native forestry	212,683	6.2	1,067.1	12.5
3.1.0 Plantation forests	32,797	1.1	21.5	0.2
3.2.0 Grazing modified pastures	855,829	29.6	4,200.1	49.1
3.3.0 Cropping	469,306	16.2	802.2	9.4
3.4.0 Perennial horticulture	894	<0.1	0.0	<0.1
3.5.0 Seasonal horticulture	102	<0.1	0.0	<0.1
3.6.0 Land in transition	595	0.0	3.3	< 0.1
4.1.0 Irrigated plantation forests	5	<0.1	0.0	<0.1
4.2.0 Grazing irrigated modified pastures	960	<0.1	0.0	<0.1
4.3.0 Irrigated cropping	8,353	0.3	0.0	<0.1
4.4.0 Irrigated perennial horticulture	2,730	0.1	4.1	< 0.1
4.5.0 Irrigated seasonal horticulture	6	<0.1	0.0	<0.1
5.1.0 Intensive horticulture	64	<0.1	0.0	<0.1
5.2.0 Intensive animal production	2,634	0.1	0.0	<0.1
Infrastructure and utilities				
5.6.0 Utilities	363	0.0	57.3	0.7
5.7.0 Transport and communication	12,329	0.4	8.4	0.1
5.9.0 Waste treatment and disposal	392	0.0	5.7	0.1

ALUM land use classification	Approximate area within land use and property study area (ha)	Proportion of the land use and property study area (%)	Approximate area within project footprint (ha)	Proportion of the project footprint (%)
Urban				
5.3.0 Manufacturing and industrial	1,023	0.0	0.1	< 0.1
5.4.0 Residential and farm infrastructure	50,715	1.8	14	0.2
5.5.0 Services	4,097	0.1	4.3	<0.1
Natural environment				
1.1.0 Nature conservation	481,366	16.7	0.0	0
1.2.0 Managed resource protection	10,543	0.4	26.4	0.3
1.3.0 Other minimal use	6,751	0.2	6.4	0.1
Extractive industries				
5.8.0 Mining	1,062	0.0	3.6	< 0.1
Water				
6.1.0 Lake	14,962	0.5	5.3	0.1
6.2.0 Reservoir/dam	1,158	0.0	0.5	< 0.1
6.3.0 River	43,329	1.5	124.6	1.5
6.5.0 Marsh/wetland	8,182	0.3	23.7	0.3
Total	**2,921,763**	**100**	**8,550.5**	**100**

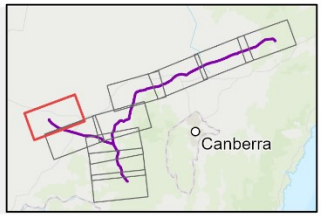
Note: land use data source (Department of Planning and Environment, 2020)



Project footprint
National park and reserve
Waterway
Railway

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
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.6.0 Land in transition
- 4.4.0 Irrigated perennial horticulture
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 5.9.0 Waste treatment and disposal
- 6.1.0 Lake
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland
- Other agricultural and primary production land use classes



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

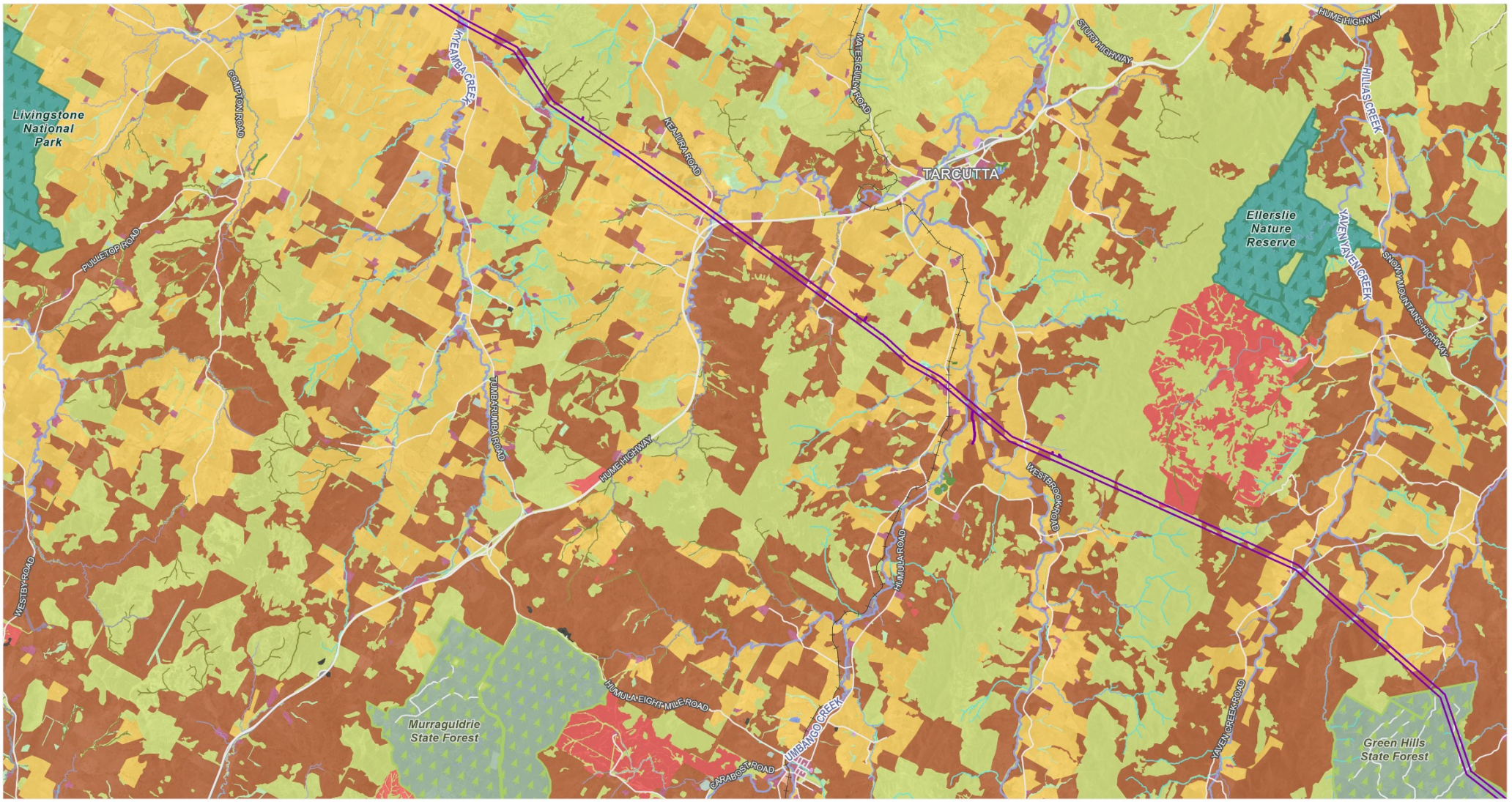
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0 3 6km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3a: Land uses within and surrounding the project footprint

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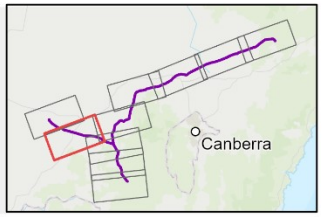


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- Project footprint
- National park and reserve
- State forest
- Waterway
- Railway

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
- 2.2.0 Production native forestry
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 4.4.0 Irrigated perennial horticulture
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland
- Other agricultural and primary production land use classes



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

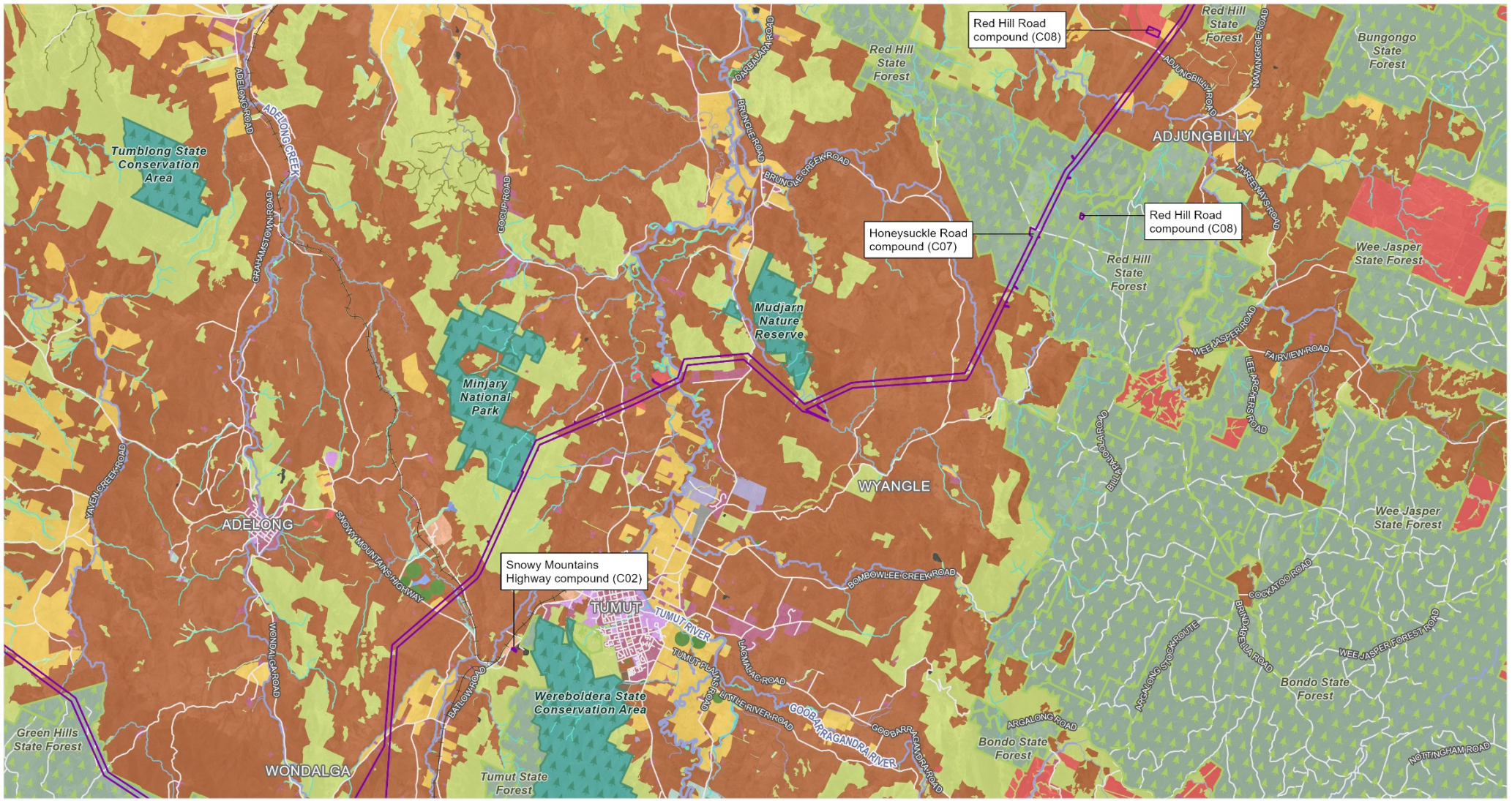
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0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

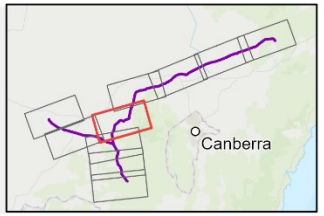
FIGURE 11-3b: Land uses within and surrounding the project footprint



Project footprint
National park and reserve
State forest
Waterway
Railway

Land Use 2017

1.1.0 Nature conservation
1.2.0 Managed resource protection
2.1.0 Grazing native vegetation
2.2.0 Production native forestry
3.1.0 Plantation forests
3.2.0 Grazing modified pastures
3.3.0 Cropping
3.6.0 Land in transition
4.4.0 Irrigated perennial horticulture
5.3.0 Manufacturing and industrial
5.4.0 Residential and farm infrastructure
5.5.0 Services
5.6.0 Utilities
5.7.0 Transport and communication
5.8.0 Mining
5.9.0 Waste treatment and disposal
6.2.0 Reservoir/dam
6.3.0 River
6.5.0 Marsh/wetland
Other agricultural and primary production land use classes



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

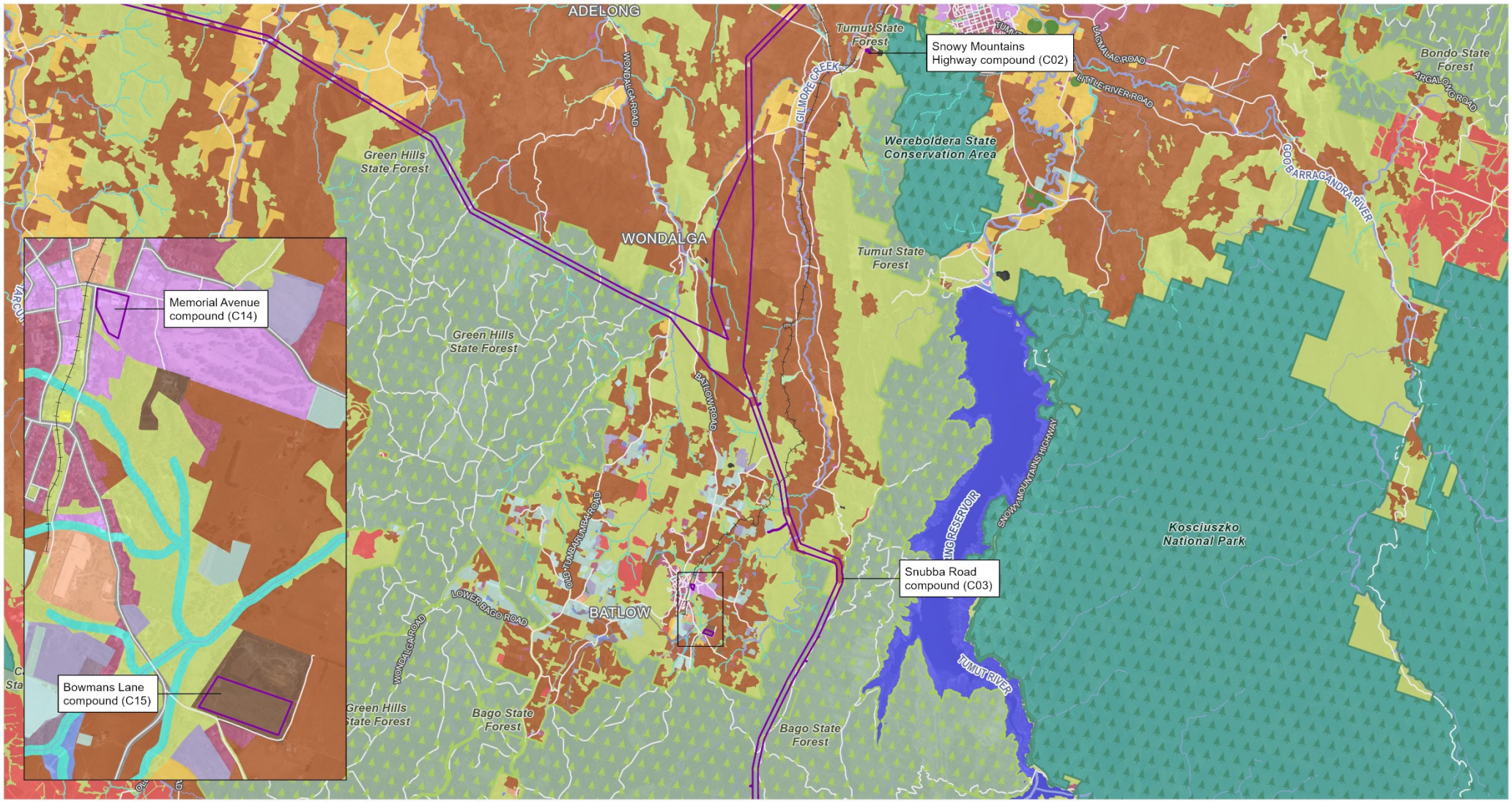
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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3c: Land uses within and surrounding the project footprint

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

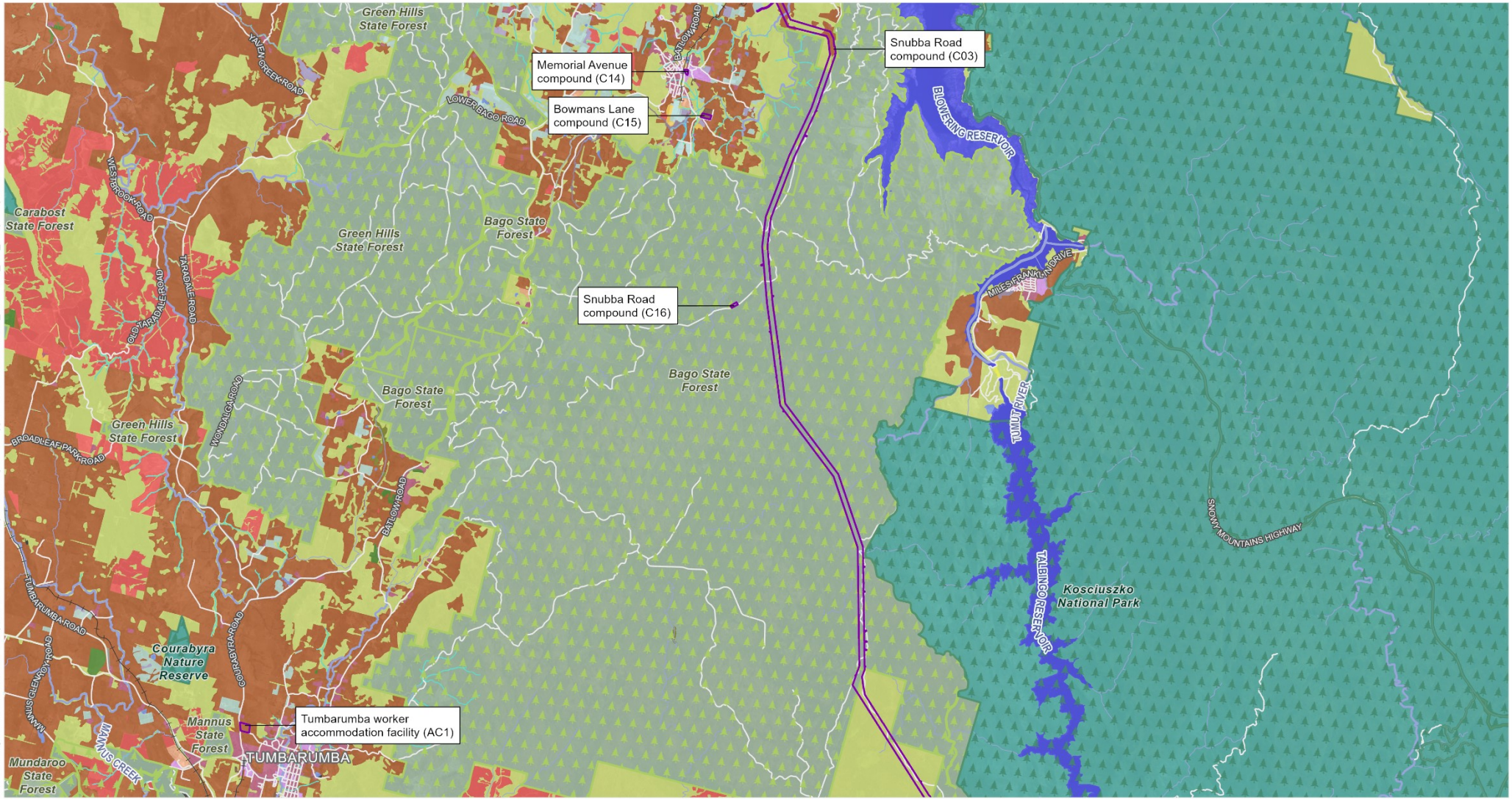
1:150,000

0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3d: Land uses within and surrounding the project footprint



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

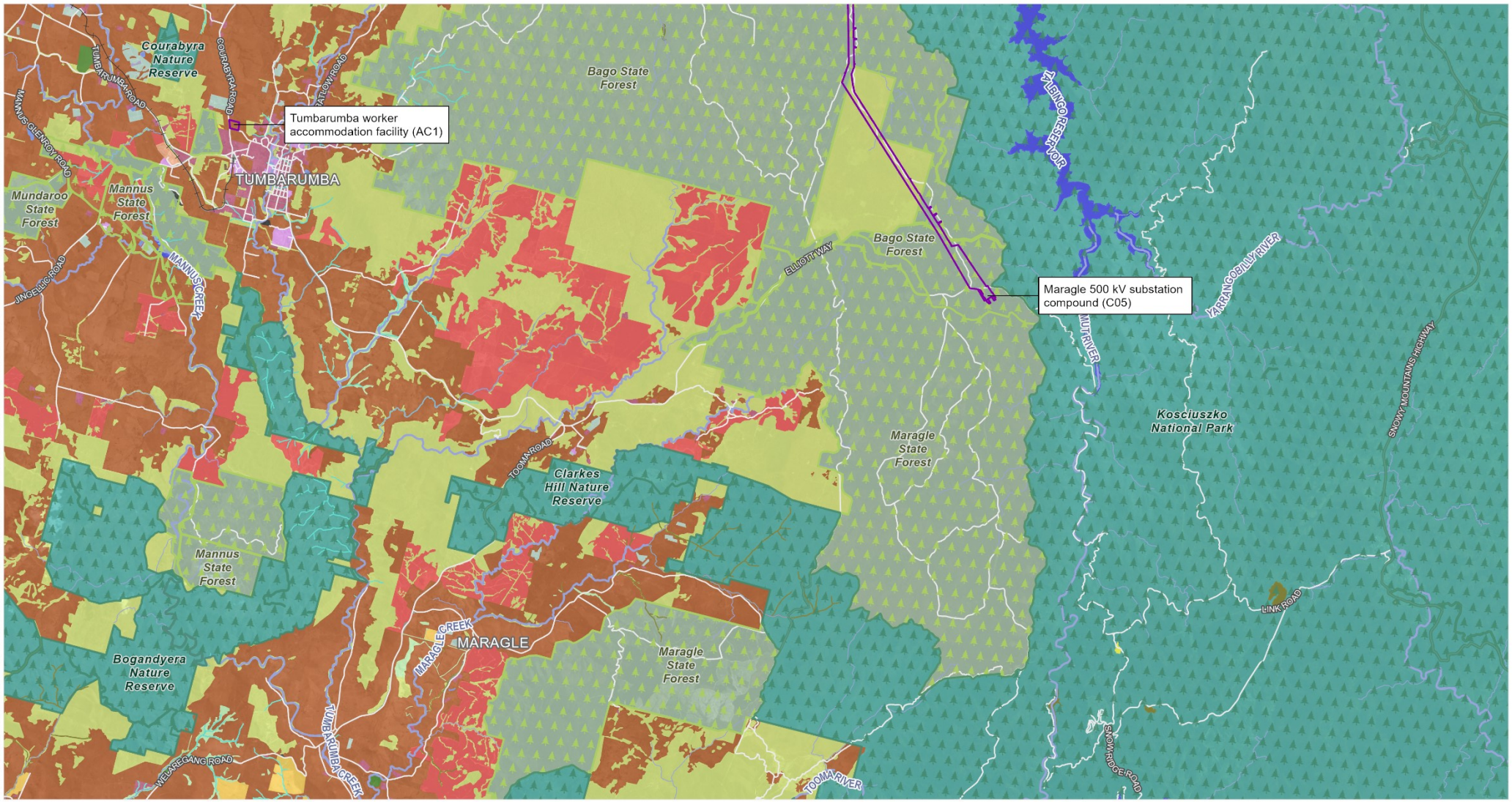
1:150,000

0 3 6km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3e: Land uses within and surrounding the project footprint



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

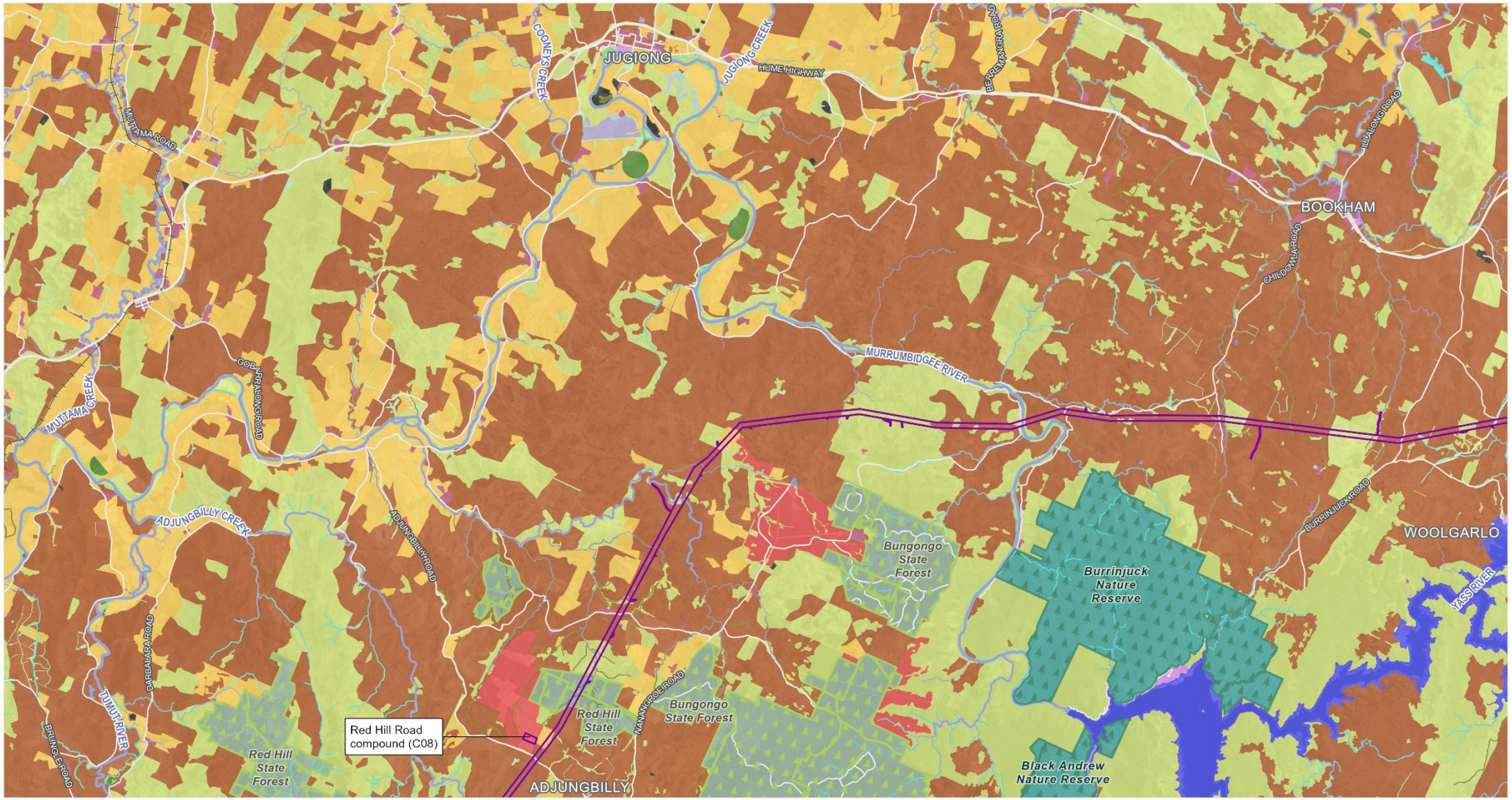
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0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3f: Land uses within and surrounding the project footprint

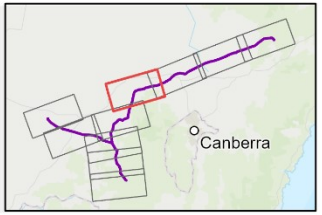


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Project footprint
National park and reserve
State forest
Waterway
Railway

Land Use 2017

1.1.0 Nature conservation
1.2.0 Managed resource protection
2.1.0 Grazing native vegetation
2.2.0 Production native forestry
3.1.0 Plantation forests
3.2.0 Grazing modified pastures
3.3.0 Cropping
3.6.0 Land in transition
4.4.0 Irrigated perennial horticulture
5.4.0 Residential and farm infrastructure
5.5.0 Services
5.6.0 Utilities
5.7.0 Transport and communication
5.8.0 Mining
6.1.0 Lake
6.2.0 Reservoir/dam
6.3.0 River
6.5.0 Marsh/wetland
Other agricultural and primary production land use classes



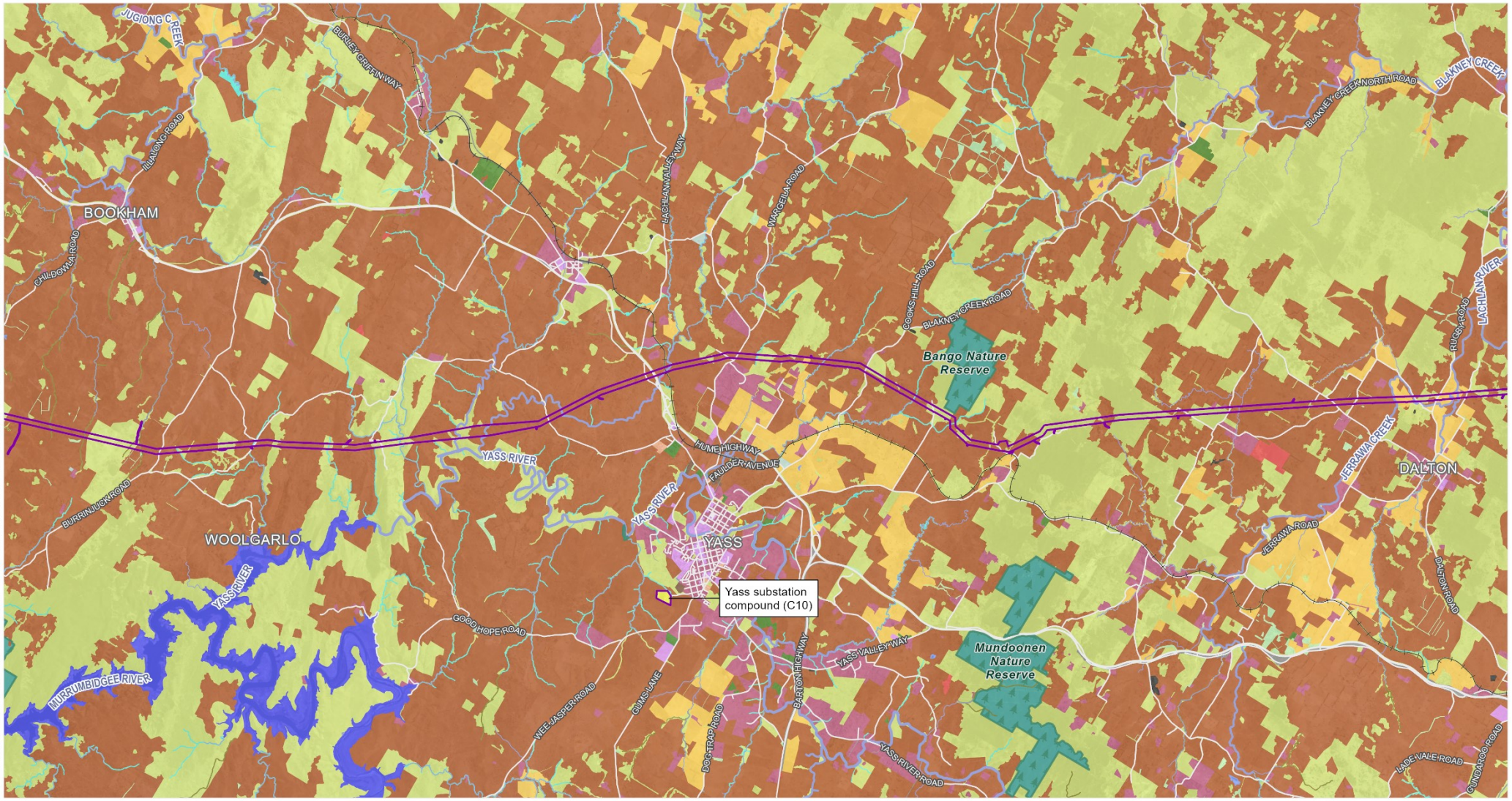
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3g: Land uses within and surrounding the project footprint



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

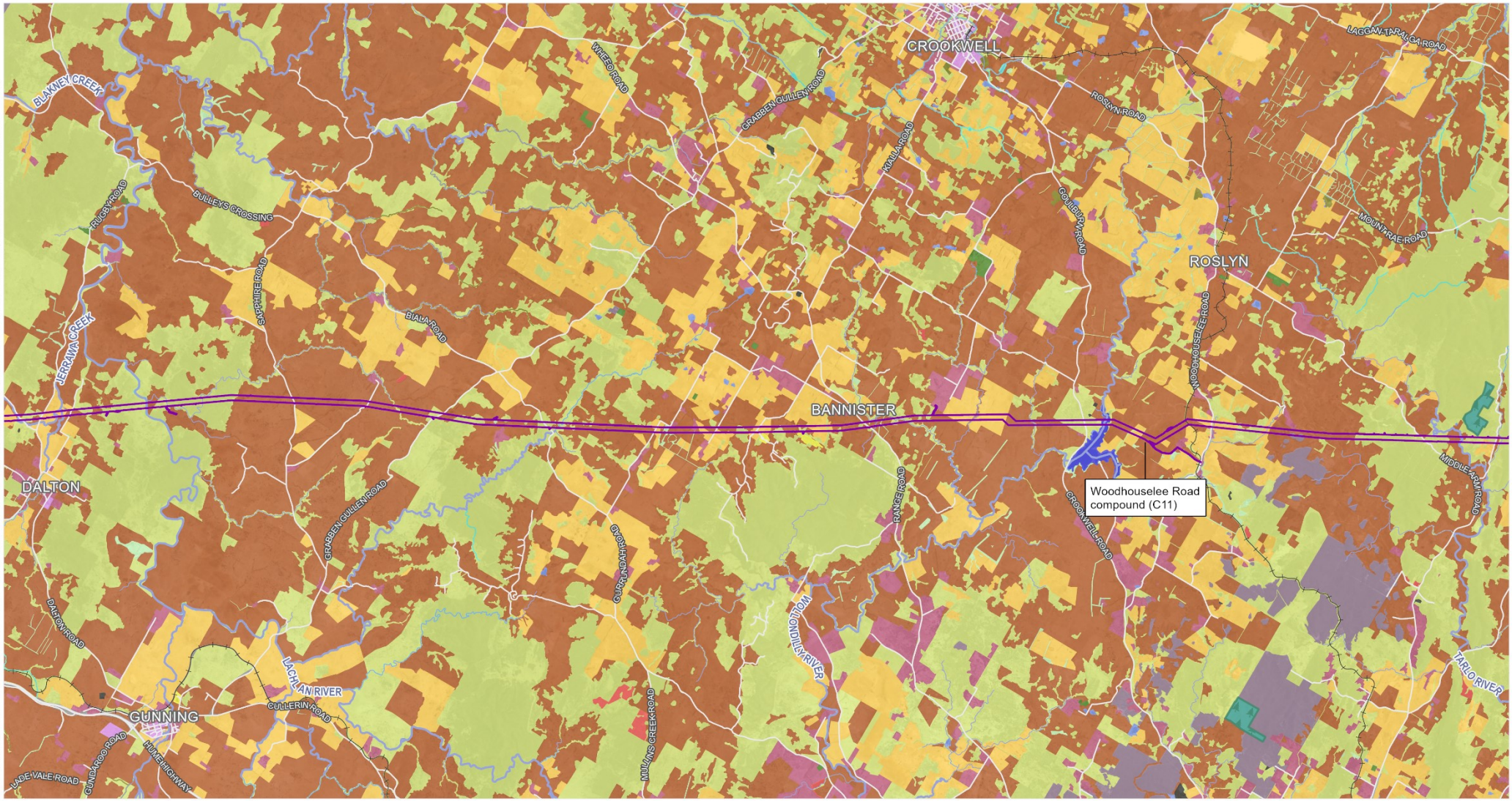
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0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3h: Land uses within and surrounding the project footprint

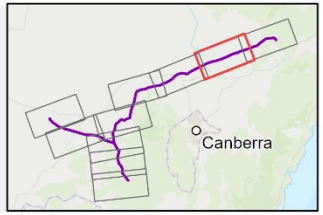


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Project footprint
National park and reserve
Waterway
Railway

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
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 5.9.0 Waste treatment and disposal
- 6.1.0 Lake
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland
- Other agricultural and primary production land use classes



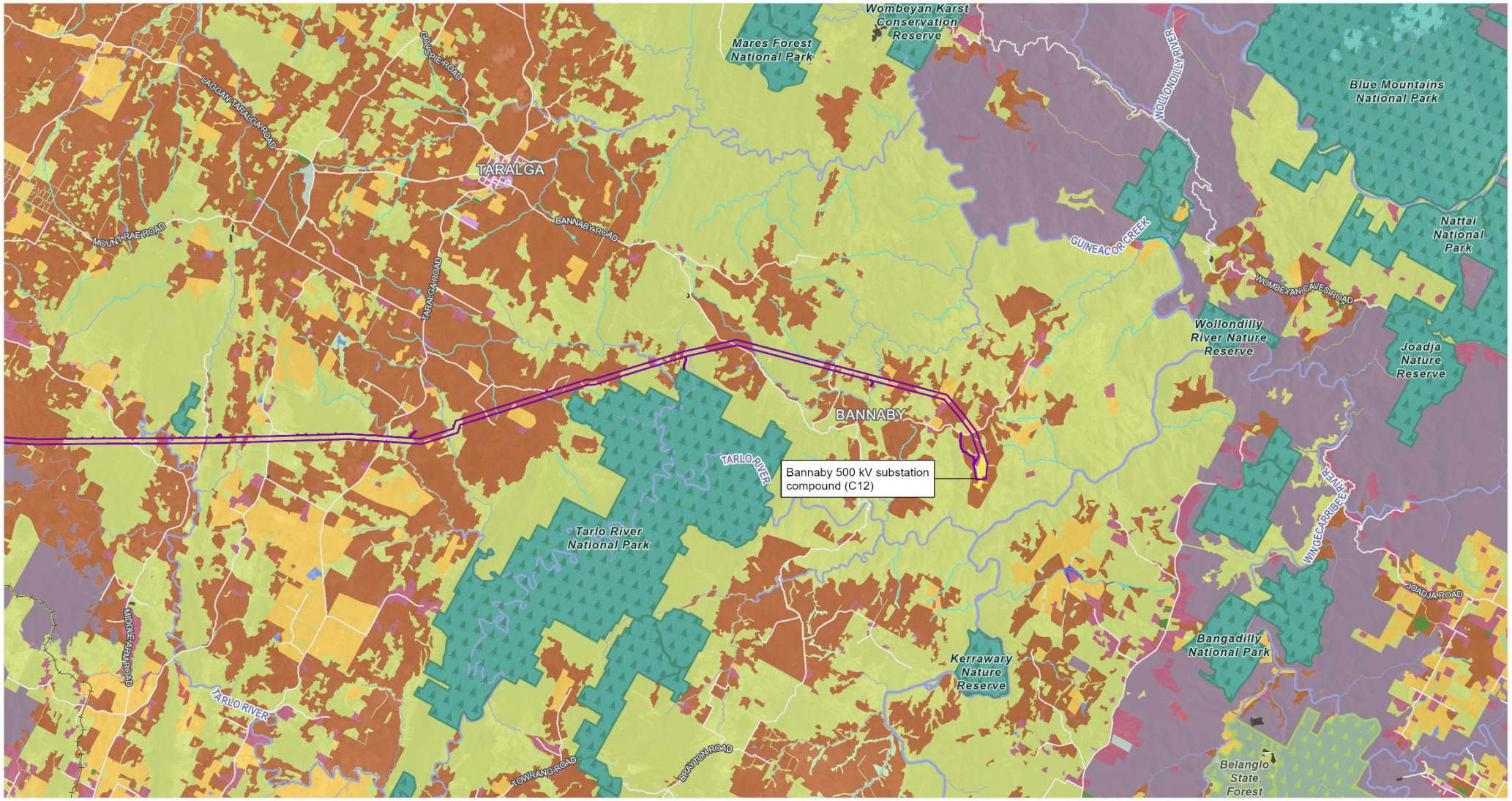
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:150,000
0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3i: Land uses within and surrounding the project footprint



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

1:150,000

0 3 6 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-3j: Land uses within and surrounding the project footprint

11.3.3. Land zoning

The main land use zone within the project footprint is RU1 Primary Production, which comprises about 66.1 per cent of the total area of zoned land and is spread throughout the project footprint. Other main land use zones include RU2 Rural Landscape (16.6 per cent) generally between Yass and Bannaby, and RU3 Forestry (12.8 per cent), which coincides with areas of State forests (refer to Section 11.3.5). Smaller areas of C3 Environmental Management land use zone, which comprise about 3.2 per cent of the total area of zoned land, also occur within the project footprint around Wollondilly River/Pejar Dam and south towards the future Maragle 500 kV substation. Table 11-3 provides further detail on land use zones within the project footprint.

Table 11-3 Land use zones within the project footprint

LEP land use zone	Approximate area within project footprint (ha)	Proportion of the project footprint (%)
C3 Environmental Management	276.4	3.2
C4 Environmental Living	0.1	< 0.1
IN1 General Industrial	3.1	< 0.1
R5 Large Lot Residential	60.4	0.7
RE1 Public Recreation	0.1	< 0.1
RU1 Primary Production	5,652.9	66.1
RU2 Rural Landscape	1,416.2	16.6
RU3 Forestry	1,091.4	12.8
SP1 Special Activities	15.1	0.2
SP2 Infrastructure	36.7	0.4
Total	**8,552.4**	**100**

11.3.4. Agricultural land

11.3.4.1. Agricultural land use and livestock

Agricultural and primary production is the largest primary land use class, comprising about 96.7 per cent of the project footprint (refer to Table 11-2). Of this, grazing modified pastures is the main secondary land use class (49.1 per cent), followed by grazing native vegetation (25.4 per cent).

Grazing modified pastures land uses are spread throughout the project footprint, especially between Bango and Wondalga. Grazing native vegetation land uses are generally concentrated between Bannister and Jerrawa. Cropping is prevalent in the project footprint between Wagga Wagga and Darlow and between Myrtleville and Dalton, with other smaller areas dispersed throughout the project footprint. Figure 11-3 shows the location of the grazing and cropping areas within and surrounding the project footprint. Further discussion on agricultural land is provided in Section 11.3.4.

Table 11-4 provides the total area of agricultural holdings in the land use and property study area for 2020 to 2021. Review of the 2021 Australian Bureau of Statistics (ABS) statistics for all five LGAs shows the main agricultural land use as being other broadacre crops such as wheat for grain and hay and silage. Fruit and nuts, grapes and other horticulture activities also occur but to a lesser extent. However, within these statistics there is a large portion described as ‘other’ land not used for cropping or horticulture. This is expected to be predominantly native vegetation or improved pastures used for grazing in addition to land

used for forestry, environmental purposes, infrastructure, intensive agriculture, or being of minimal use or unused land.

Table 11-4 Total area of agricultural holdings in the land use and property study area

LGAs	Area of holdings (ha)	Number of businesses	Average size (ha)
Wagga Wagga City	444,995	463	961
Snowy Valleys	236,493	421	562
Cootamundra-Gundagai Regional	338,839	285	1,189
Yass Valley	242,441	340	713
Upper Lachlan Shire	387,447	586	661
Total	**1,650,215**	**2,095**	**788**

Source: ABS, 2022

Aerial agricultural operations (such as aerial spreading of fertiliser and pesticides) are extensively used in the mixed dryland farming areas near Wagga Wagga and Tarcutta. Aerial agricultural operations are less intensive in the eastern part of the agricultural study area, as aerial applications are less frequent in horticultural and grazing situations. Despite this, landowners indicated that some weed control and fertiliser applications are undertaken by air.

The main livestock carried in the land use and property study area are sheep and lambs followed by cattle for meat and dairy. Pigs, goats and other livestock make up the remainder (ABS, 2022).

11.3.4.2. Land and soil capability

Land in NSW is commonly classified according to the capability of land to remain stable under particular land uses. In accordance with the LSC Assessment Scheme (OEH, 2012), there are eight classes of land capability, with class 1 representing extremely high capability land and class 8 representing extremely low capability land.

The majority of the agricultural study area and project footprint is comprised of very low to moderate capability lands (class 4 to 7), which comprise about 93-94 per cent of the total areas of the agricultural study area and project footprint. However, the portion of very low to low capability land (class 6 to 7) is higher for the project footprint (57.9 per cent) than for the agricultural study area (51.8 per cent). The main areas of very low to low capability land within the project footprint are between the Tarcutta area and Batlow, and between Wyangle and Bookham.

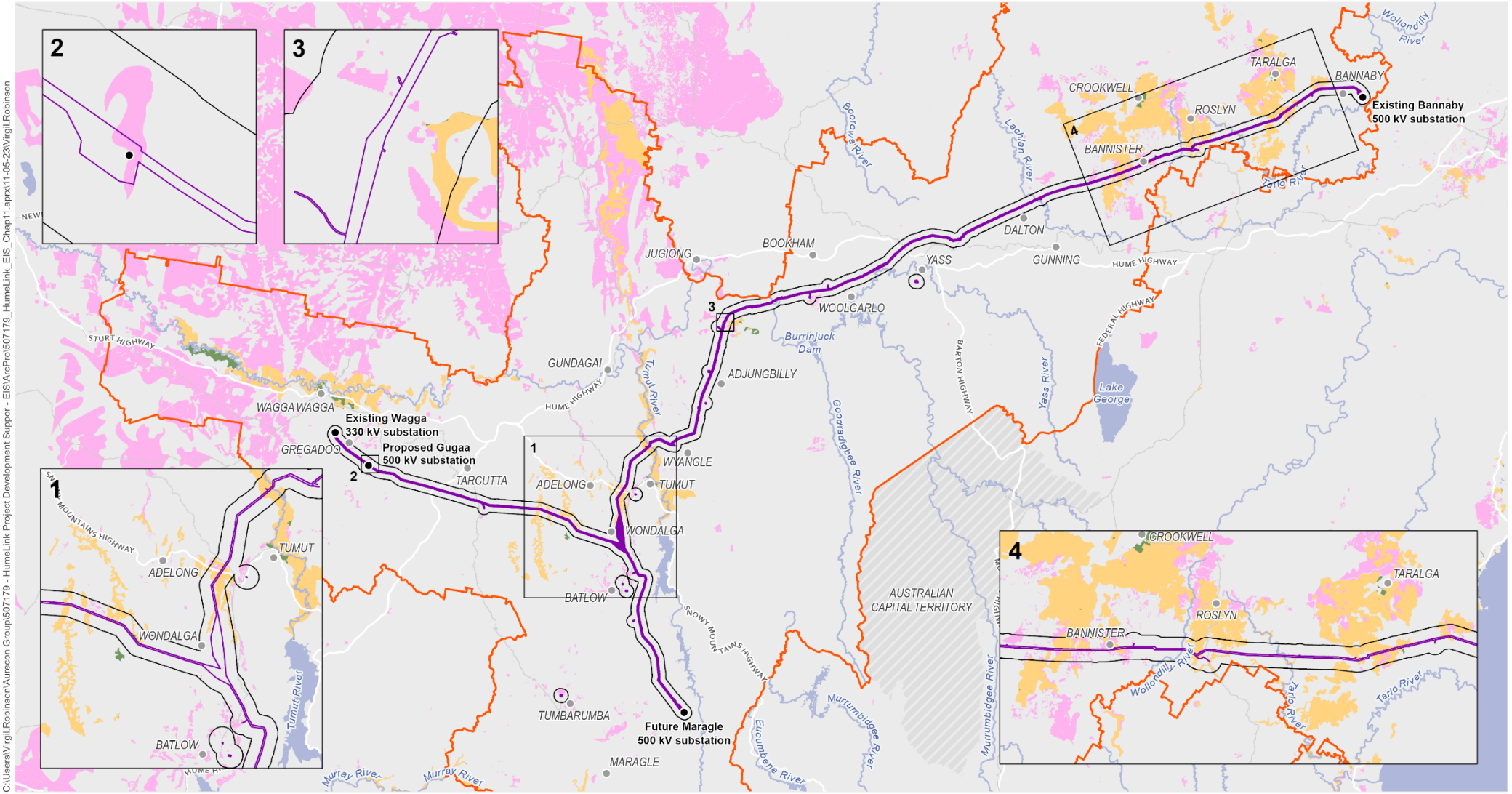
High capability land (class 3) comprises about six per cent of the agricultural study area and project footprint, which is mostly located around Tumut in the river valleys, with some areas also located near Bannister and Taralga. There are no areas of very high to extremely high capability land (class 1 to 2) in the agricultural study area or project footprint.

Land capability is also shown on BSAL mapping, which identifies land with high quality soil and water resources capable of sustaining high levels of productivity (OEH, 2013). A total of 2.8 million hectares of BSAL has been identified and mapped at a regional scale across the State. Around 447 hectares of BSAL is located within the project footprint (equivalent to 5.2 per cent of the total area of the project footprint) and includes:

- small areas south-west of Adelong
- east, south and north of Tumut along the Tumut and Goobarragandra rivers
- around Bannister
- south of Roslyn
- south of Taralga
- small areas east of Taralga.

Similar to BSAL mapping, draft SSAL mapping can also be used to represent land capability. This land is inherently fertile and generally lacks significant biophysical constraints making it sustainable for intensive agricultural production such as cultivation with minimal management practices to maintain its high quality. A draft map of SSAL was released by DPI in 2021. The distribution of draft SSAL across the agricultural study area is similar to BSAL, as their identification is based on similar parameters. However, there are slightly greater areas of draft SSAL than BSAL, especially south of Jugiong and around Bannister. Around 534 hectares of draft SSAL is located within the project footprint, which is equivalent to 6.2 per cent of the total area of the project footprint.

Figure 11-4 shows the distribution of BSAL and draft SSAL within and surrounding the agricultural study area and project footprint.



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

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0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-4: BSAL and draft SSAL mapping

11.3.4.3. Biosecurity risks

Biosecurity risks to agriculture within the agricultural study area are associated with the presence and spread of weeds, pest animals and plant and animal diseases.

The following biosecurity risks have been identified from desktop review, engagement with representatives from LLS, council and landowners, and property inspections (refer to Section 11.2.2.2) within the agricultural study area:

- the most common weed recorded during property inspections was Blackberry (*Rubus fruticosus sp. agg*), a State priority weed within the Riverina LLS and South East LLS regions, which was found in relatively high numbers
- 13 State priority weeds mainly recorded in the Wagga Wagga to Tarcutta and Tarcutta to Tumut sections of the agricultural study area
- 24 regional priority weeds, with Chilean Needle Grass (*Nassella neesiana*), Coolatai Grass (*Hyparrhenia hirta*) and Serrated Tussock (*Nassella trichotoma*) the most widespread regional priority weeds.

Technical Report 1 - Biodiversity Development Assessment Report also considers the presence of weeds within the project footprint and surrounding land which is based on field surveys within accessible lands in accordance with Commonwealth and state government guidelines (refer to Chapter 8 (Biodiversity)).

Foxes, wild rabbits and kangaroos have a widespread distribution across the agricultural study area (Riverina LLS, 2018 and South East LLS, 2018). Other more localised pest species within the agricultural study area include feral goats, wild pigs, feral horses, deer and wild dogs. Plague locusts and mice can also cause problems in favourable seasons. Footrot, lice, and ovine Johnes disease (OJD) are likely to be the highest livestock pest and disease risks within the agricultural study area.

Footrot is a contagious bacterial disease of sheep and goats. However, the occurrence of footrot in the vicinity of the agricultural study area has been low in recent years. In 2021, the infection rate was 0.6 per cent for the Riverina and South East LLS regions (DPI, 2022b).

OJD is a wasting disease of sheep that can result in sizeable economic losses on infected farms due to sheep deaths, lost meat production, fewer lambs and less wool. Most of the agricultural study area was mapped in a high prevalence area of OJD in 2011 due to prevalence of OJD in the preceding two years, with more than 12.5 per cent of flocks estimated to be infected (DPI, 2011b). However, recent data is limited, and landowners consulted as part of the agricultural land impact assessment noted that OJD is not a substantial problem and is currently well managed.

Horticultural enterprises are particularly susceptible to plant diseases and pests. All of the agricultural study area is within the Phylloxera Exclusion Zone, which bans the taking of grapevines, cuttings or budwood into this zone. The agricultural study area is also in the Potato Biosecurity Zone, which covers all of NSW and restricts movement of plants belonging to the family *Solanaceae*.

Other plant and animal diseases relevant to the agricultural study area include exotic and endemic pests and diseases of the apple and other fruit industries. Exotic pests have the potential to severely impact the honeybee and pollination- dependent industries if they were to become established.

11.3.4.4. Travelling stock reserves

The grazing industry uses a network of TSRs for moving or grazing stock on foot around NSW. These are commonly managed by LLS under the *Local Land Services Act 2013*. 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 (eg for overnight yarding). In addition to the TSRs, livestock can also be moved along public roads subject to a permit from the LLS.

There are 26 TSRs within or partially located in the agricultural study area, with several TSRs being formed of multiple Crown reserves. Table 11-5 provides details of four of the 25 TSRs that are intersected by the project footprint. Overall, the project footprint intersects about 18.4 hectares of TSRs.

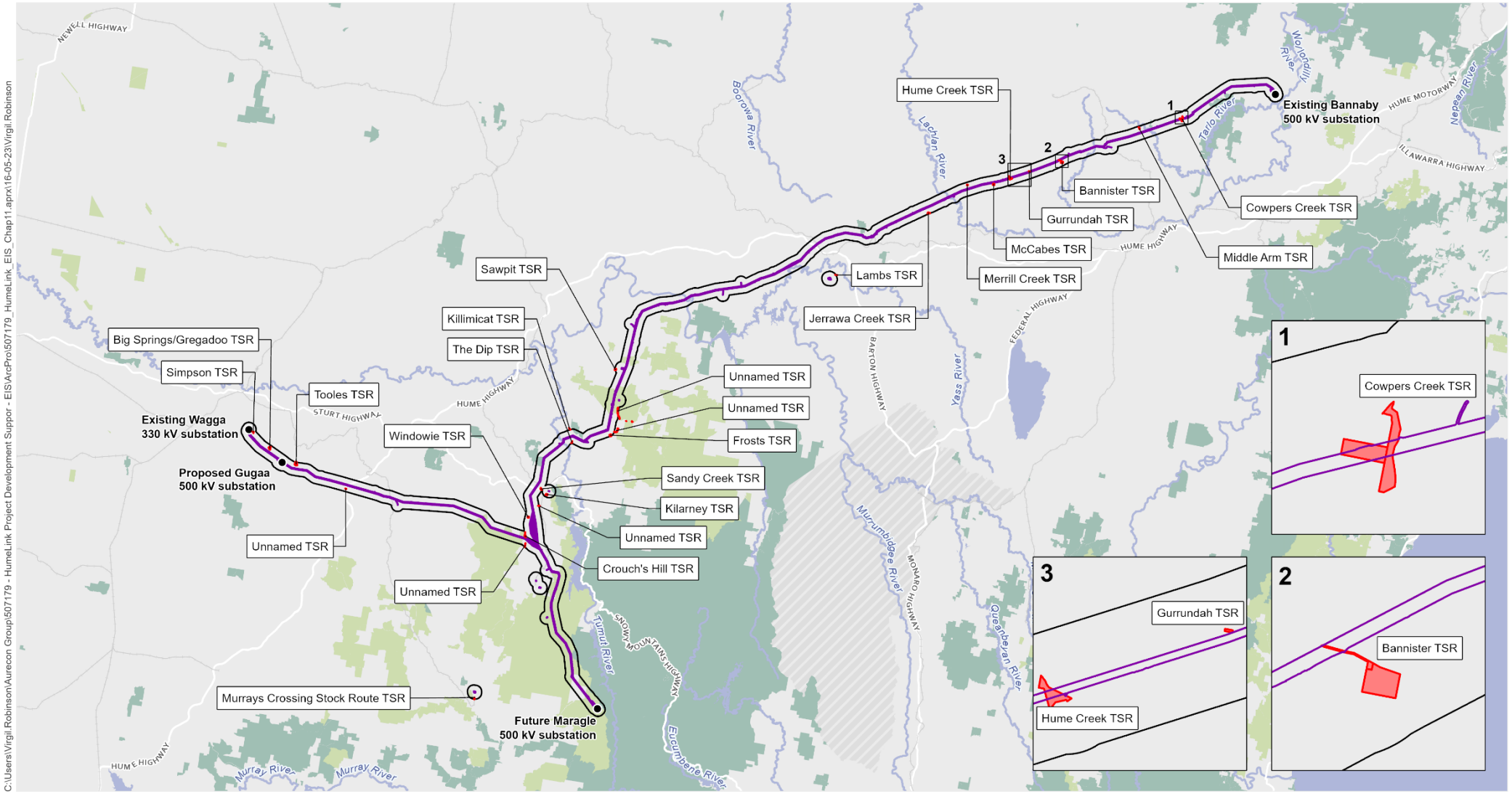
Table 11-5 TSRs intersected by the project footprint

TSR	LLS region	Crown reserve number	Area within the project footprint (ha)	Proportion of TSR intersected by project footprint (%)
Hume Creek	South East	R59606	6.6	30.0
Gurrundah	South East	R89984	< 0.1	0.1
Bannister	South East	R81021 R60709	0.6	3.2
Cowpers Creek	South East	R1002001 R37833	11.2	36.0

Source: LLS, 2021

In addition to TSRs, 'livestock highways' are a key network of livestock routes connecting key agricultural regions within NSW, and with QLD and VIC (Department of Industry, 2017). No livestock highways have been identified within the project footprint.

Figure 11-5 shows the location of TSRs in relation to the project footprint.



C:\Users\Virgil.Robinson\Aurecon Group\507179 - HumeLink Project Development Suppor - EIS\ArcPro\507179_HumeLink_EIS_Chap11.aprx\16-05-23\Virgil.Robinson

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

1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 11-5: TSRs within agricultural study area and project footprint

11.3.4.5. Agricultural productivity

Agricultural productivity is described by considering employment in the agricultural industry, the types of agricultural land use and livestock carried, and the value of agricultural production.

Agriculture, forestry and fishing are the largest industries (by number of persons employed) in three of the five LGAs within the land use and property study area (ie Snowy Valleys, Cootamundra-Gundagai Regional and Upper Lachlan Shire LGAs). Total employment in the agriculture, forestry and fishing industries is estimated at around 4,500 persons across all five LGAs. This is about nine per cent of all employed persons in the five LGAs. In 2020, there were 3,448 agriculture, forestry and fishing businesses in the five LGAs (ABS, 2021a). This is about 29 per cent of all businesses within the five LGAs, but the proportion was 36 to 62 per cent in the Snowy Valleys, Cootamundra-Gundagai Regional and Upper Lachlan Shire LGAs.

11.3.4.6. Value of agricultural production

The total gross value of agricultural production across the land use and property study area in 2020-21 was $973 million (ABS, 2022). The disposal of cattle and calves (mostly for meat) was the most valuable agricultural commodity produced in 2020-21 at over $250 million. It was followed by wool, sheep and lamb, wheat and other broadacre crops. Each commodity was valued at over $100 million.

The total gross value of agricultural production in 2020-21 was equivalent to $590 per hectare over the total area of agricultural holdings (1,650,215 hectares) in the land use and property study area. However, there were differences between the LGAs which reflect the nature of the agricultural enterprises present. Snowy Valleys LGA had the highest overall average gross value ($838 per hectare) due to the large average gross value of the horticulture industry. The average gross value of production in the Wagga Wagga City LGA ($748 per hectare) was enhanced by its extensive cropping enterprises.

Further detail on the value of agricultural production is provided in *Technical Report 4 – Agricultural Impact Assessment*.

11.3.5. Forestry land

Production native forestry is the dominant land use in the project footprint south of Tumut, in the areas surrounding Batlow (refer to Figure 11-3). Production native forestry is also significant in the project footprint between Wondalga and Westwood, as well as north of Tumut in Red Hill and Adjungbilly. Figure 11-3 shows the location of the forestry land within and surrounding the project footprint.

Forestry and timber processing are important land uses to the regional economy, particularly to the Snowy Valleys LGA. Forestry land within the land use and property study area consists of production native forestry land (ie State forests) and plantation forests (ie privately owned plantation forests).

State forests are managed by the FCNSW to balance environmental conservation, recreation, and timber production. The project footprint intersects about 1,087.5 hectares of State forest south of Batlow towards the future Maragle 500 kV substation which is mainly associated with Bago State Forest. Table 11-6 details the State forests intersected by the project footprint, with Figure 11-2 showing their location.

Table 11-6 State forests intersected by the project footprint

State forest	Forest type	Area within the project footprint (ha)	Proportion of State forest intersected by project footprint (%)
Green Hills State Forest	Softwood plantations	239.5	0.9
Red Hill State Forest	Softwood plantations	171.8	1.7
Bago State Forest	Softwood plantations Hardwood forests	675.8	1.3
Total		**1,087.1**	**1.2**

Source: FCNSW, 2014

The project footprint also intersects about 21.5 hectares of land identified as being used for privately owned plantation forests. This includes plantation forests around Adjungbilly and Gobarralong, Gocup, and Ellerslie (refer to Figure 11-3).

11.3.6. Other land uses

11.3.6.1. Natural environment

Despite covering a relatively large percentage of the land use and property study area (about 17.3 per cent), natural environment land use only occupies about 0.4 per cent of the project footprint, most of which is used for managed resource protection (including riparian areas and landscaped areas) (refer to Table 11-2). No nature conservation land use areas are mapped within the project footprint. However, the project footprint is located close to a number of national parks, nature reserves, and state conservation areas including (refer to Figure 11-3):

- Minjary National Park – less than 10 metres west of the project footprint
- Mudjarn Nature Reserve – about 180 metres north of the project footprint
- Bango Nature Reserve – about 140 metres north of project footprint
- Back Arm Nature Reserve – about 70 metres north of the project footprint
- Tarlo River National Park – less than 10 metres south of the project footprint
- Kosciuszko National Park – about 90 metres east of the project footprint.

11.3.6.2. Infrastructure and utilities

Major transport infrastructure intersected by the project footprint includes the Hume Highway, Batlow Road, Snowy Mountains Highway, Gocup Road and the Main Southern Railway Line, about seven kilometres north-west of Yass. The project footprint also intersects numerous other regional and local roads and four non-operational railway lines. Chapter 20 (Traffic, transport and access) provides further detail on transport infrastructure within and surrounding the project footprint.

The project footprint intersects a number existing Transgrid assets including the Wagga 330 kV substation, Yass 330 kV substation and Bannaby 500 kV substation. In addition, three substations are located adjacent to the project footprint between Bannister and the Bannaby 500 kV substation: Gullen Range 330 kV substation, Crookwell 2 330 kV substation and Bannaby 330 kV substation. Several existing high-voltage transmissions lines (eg 132 kV and 330 kV) also run parallel and/or intersect the project footprint for the majority of its length.

In addition to Transgrid assets, the Gullen Range Wind Farm and Gullen Solar Farm at Bannister and the Crookwell 2 Wind Farm at Woodhouselee are intersected by the project footprint. However, the main infrastructure associated with the wind farm and solar farm (eg wind turbines and solar array) is located

outside the project footprint. Only ancillary infrastructure such as access tracks and electricity transmission lines (over and/or underground) are located within the project footprint. Three future wind farm projects are also intersected by the project footprint (refer to Chapter 25 (Cumulative impacts)).

The project footprint also contains a number of existing local utility services including council assets (eg water mains), telecommunication lines, and power distribution lines (eg 11 kV, 33 kV and 66 kV lines). However, there are no major water or gas pipelines located within the project footprint. The closest gas pipelines include the Moomba to Sydney and Dalton to Canberra underground gas pipelines, which are both located about 3.5 kilometres from the project footprint at Dalton. The closest major water pipelines are the Oura to Ungarie underground water pipeline and Jugiong to Boorowa underground water pipeline, which are both located 15 kilometres from the project footprint at Gregadoo and Gobarralong, respectively.

11.3.6.3. Urban

While the project footprint does not include major urbanised areas, the regional centres near the project footprint include Wagga Wagga (about five kilometres from the project footprint), Tumut (about four kilometres from the project footprint) and Yass (about five kilometres from the project footprint) as well as smaller settlements such as Gilmore and Dalton. The primary urban land use within the project footprint is residential and farm infrastructure. In the context of the project footprint, residential land use is primarily associated with residences on large lots (eg greater than one hectare).

11.3.6.4. Extractive industries

No mining leases have been identified within or near the project footprint. However, the project footprint intersects 17 current mineral exploration licences held by 12 companies. The identified exploration licences were observed to occur across a range of land tenures and uses, including Crown land and freehold land.

The project footprint intersects a number existing Transgrid assets including the Wagga 330 kV substation, Yass 330 kV substation and Bannaby 500 kV substation. In addition, three substations are located adjacent to the project footprint between Bannister and the Bannaby 500 kV substation: Gullen Range 330 kV substation, Crookwell 2 330 kV substation and Bannaby 330 kV substation. Several existing high-voltage transmissions lines (eg 132 kV and 330 kV) also run parallel and/or intersect the project footprint for the majority of its length.

In addition to Transgrid assets, the Gullen Range Wind Farm and Gullen Solar Farm at Bannister and the Crookwell 2 Wind Farm at Woodhouselee are intersected by the project footprint. However, the main infrastructure associated with the wind farm and solar farm (eg wind turbines and solar array) is located outside the project footprint. Only ancillary infrastructure such as access tracks and electricity transmission lines (over and/or underground) are located within the project footprint. Three future wind farm projects are also intersected by the project footprint: Jeremiah Wind Farm (subject to approval), Rye Park Wind Farm and Crookwell 3 Wind Farm (refer to Chapter 25 (Cumulative impacts) for consideration of these projects).

The project footprint also contains a number of existing local utility services including council assets (eg water mains), telecommunication lines, and power distribution lines (eg 11 kV, 33 kV and 66 kV lines). However, there are no major water or gas pipelines located within the project footprint. The closest gas pipelines include the Moomba to Sydney and Dalton to Canberra underground gas pipelines, which are both located about 3.5 kilometres from the project footprint at Dalton. The closest major water pipelines are the Oura to Ungarie underground water pipeline and Jugiong to Boorowa underground water pipeline, which are both located 15 kilometres from the project footprint at Gregadoo and Gobarralong, respectively.

11.4. Potential impacts – construction

11.4.1. Property and ownership impacts

The project would require the use of land both temporarily and permanently. While the permanent land requirements would commence during construction, these impacts would be long-term and relate to operation. Refer to Section 11.5 for a discussion of permanent property impacts.

11.4.1.1. Tenure and ownership

Temporary adjustments to property tenure or ownership arrangements would be required to facilitate construction of the project. The temporary arrangements would involve leases of freehold, government and Crown land and landowner agreements for construction access and establishment of temporary construction facilities.

Proposed leases associated with the establishment and use of construction compounds and the worker accommodation facility would include:

- about 40.6 hectares of freehold land associated with Snubba Road compound (C03), Gregadoo Road compound (C06), Adjungbilly Road compound (C09), Woodhouselee Road compound (C11) and Memorial Avenue compound (C14)
- about 28.6 hectares of land owned by Snowy Valley Council associated with Snowy Mountains Highway compound (C02), Bowmans Lane compound (C15) and the Tumbarumba accommodation facility (AC1)
- about 10.8 hectares of land owned by FCNSW associated with Honeysuckle Road compound (C07) and Red Hill Road compound (C08)
- about 2.6 hectares of Crown land managed by FCNSW associated with Snubba Road compound (C16).

Land may also be temporarily required for additional construction facilities and work sites such as temporary access tracks and minor staging, brake and winch sites, storage or laydown areas along the project footprint. The temporary arrangements could take place across land with various tenure and ownership arrangements and would be confirmed during detailed design and further construction planning.

Overall, impacts on property tenure or ownership during construction would be considered minor due to the relatively small amount of land affected compared to the project footprint and likely short-term impacts on landowners. It is expected that potential impacts would be minimised through compensation provided via leases and landowner agreements. Land temporarily used for construction would be rehabilitated in consultation with the affected landowners and returned as soon as practicable at the completion of construction.

11.4.1.2. Other property impacts

Construction is unlikely to substantially restrict movements of landowners and other users within the project footprint for the entire duration of construction. Property access may be restricted temporarily for certain activities such as the construction of transmission line structures or stringing. However, these restrictions would be short-term and undertaken in consultation with landowners and/or relevant property managers. While there is likely to be some temporary fragmentation of properties during construction, construction at each transmission line structure would be intermittent and would not occur for the full construction duration. Any properties subject to short-term changes to access would be provided with alternative access. Overall, impacts on property access during construction is assessed as being minor.

Construction of the transmission lines and the establishment of associated easements may also require the removal or adjustment of structures, such as, but not limited to dwellings, fencing and irrigation, within the project footprint. Nine dwellings are located within the project footprint. Based on the current concept design, one dwelling is likely to require demolition or relocation. The final transmission line route would aim to be located as far as practicable from dwellings. As such, the need for the demolition or relocation of dwellings and other property structures would be confirmed during detailed design and in consultation with landowners. Removal or adjustment of other structures would be carried out in accordance with Transgrid's *Easement guidelines - Living and working with electricity transmission lines*. Overall, impacts on property structures during construction is assessed as being moderate across the project footprint.

11.4.2. Agricultural land use impacts

11.4.2.1. Agricultural land use

The agricultural land directly impacted by permanent and temporary works would be relatively small in the context of the agricultural study area and the regional agricultural industry. The part of the project footprint on agricultural land (7,178 hectares) is equivalent to about 0.4 per cent of the total area of agricultural holdings in the land use and property study area (1,650,215 hectares).

Based on the indicative concept design and construction methodology, the area of land within the project footprint that is likely to be used for construction of the project is about 2,712.8 hectares. Of this, 2,218.1 hectares or about 82 per cent is within land mapped as agricultural land uses, most of which would be from the transmission line structures and associated access tracks. This would predominantly impact grazing land and a smaller proportion of cropping land. Construction of the proposed Gugaa 500 kV substation would almost entirely impact cropping land. Modifications to the Wagga 330 kV substation and Bannaby 500 kV substation would have a negligible impact on agricultural land use. Establishment and use of the construction compounds would impact about 27.7 hectares of agricultural land use, with the majority of impact being on cropping land.

11.4.2.2. Land and soil capability

Construction of the project would not affect the intrinsic capability or physical characteristics of soil or land. The main impact on existing soil and land capability during construction would be through the temporary removal of land from agricultural production. Impacts associated with construction of transmission line structures are expected to be relatively short-term, with a total of up to 21 weeks of intermittent construction activity expected at each structure. Impacts at other sites such as construction compounds, substations and access tracks are likely to extend for longer periods and could extend for the full construction timeframe of 2.5 years.

During construction, the project could impact up to 447 hectares of BSAL and 534 hectares of draft SSAL within the project footprint. However not all BSAL and draft SSAL land would be directly impacted during construction and agricultural production (if impacted) would only be temporarily lost for most of this area. Thus, this impact is considered to be minor. The permanent loss of existing soil and land capability including BSAL and draft SSAL would commence during construction (assessed further in Section 11.5.2.2). Areas not required for operational purposes would be rehabilitated (if required) and returned to their former land uses (or as agreed with landowners) after construction has been completed.

11.4.2.3. Biosecurity risks

There is a risk that animal diseases, plant diseases, pests and weeds could be introduced or spread during construction of the project. Potential impacts associated with this risk could include increased costs and loss of income for owners of agricultural properties near the project, including for horticultural enterprises. Depending on the nature of the biosecurity issue, the impact could be short to long-term (more than five years). The biosecurity risks would be highest during construction due to disturbance of ground cover and soil from earthworks and the greater frequency of vehicle and personnel movements.

In the absence of mitigation measures, the risk of weed spread associated with the project would be high. Some species of weeds that were identified during property inspections are readily spread by vehicles, machinery and human activity, including but not limited to Khaki Weed (*Alternanthera pungens*), Noogoora Burr (*Xanthium occidentale*) and Bathurst Burr (*Xanthium spinosum*). Spreading of weeds has the potential to impact surrounding agricultural enterprises due to the costs of monitoring pests, weeds or diseases and implementing control measures as well as the reduced income caused by loss of livestock, crop or pasture production and lower produce quality. However, property management plans would be developed in consultation with landowners, which would include specific biosecurity protocols that would be implemented during construction to minimise these 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 impacts on sheep enterprises. 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 within the agricultural study area.

Vertebrate pests such as pigs, foxes, rabbits and kangaroos 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 these pests and therefore the impacts from vertebrate pest spreading are considered to be very low.

Any organic producers within the agricultural study area would experience 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. These could include genetically modified plants, mineral fertilisers, and pesticides.

Biosecurity controls and property management plans (detailed in Section 11.6.3) would be implemented to manage potential biosecurity risks during construction. Following implementation of these mitigation measures, relatively low biosecurity risks are expected.

11.4.2.4. Travelling stock reserves

As outlined in Section 11.3.4.4, the project footprint intersects 18.4 hectares of TSRs across four TSRs. Hume Creek and Cowpers Creek TSRs have large proportions of their total area intersected by the project footprint (30 and 36 per cent, respectively), while Gurrundah and Bannister TSRs have substantially smaller proportions intersected (0.1 and 3.2 per cent, respectively). These TSRs may be impacted by construction of the transmission line structures and during stringing activities during which some movement of livestock along TSRs or adjacent public roads may be temporarily restricted. However, these restrictions would be of short duration and the project is not expected to significantly prevent or hinder livestock movements or the use of TSRs during construction. In addition, there are three nearby TSRs (Merril Creek,

McCabes and Middle Arm TSRs) within the agricultural study area which would not be impacted by the project and could be utilised as required.

11.4.2.5. Agricultural productivity

As noted in Section 11.4.2.1, about 2,218.1 hectares of agricultural land is expected to be impacted by construction based on the indicative concept design. However, agricultural land use across the transmission line easement (ie 1,649.3 hectares) would be largely available during construction. As such, only 568.8 hectares of agricultural land use is likely to be completely unavailable for agricultural uses during construction. Therefore, the direct impact of the project on agricultural production would be relatively low during construction and would have a minor effect on agricultural productivity.

Construction activities are not expected to substantially restrict movements of agricultural landowners, workers, their livestock, or equipment within the agricultural study area. It is possible that some movement would be affected temporarily due to restricted access to sections of the project footprint, eg during construction of transmission line structures or stringing activities. However, these restrictions would be relatively short term and, limited in area. Land use restrictions would be carried out in consultation with landowners and the relevant agreements in the property management plans. Therefore, any restrictions are unlikely to markedly affect movements for agricultural purposes.

Construction activities carried out on pasture, cropping or horticultural land would have the potential to disrupt husbandry operations. Critical times include crop sowing (typically April to June) and harvesting periods (typically October to December). Delays to these activities can result in income losses due to sub-optimal sowing times and weather damage. During these periods, construction activities may need to be managed to minimise impacts on the usual cultivation, crop establishment, spray travel patterns and husbandry operations. Impacts that commence during construction may continue into operation of the project (refer to Section 11.5.2.5).

Some direct damage to crops and pastures may also occur due to vehicle and equipment movement and the construction of transmission line structures, access tracks and associated ancillary work. However, the impact on crops and pastures during construction would be relatively minor due to the small areas directly affected (ie 568.8 hectares), the relatively short construction period at each location, and the ability to continue cropping across most of the project footprint during construction. Other potential impacts on livestock enterprises during construction could be associated with farm infrastructure (eg stock water pipelines or fences) being inadvertently damaged and not promptly repaired, or if gates are left open. The property management plans would include a process for rectification of any damage caused by construction.

Impacts on aerial agriculture operations (such as aerial spreading of fertilisers, aerial spraying and drone use) near the project have the potential to commence during construction of the transmission lines in cropping or horticultural areas and continue into operation (refer to Section 11.5.2.5).

The main potential impact on livestock enterprises would be disturbance to sheep and cattle caused by noise and vehicle movements. 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. However, the effect on productivity is expected to be relatively minor.

Mitigation measures detailed in Section 11.6.3 would be implemented to manage potential impacts and risks identified above during construction.

11.4.3. Forestry land use impacts

As outlined in Section 11.3.2, the project footprint intersects about 1,088.6 hectares of State forests and privately owned plantation forests. This represents around 0.5 per cent of the total forestry land across the land use and property study area.

Based on the indicative concept design it is likely that the construction of the project would result in impacts on up to 375.9 hectares of State forest land and 16.2 hectares of privately owned plantation forest (to be confirmed during detailed design). Of this, 37.5 hectares would be located within construction compounds. This represents a temporary loss of less than 0.2 per cent of the respective total forestry land across the land use and property study area.

Construction of the project would result in temporary impacts on forestry land at the following construction compounds:

- Maragle 500 kV substation compound (C05) – located in Bago State Forest (most of this area is already expected to be cleared for the Snowy 2.0 Transmission Connection Project)
- Honeysuckle Road compound (C07) – located in Red Hill State Forest
- Red Hill Road compound (C08) – located in Red Hill State Forest
- Adjungbilly Road compound (C09) – located in privately owned plantation forest associated with the Black Flat forest area
- Snubba Road compound (C16) – located in Bago State Forest.

The use of these areas for construction compounds may require clearing of the land and therefore costs to the operator in terms of lost productivity. While the construction compounds would be temporary, they may have an economic and productivity impact on the forest industry due to the cost and delays associated with replanting and waiting for new growth.

The economic impact of the project's operation on forestry land uses is discussed in Chapter 12 (Economic).

Given the above, the temporary impacts of project construction on forestry land uses are assessed as being moderate.

While impacts on forestry land associated with the transmission line easement would commence during construction, they would be long-term and predominantly associated with the maintenance and operation of the transmission line. Section 11.5.3 provides an assessment of impacts on permanent forestry land.

11.4.4. Other land use impacts

Table 11-7 provides a summary of other potential land use impacts during construction.

Table 11-7 Summary of other land use changes during construction of the project

Land use class	Description of impact
Infrastructure and utilities	The project footprint intersects about 71.5 hectares of infrastructure and utility land uses, accounting for about 0.8 per cent of the total for these land uses across the land use and property study area. This area mainly includes the existing Wagga 330 kV substation and Bannaby 500 kV substation that are proposed for modification as part of the project. The existing substation at Yass is not proposed to be modified as part of the project but spare areas of land would be used as a construction compound. Changes to the land use in these areas would not occur. Other Transgrid assets that are intersected by the project footprint included several existing high-voltage transmissions lines. However, the project is not expected to interfere with the function of these assets. The project footprint also intersects a small area of utilities land use at Bannister and Woodhouselee associated with the Gullen Range Wind Farm, Gullen Solar Farm and Crookwell 2 Wind Farm. Ancillary infrastructure such as access tracks and transmission lines associated with these facilities are located in project footprint. However, the project is unlikely to interfere with access and function of the wind and solar farms. Any impacts would be managed through consultation with the landowner/asset owner. As discussed in Chapter 3 (Project description - infrastructure and operation) a telecommunications connection with the future Rye Park Wind Farm substation is also proposed as part of the project. However, the project is not expected to impact the operation of the wind farm. There are no major underground gas or water pipelines within the project footprint that would require relocation and/or protection works. Potential impacts on local services and utilities located within the project footprint would be determined during detailed design and further construction planning. Any proposed relocation and/or protection work would be determined in consultation with the relevant asset owners. The project would not alter the use of the major transport corridors intersected by the project footprint during construction. However, there may be temporary disruptions. Refer to Chapter 20 (Traffic, transport and access) for further discussion on traffic and transport impacts during construction. Establishment and use of the Bowmans Lane compound (C15) would result in a temporary loss of about 5.7 hectares of waste treatment land use area. However, agreement on the use of the site to facilitate the project has been obtained from Snowy Valleys Council. This land would be returned to its existing condition and use following the completion of construction. Overall, impacts on infrastructure and utilities during construction of the project would be temporary and are considered to be negligible.
Urban	The project footprint intersects with about 18.4 hectares of land associated with urban land uses. This represents about 0.2 per cent of the project footprint, and less than 0.1 per cent of the total amount of urban land use area across the land use and property study area. Residential and farm infrastructure land use within the project footprint represents less than 0.1 per cent of the total of that land use across the land use and property study area, and the supply of suitable land for these uses would not be significantly impacted. As discussed in Section 11.4.1.2, the project may require the demolition or relocation of dwellings and the removal or adjustment of other property structures. Whilst these impacts would be highly significant to affected landowners, in terms of land use, the impact is considered minor. Construction work associated with the project is unlikely to impact manufacturing and industrial land uses within or near the project footprint. A 0.1 hectare area of manufacturing and industrial land use is intersected by the project footprint at Woodhouselee and the Snowy Mountains Highway compound (C02) is located on land recently rezoned under the Tumut Local Environmental Plan 2012 for industrial purposes. Due to the low likelihood of land use changes and the insignificant amount of land affected, the impact on manufacturing and industrial land uses arising from construction would be negligible. The project footprint intersects with about 4.3 hectares of services land uses including at the Memorial Avenue compound (C14) in Batlow and the Gregadoo Waste Management Centre next to the existing Wagga 330 kV substation. The Memorial Avenue compound (C14) would use current facilities on-site and would represent a continuation of the observed current use. In addition, the project footprint does not intersect operational areas of Gregadoo Waste Management Centre, and the facility would continue to operate during construction. Therefore, impacts would be negligible.

Land use class	Description of impact
Natural environment	Potential impacts on areas classified as natural environment during construction would be limited to areas identified as managed resource protection and other minimal use areas. The areas identified as managed resource protection are mainly associated with agricultural windbreaks, remnant vegetation and riparian areas. The project footprint intersects 26.4 hectares of managed resource protection and 6.4 hectares of other minimal use areas, which represent 0.5 per cent and 0.3 per cent (respectively) of the total area for these land uses across the land use and property study area. Vegetation within managed resource protection areas may be required to be cleared to enable the construction of the project. Further details of vegetation clearing extents and potential biodiversity issues are discussed and assessed in Chapter 8 (Biodiversity). As discussed in Section 11.3.2, the project footprint does not include land identified as nature conservation (ie nature reserves, state conservation areas, and national parks). Potential indirect impacts on adjacent national parks and nature reserves are provided in Table 11-8. Overall, potential impacts on natural environment land use impacts from construction of the project are considered minor in the broader context of the land use and property study area.
Extractive industries	There are no extractive industries within the project footprint. Additionally, there are no mining leases identified within or close to the project footprint. Although the project footprint intersects a number of current and potential exploration licences, none of these permit extraction activities. There is potential for mining exploration activities (eg survey and geotechnical investigations) associated with the identified exploration licences to take place during construction of the project. However, it is likely that the activities would be able to proceed alongside the project during construction, or in an adjacent part of the exploration licence area. Overall, impacts on extractive industries land uses during construction of the project would be negligible.
Water	Land uses categorised as water comprise 154 hectares or 1.8 per cent of the project footprint, which represents 0.23 per cent of the total water land use area in the land use and property study area. During construction, temporary waterway crossings may be required for access tracks. Access track construction would be carried out in a manner that causes minimum disturbance to riparian areas and watercourses. Some recreation uses such as kayaking, fishing, or boating on the larger waterbodies of Pejar Dam, Murrumbidgee and Tumut rivers may be temporarily impacted during line stringing. While there may be temporary, short-term access restrictions to some areas, these would not alter the land use in the long-term. Overall, impacts on water land uses during project construction are assessed as being negligible.

As discussed in Section 11.3.2, there are a number of national parks and nature reserves close to the project footprint, including Minjary National Park, Mudjarn Nature Reserve, Bango Nature Reserve, Back Arm Nature Reserve, Tarlo River National Park, and Kosciuszko National Park. While these national parks and nature reserves would not be directly impacted by the project, there is potential for indirect impacts to occur during construction. The main construction activity to be carried out adjacent to national parks and nature reserves would be associated with construction of the transmission line structures and clearing within the transmission line easement. Table 11-8 considers potential indirect impacts in accordance with *Developments adjacent to NPWS lands: Guidelines for consent and planning authorities* (NPWS, 2020).

Overall, potential indirect impacts on adjacent national parks and nature reserves are expected to be minimal and managed in accordance with mitigation measures proposed for the project.

Table 11-8 Issues to be considered for potential indirect impacts on NPWS land adjacent to the project footprint

Issues to be considered	Discussion
Erosion and sediment control	Consideration of potential erosion and sediment impacts during construction is provided in Chapter 16 (Soils, geology and contamination). Potential adverse impacts are expected to be adequately managed with the implementation of appropriate erosion and sediment controls detailed in Chapter 16 (Soils, geology and contamination). As such, the risk of erosion and the movement of sediment onto NPWS land is considered negligible.
Stormwater runoff	Consideration of potential surface water quality impacts during construction is provided in Chapter 17 (Surface water and groundwater quality). While there is a low to moderate risk of water quality impacts during construction, it is expected that with the implementation of mitigation measures detailed in Chapter 17 (Surface water and groundwater quality), water quality impacts from construction activities would be short term and limited in extent. As such, stormwater runoff impacting NPWS land during construction is considered negligible.
Wastewater	Impacts associated with the generation of wastewater during construction are discussed in Chapter 17 (Surface water and groundwater quality). Wastewater would be generated from the construction compounds, Tumbarumba accommodation facility (AC1) and other ancillary facilities and support sites. With the implementation of appropriate wastewater management and disposal requirements, no adverse impacts on NPWS land would be expected.
Pests, weeds and edge effects	Consideration of the spread of pests and weeds and potential edge effects during construction is included in Section 11.4.2.3 and Chapter 8 (Biodiversity), respectively. It is considered that with the implementation of mitigation measures detailed in Section 11.6.3 and Chapter 8 (Biodiversity), the risk of spreading pests and weeds and causing edge effects along the NPWS land would be manageable.
Fire and the location of asset protection zones	As discussed in Chapter 19 (Hazards and risks), a Bush Fire Emergency Management and Evacuation Plan would be prepared for the project and is expected to adequately manage the bushfire risk during construction. As such, there is no expectation for NPWS to change its fire management regime for the land it manages.
Boundary encroachments and access through NPWS land	The project would not encroach on or require access through NPWS land.
Visual, odour, noise, vibration, air quality and amenity impacts	Consideration of visual, odour, noise, vibration, air quality and amenity impacts are included in Chapter 13 (Social), Chapter 14 (Landscape character and visual amenity), Chapter 15 (Noise and vibration) and Chapter 21 (Air quality). A number of mitigation measures are proposed to manage the associated impacts experienced during construction. In addition, the concept design of the project has also minimised potential amenity related impacts by paralleling existing transmission line easements where possible. As such, the project is unlikely to reduce the amenity or public enjoyment of the adjacent NPWS land.
Threats to ecological connectivity and groundwater dependent ecosystems (GDEs)	Threats to ecological connectivity and GDEs are considered in Chapter 8 (Biodiversity). While impacts on connectivity may commence during construction, the impact would be predominantly during operation. Notwithstanding, mitigation measures detailed in Chapter 8 (Biodiversity) would be implemented to minimise potential connectivity impacts. Construction of the project is unlikely to pose a significant risk to GDEs.
Cultural heritage	The project would not impact any areas and sites of heritage value on NPWS land, including Aboriginal cultural heritage.
Access to parks	Construction of the project may result in a minor increase in the level of congestion on roads that provide access to the adjacent national parks and nature reserves. In addition, there may be the potential for short duration road closures (full or partial) during stringing of the proposed transmission line which may also temporarily affect access to the adjacent national parks and nature reserves. However, mitigation measures detailed in Chapter 20 (Traffic, transport and access) would minimise potential impacts. As such, the project is unlikely to compromise public and NPWS access to parks.

11.5. Potential impacts – operation

11.5.1. Property and ownership impacts

11.5.1.1. Tenure and ownership

The project would require permanent adjustments to property tenure or ownership arrangements of freehold, government and Crown land to facilitate operation. This would involve:

- establishment of transmission line easements to provide a right of access to maintain and operate the transmission lines and other operational assets
- additional minor easements or landowner agreements may be required if ancillary infrastructure falls outside the proposed easement for the new transmission lines
- landowner agreements or specific access track easements for permanent off-easement access tracks
- property acquisition for the proposed Gugaa 500 kV substation and telecommunications hut at Killimicat.

While land requirements associated with the project operation would be long-term, the potential worst case spatial extent of new permanent built infrastructure, which would be fenced off, would be around 58 hectares based on the indicative concept design. Twenty-two hectares of this would be required for the proposed Gugaa 500 kV substation. The remaining 36 hectares would be mainly for transmission line structures as the telecommunications hut at Killimicat would only occupy 0.04 hectares. The telecommunications hut at Killimicat would also require an easement for connection to the local power supply. The easement would be about two metres wide by 980 metres and would require an area of about 0.2 hectares. The land required for permanent structures would no longer be available for other purposes. However, the total amount of land required would be significantly less than the area of the total project footprint. Freehold land acquisitions for the proposed Gugaa 500 kV substation and the telecommunications hut would be carried out in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Property Acquisition Standards* (Department of Finance, Services and Innovation, 2019).

The new transmission line would be around 360 kilometres long and sit within an easement typically 70 metres wide with a few locations requiring a wider easement of between 110 and 130 metres. Based on the concept design, the transmission line easement would require an area of around 2,014 hectares, which will be subject to refinement during detailed design. Land between transmission line structures would not be fenced off and would remain accessible. The establishment of easements would depend on the land ownership. Easements through freehold land for the transmission lines, structures and access tracks would be acquired either by agreement or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the *Property Acquisition Standards* (Department of Finance, Services and Innovation, 2019). Formal easement applications for affected sections of Crown land would be in accordance with the *Crown Land Management Act 2016*. Easements through State forests would be by agreement with FCNSW via a Deed of Easement, or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Considering the above, the land requirements for project operation are considered manageable and would be a minor impact.

During operation, some land within the easement would be permanently required for transmission line infrastructure. Other land would have partial use restrictions in accordance with the requirements of Transgrid's *Easement guidelines - Living and working with electricity transmission lines*. While the tenure

and ownership arrangements would be long-term and create management implications, the compensation process is designed to reduce the magnitude of the impacts.

As such, the operational impact on tenure and ownership would be considered moderate.

11.5.1.2. Other property impacts

Movement within and across the transmission line easement would be permanently altered once the project becomes operational due to the limitations imposed under Transgrid's *Easement guidelines - Living and working with electricity transmission lines*. Despite the likelihood of localised and/or intermittent restrictions on movement, overall, impacts would be manageable and therefore, minor.

Operation of the project would also result in restrictions to the establishment of future infrastructure and dwellings in or near the easement. Any future infrastructure or dwellings would need to comply with Transgrid's *Easement guidelines - Living and working with electricity transmission lines*. Additional built infrastructure changes following the construction phase would be unlikely. As such, the impacts arising from operation of the project could be effectively managed as part of normal operations and would therefore be considered negligible.

It is expected that the impact of the project on land prices within the project footprint and wider land use and property study area would be minimal and directly correlated to any loss of productivity. Any impacts would be minor and would likely decrease in significance over time. Further discussion is provided in *Technical Report 5 - Land Use and Property Impact Assessment*.

11.5.2. Agricultural land use impacts

11.5.2.1. Agricultural land use

Operation of the project would result in permanent impacts on agricultural land uses where operational infrastructure would be established, eg transmission line structures, the telecommunications hut, permanent access tracks and at the proposed Gugaa 500 kV substation.

Based on the indicative concept design, the total area of agricultural land likely to be affected is about 2,171.1 hectares. However, most of this area consists of the transmission line easement (1,912.3 hectares) in which some agricultural land uses, such as grazing, could continue. Therefore, the area of agricultural land use that would be completely unavailable for agricultural land uses during operation is estimated at 258.8 hectares. This is equivalent to 0.02 per cent of the total area of agricultural holdings in the land use and property study area and 33 per cent of the project footprint.

Similar to construction impacts described in Section 11.4.2.1, operational impacts associated with transmission line structures are expected to be predominantly on grazing land and a smaller proportion of cropping land. Impacts associated with the proposed Gugaa 500 kV substation would be mainly on cropping land.

11.5.2.2. Land and soil capability

Some of the project footprint (such as the transmission line easement) would not be permanently removed from agricultural production. For example, grazing may continue under the transmission line around the transmission line structures.

Other parts of the project footprint, such as access tracks, are likely to affect soil characteristics to the extent that these locations would no longer be productive cropping or pasture areas. However, the impact is considered to be minor given the relatively small area proposed to be used for permanent access tracks.

The area of BSAL within the project footprint is about 477 hectares (equivalent to about 5.2 per cent of the total project footprint), however based on the indicative concept design only 151 hectares is likely to be impacted. The area of draft SSAL within the project footprint is about 534 hectares (equivalent to about 6.2 per cent of the total project footprint), however based on the indicative concept design only 177 hectares is likely to be impacted.

During operation, the impact on BSAL and draft SSAL would be minor due to:

- the small area of BSAL and draft SSAL impacted compared to the amount of BSAL and draft SSAL across the agricultural study area and land use and property study area
- cropping and grazing being able to continue on BSAL and draft SSAL within most of the transmission line easement and the loss of agricultural production being limited to the area occupied by permanent project infrastructure.

11.5.2.3. Biosecurity risks

There is potential that maintenance and operation of the project may introduce or spread animal and plant diseases, pests and weeds within the project footprint. The potential impacts of this would be similar in nature to the construction phase (refer to Section 11.4.2.3), but the risk would be lower as there would be fewer vehicle and equipment movements and limited ground disturbance.

11.5.2.4. Travelling Stock Reserves

The impact of the project on the four TSRs that intercept the project footprint would generally be limited to the construction phase. These TSRs could be subject to easements and transmission line structures during project operation, but any impacts would be considered negligible.

11.5.2.5. Agricultural productivity

Agricultural productivity may be affected by the operation of the project due to the presence of transmission line structures and transmission lines. The presence of transmission line structures in areas of cropping land would disrupt normal husbandry operations around the structure. Usual cultivation, sowing and spraying travel patterns would be required to be adjusted to avoid the structure, and care would need to be taken to avoid collisions when using wide farming equipment. The degree of disruption would depend on the location of transmission line structures relative to fences and other structures. Some large grain harvesters would also not be suitable for grain loading and unloading activities within the transmission line easement due to height restrictions detailed in Transgrid's *Easement guidelines - Living and working with electricity transmission lines*.

Many landowners in the agricultural study area use global positioning system (GPS) guidance for their cropping equipment. 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 landowners. 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 impact on landowners.

Irrigated crop, pasture or horticulture enterprises may be impacted by transmission line structures and other associated facilities. These structures may interfere with irrigation systems. However, these systems are unlikely to be used much in the project footprint.

Transmission line structures and transmission lines in agricultural areas have the potential to impact on aerial agriculture operations (such as aerial spreading of fertilisers, aerial spraying with fixed wing aircraft or helicopters and drone use). The efficiency and effectiveness of aerial agriculture operations can decline because application procedures must be changed to compensate for the presence of the infrastructure, which can be a potential hazard for low-level aviation activities.

The location of the transmission near existing airstrips used for aerial agriculture may also restrict the use of these airstrips in some cases. Nearby transmission lines can compromise safety during take-off and landing. In these cases, the use of the airstrips may not be possible in certain conditions, or the airstrip may need to be relocated.

Drone flight and sensing are restricted in and around transmission line structures and transmission lines. Drones are subject to electric and magnetic interference from transmission lines. Transgrid's *Easement guidelines - Living and working with electricity transmission lines* indicate that unmanned aerial vehicles (such as drones) cannot be flown within 60 metres of any transmission line structure, guy wire or conductor. Chapter 19 (Hazards and risks) provides more information on aerial impacts and management.

There may be some impact on livestock movement and husbandry activities if stockyards and loading facilities are located close to the transmission structures. In these cases, facilities may have to be relocated.

Overhead transmission lines may also impact on the operation of electric fencing. Electric fencing must be located at least 30 metres from transmission line structures or supporting guy wires and be no higher than 2.5 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.

Overall, the impact of the project on agricultural production would be minimal during operation due to the small area affected relative to the total size of agricultural enterprises within the surrounding LGAs.

11.5.3. Forestry land use impacts

During operation, forestry would no longer be an appropriate land use within the transmission line easement as vegetation would be cleared or restricted in height for safety and operational reasons.

Based on the indicative concept design it is likely that the operation of the project would result in about 347.7 hectares of State forest land and 4.1 hectares of privately owned plantation forest being permanently removed from production; this would be confirmed during detailed design. This would equate to about 0.2 per cent of the total area of forestry land use within the land use and property study area. In addition to direct impacts associated with land clearing, restrictions on operating within and near transmission line easements may further reduce or alter access arrangement for forestry equipment on a permanent basis.

Transgrid would seek to compensate forestry operators for any loss of forestry land. Transgrid's preference would be to provide compensation payment, though compensation could also occur through provision of replacement land. Either approach would help to minimise any reduction in forestry land available for timber supply. Any compensation or arrangements for land replacement would be considered in

consultation with FCNSW. This would offset permanent impacts, but would potentially have flow-on land use impacts associated with transferring land currently used for other purposes to forestry land uses. The economic impact on forestry during operation is discussed in Chapter 12 (Economic).

Considering the above, the permanent impacts on forestry land arising from the operation of the project are considered to be moderate.

11.5.4. Other land use impacts

Table 11-9 provides a summary of the land use changes during operation for other land uses.

Table 11-9 Summary of other land use changes during operation of the project

Land use class	Description of impact
Infrastructure and utilities	As the majority of the utilities land use areas impacted by the project footprint are associated with existing substations that would not change in use, the operational impact would be considered minimal. The operation of the proposed Gugaa 500 kV substation would result in a permanent addition of up to 22 hectares of utilities land use area. Where the transmission line infrastructure traverses transport infrastructure such as roads or railway lines, occasional or routine access to complete maintenance or repair work may temporarily affect users during operation. This would not impact land use. Refer to Chapter 20 (Traffic, transport and access) for further for further discussion on traffic and transport impacts during operation. Infrastructure and utilities land use impacts arising from the operation of the project would therefore be negligible.
Urban	The operational area of the project would be smaller than the project footprint, thereby resulting in further reduced impacts on urban land use areas. In addition, impacts during construction associated with construction compounds would no longer be experienced. As such, impacts on urban land use arising from the operation of the project are therefore considered negligible.
Natural environment	The operation of the project would result in changes to areas categorised as managed resource protection and other minimal use land uses. The construction and operation of the proposed Gugaa 500 kV substation would result in a permanent land use change for 0.9 hectares of managed resource protection land (associated with a planted tree windbreak). Ongoing vegetation management within the transmission line easement to ensure vegetation clearance requirements and asset protection zones are maintained would also result in a permanent impact on natural environment land uses. Further details of vegetation clearing extents and potential biodiversity issues are discussed and assessed Chapter 8 (Biodiversity). Overall, due to the small total area affected, permanent impacts on natural environment land uses arising from the operation of the project are considered minor. No additional indirect impacts on the national parks and nature reserves close to the project footprint to those discussed in Table 11-8 are expected during operation. It is likely that potential risks and impacts would be reduced in nature, extent, and duration due to the scale of work associated with the operation of project compared to construction.
Extractive industries	During operation, mining exploration activities and any potential mining activities would be limited to operating in line with Transgrid's *Easement guidelines - Living and working with electricity transmission lines*. In accordance with those guidelines, any potential mining activity would be determined by Transgrid on a case-by-case basis. Any potential exploration licence activities described in Section 11.4.4 would likely be able to proceed during operation without requiring access to the transmission line easement. Overall, these impacts would be negligible.
Water	Operation of the project may include changed access to water land uses, eg through restrictions to on-water activities under transmission lines. However, operation of the project would have a negligible impact on water land uses.

11.6. Management of impacts

11.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). Specific impacts on property and existing land uses would be managed in accordance with property management plans that would be developed for each directly impacted property in consultation with landowners and relevant stakeholders.

11.6.2. Avoidance and minimisation of impacts

The project footprint has been developed in consideration of avoiding and minimising impacts on existing property and land uses that would be highly impacted by the project (refer to Appendix E (Options Report)). This process was informed by extensive engagement with landowners and relevant stakeholders.

In particular, the avoidance of national parks, nature reserves, and state conservation areas during refinement of the project footprint substantially mitigates the likelihood of impacts on natural environment land uses arising from either the construction or operation of the project.

The project footprint is a conservative area that allows for further refinement of the transmission line route during detailed design to continue to avoid or minimise impacts on existing land uses that are incompatible with the proposed transmission line easement, such as residential dwellings and other structures, where possible. The final transmission line route would aim to be located as far as practicable from residential dwellings. If impacts cannot be avoided, the dwellings/structures may need to be removed or relocated. In such circumstances the potential loss will be assessed in accordance with *Land Acquisition (Just Terms Compensation) Act 1991* and agreement will be sought with the landowner prior to the commencement of construction.

11.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that will be implemented to avoid or minimise potential impacts on land use and property are listed in Table 11-10.

Table 11-10 Mitigation measures – Land use and property

Ref	Impact	Mitigation measure	Timing	Relevant location
LP1	Direct land use impacts	The location of infrastructure, work sites and access tracks (temporary and permanent) will be confirmed in consultation with landowners. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where possible.	Detailed design and construction	All locations
LP2	Property impacts	A property management plan will be developed for directly impacted properties in consultation with landowners and stakeholders. The property management plans will outline the protocols that will be implemented to address landowner concerns during construction. This may include: • the process for rectification of any damage to property infrastructure caused by construction • the process for rehabilitation and stabilisation of disturbed areas following the completion of construction • measures to minimise disruption to agricultural practices during construction • any fencing and gate requirements • specific biosecurity protocols.	Detailed design and construction	All locations
LP3	Agricultural impacts	Alternative technologies which could enable weed control close to the transmission lines will be considered.	Detailed design and construction	All locations
LP4	Biosecurity	Biosecurity controls will be implemented to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will be in accordance with Transgrid's *Biosecurity Procedure and Biosecurity Environmental Guidance Note* and include development of specific controls if high biosecurity risks are identified. Appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction via the project. The specific controls applicable to a property will be identified in consultation with the affected landowner. The effectiveness of these controls will be monitored in a manner and time interval consistent with the level of risk on each property. In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per *Biosecurity Act 2015* (NSW) and Biosecurity Regulation 2017.	Construction and operation	All locations
LP5	Access impacts	Management of access on private landowner properties required for access to infrastructure for maintenance, including opening and closing of gates, will be done in accordance with landowner requirements.	Operation	Transmission line
LP6	GPS impacts	If adverse effects on agricultural precision farming (using GPS) is 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 landowners.	Operation	Transmission line

11.6.4. Managing residual impacts or uncertainties

The assessment approach for land use and property adopted a conservative project footprint as well as a more refined indicative concept design, which was aimed at providing a robust assessment of potential impacts in the absence of a final transmission line route and other design uncertainties. Chapter 7 (Approach to assessment of impacts) explains this approach further.

Chapter 2 (Strategic context and project need) outlines the process by which the project footprint has been developed in consideration of minimising impacts on property and land use. The final transmission line route, permanent infrastructure locations and extent of property acquisition would be refined and confirmed during finalisation of the project design in consultation with the relevant landowners. Any easement arrangement and acquisition requirements would be finalised with a view to minimising land use and property impacts wherever possible. Residual direct impacts on property and existing land uses would generally be managed through compensation of the easement affected landowners.

12. Economic

This chapter provides a detailed summary of the assessment of the potential economic impacts of the project. The full assessment is provided in *Technical Report 6 – Economic Impact Assessment* (HillPDA, 2023b). This chapter also draws on conclusions from *Technical Report 4 – Agricultural Impact Assessment* (Tremain Ivey Advisory, 2023) and *Technical Report 5 – Land Use and Property Impact Assessment* (HillPDA, 2023a).

12.1. Environmental Assessment Requirements

12.1.1. Secretary's Environmental Assessment Requirements

Table 12-1 outlines the SEARs relevant to economic impacts and where these requirements are addressed in this EIS.

Table 12-1 Secretary's Environmental Assessment Requirements – Economic

Reference	SEARs	Where principally addressed in the EIS
Economic		
Key issues	The EIS must address the following matters: • an assessment of the benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services, and details of how the construction workforce will be managed to minimise local impacts, including a consideration of the construction workforce accommodation and an assessment of the impacts to State forests.	Section 12.4 and Section 12.5 discuss potential economic benefits and impacts of the project for the region, State and at a national level with further detail provided in *Technical Report 6 – Economic Impact Assessment*. Section 12.6 provides measures for how potential local economic impacts will be managed. The economic impact to State forests is discussed in Section 12.4 and Section 12.5. Land use impacts to State forests are considered in Chapter 11 (Land use and property) and *Technical Report 5 – Land Use and Property Impact Assessment.* The potential impacts to agricultural productivity and property acquisition as a result of the project are discussed in Chapter 11 (Land use and property) and *Technical Report 4 – Agricultural Impact Assessment.* Chapter 13 (Social) provides a summary of social impacts associated with the project, including consideration of demand for community infrastructure and worker accommodation, with further detail provided in *Technical Report 7 – Social Impact Assessment*.

12.2. Assessment approach

12.2.1. Legislative and policy context

The following State and regional policies and guidelines were considered as part of the economic assessment:

- *2022 Integrated System Plan* (Australian Energy Market Operator (AEMO), 2022)
- New South Wales (NSW) *Transmission Infrastructure Strategy* (Department of Planning and Environment (DPE), 2018a)
- *State Infrastructure Strategy 2022-2042* (Infrastructure NSW, 2022)
- *NSW Electricity Strategy* (State of NSW and Department of Planning, Industry, and the Environment (DPIE), 2019)
- *Riverina Murray Regional Plan 2041* (DPE, 2023a)
- *South East and Tablelands Regional Plan 2036* (DPE, 2017a).

The economic assessment also considered:

- Local Strategic Planning Statements (LSPS) from the Cootamundra-Gundagai Council, Goulburn-Mulwaree Council, Snowy Valleys Council, Hilltops Council, Wagga Wagga City Council, Upper Lachlan Shire Council and Yass Valley Council
- Regional Economic Development Strategies from Cootamundra-Gundagai Regional Council, Hilltops Council, Snowy Valleys Council and Southern Tablelands.

The economic assessment was prepared in line with the QLD Government's *Economic Impact Assessment Guideline* (State of QLD, Department of State Development, 2017) in the absence of an equivalent NSW Government guideline applicable to the project.

Further details on the above-listed policies and guidelines are provided in *Technical Report 6 – Economic Impact Assessment*.

12.2.2. Methodology

The assessment methodology for the economic impact assessment included:

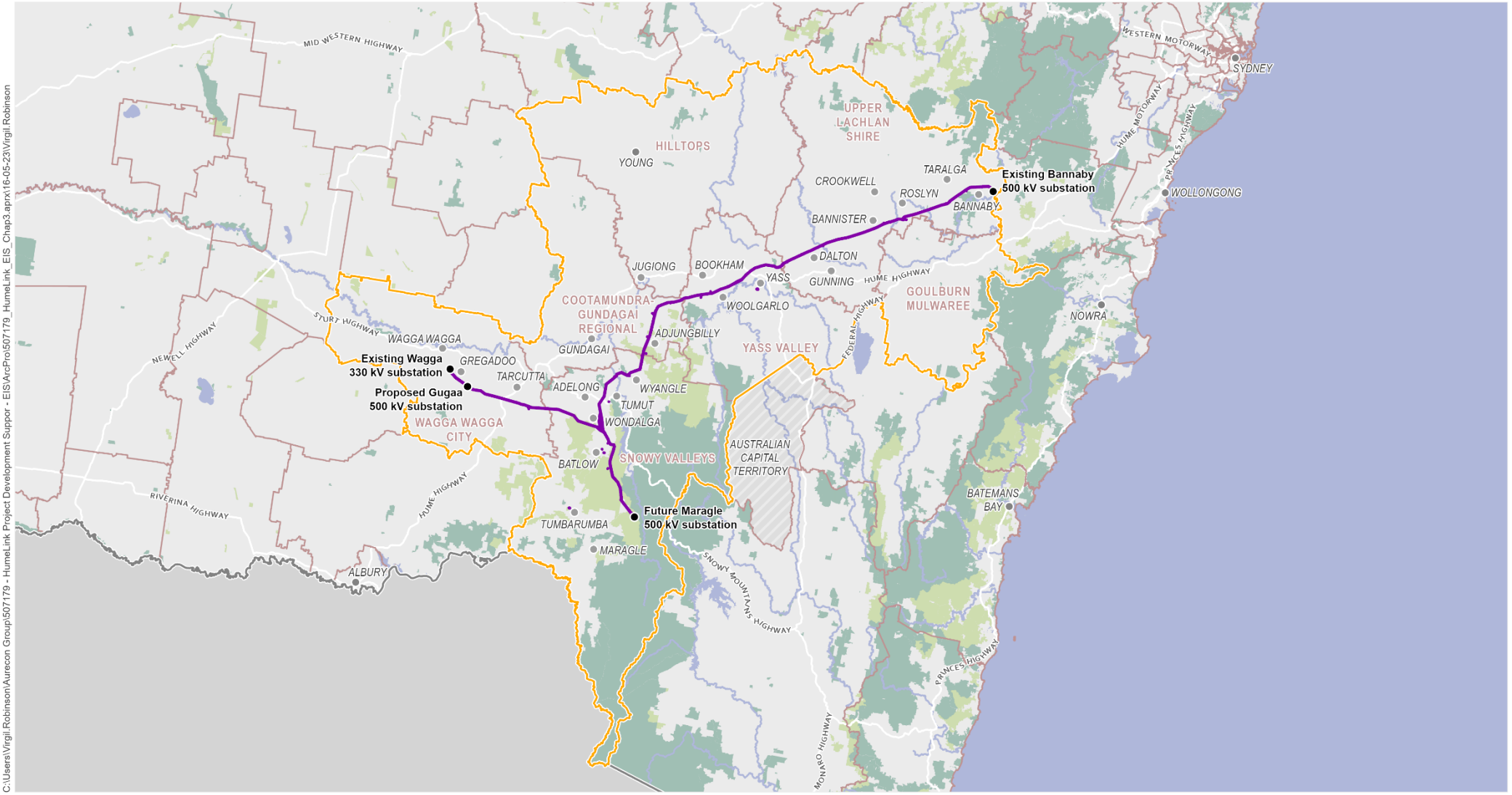
- reviewing relevant legislation and policy documents
- defining and describing the economic study area
- identifying the potential economic impacts during construction and operation of the project
- developing and using an input-output (I-O) model to identify and assess potential economic benefits and impacts at the national, State and regional level
- identifying measures to minimise the potential impacts identified.

The economic study area has been defined to include the Local Government Areas (LGAs) that are most likely to be impacted by the project, as illustrated by Figure 12-1. These are:

- Wagga Wagga City
- Cootamundra-Gundagai Regional
- Snowy Valleys
- Yass Valley
- Upper Lachlan Shire
- Goulburn-Mulwaree
- Hilltops.

The economic study area extends beyond the five LGAs that the project footprint falls within because the potential economic benefits and impacts are likely to extend to the nearby Goulburn-Mulwaree and Hilltops LGAs.

Technical Report 6 – Economic Impact Assessment includes further detail on the assessment methodology including key assumptions and limitations associated with the economic impact assessment for the project and the use of I-O modelling to quantify the economic benefits and impacts.



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

1:1,750,000

0 40 80 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 12-1: Economic study area

12.3. Existing environment

A summary of the existing economic performance of the economic study area is provided in the following sections. The description uses the latest available data sourced from Economy.ID and the Australian Bureau of Statistics (ABS). Further detail including the data sources is provided in Appendix B of *Technical Report 6 - Economic Impact Assessment*.

Chapter 11 (Land use and property) provides a description of the land uses within and surrounding the project footprint, which provides a background to the existing economic performance of the economic study area.

12.3.1. Population growth

The population of the economic study area as of 2021 was 171,005 residents, of which 40 per cent resided in the Wagga Wagga City LGA (ABS, 2021a). This population is projected to grow at 0.5 per cent per year to 2041 when a population of 188,414 residents is forecast (DPE, 2022f). Most of this growth is expected to occur in the Goulburn-Mulwaree LGA, with Hilltops, Snowy Valleys and Cootamundra-Gundagai Regional LGAs expected to experience negative growth.

12.3.2. Employment profile

In 2022 there were around 84,225 residents employed and almost 3,500 residents unemployed in the economic study area. The economic study area's unemployment rate was 4.1 per cent, down from 4.4 per cent in the corresponding quarter of the previous year (Economy.ID, 2022a-g). This is consistent with national trends and is reflective of the tighter labour market. The economic study area's declining unemployment rate may be due to the decline in labour force population over this period and since 2020. As such, a number of people previously unemployed dropped out of the labour force as discouraged workers. It reflects the trend in regional NSW and Australia where larger towns such as Dubbo, Tamworth, Orange, Coffs Harbour, Albury and Wagga Wagga have enjoyed economic growth and diversification of industry while workers in the smaller LGAs (that are predominantly agricultural based) have been leaving these LGAs to the larger towns and capital cities for alternative work.

As of 2019, the major industry employers in the economic study area were health care and social assistance (13.8 per cent or about 17,990 people), public administration and safety (10 per cent or about 13,035 people) and retail trade (9.7 per cent or about 12,645 people) (ABS, 2021b-h). Employment numbers for industries relevant to the project either through potential employment opportunities or potential for impact included:

- accommodation and food services – 8.7 per cent or about 11,340 people
- construction industry – 6.9 per cent or about 8,995 people
- agriculture, forestry and fishing industry – 7.4 per cent or about 9,645 people
- professional, scientific and technical services – 4.4 per cent or about 5,735 people
- electricity, gas, water, and waste services industry – 1.1 per cent or about 1,435 people.

The agriculture, forestry and fishing industry was the top industry sector by employment for the Snowy Valleys, Hilltops, Cootamundra-Gundagai Regional, Yass Valley and Upper Lachlan Shire LGAs for 2020/21 (varying between 15 per cent to 35 per cent of total industry employment). The importance of the industry is reiterated in a number of local policies, plans, and strategies for the LGAs including the *Cootamundra-Gundagai Regional Council Local Strategic Planning Statement 2020*

(Cootamundra-Gundagai Regional Council, 2020) and the *Upper Lachlan Shire 2040: Local Strategic Planning Statement* (Upper Lachlan Shire Council, 2020).

Health care and social assistance was the top industry sector by employment for Wagga Wagga City and Goulburn-Mulwaree LGA for same period accounting for 19 per cent and 18 per cent of the total industry employment respectively. Despite this, Wagga Wagga City Council's *Wagga Wagga Local Strategic Planning Statement - Wagga Wagga 2040* (Wagga Wagga Council, 2021), notes the importance of agriculture and forestry in the region and its economy.

12.3.3. Gross regional product and industry analysis

Gross regional product (GRP) is a measure of size or net wealth generated by the regional economy over one year. The economic study area had a GRP of $9.3 billion in 2021 (Economy.ID, 2022a-g). The headline GRP for each LGA within the economic study area in 2021 was:

- Wagga Wagga City – $4.2 billion with 1.9 per cent increase from previous year
- Cootamundra-Gundagai Regional – $504 million with 0.7 per cent decrease from 2016 to 2021 (2020 GRP data was not available for LGA)
- Snowy Valleys – $860 million with 1.6 per cent increase from previous year
- Yass Valley – $621 million with one per cent increase from previous year
- Upper Lachlan Shire – $366 million with 10.7 per cent increase from previous year
- Goulburn-Mulwaree – $1.735 billion with a 3.4 per cent increase from previous year
- Hilltops – $978 million with a 6.4 per cent increase from previous year.

The three largest industries in terms of output for 2020/21 for the economic study area were:

- agriculture, forestry and fishing ($2.5 billion and 14 per cent of total industry output)
- construction ($2.3 billion and 13 per cent of total industry output)
- manufacturing ($2.3 billion and 13 per cent of total industry output).

The electricity, gas, water and waste industry also accounted for a notable four per cent of total industry output.

The top three industries for each LGA in the economic study area are provided in Table 12-2.

Table 12-2 Largest industries by output, value added and specialisation for 2020/21 for each LGA within the economic study area

LGA	Top three industry sectors by output	Top three industry sectors by value added	Top three industry sectors by specialisation
Wagga Wagga City	• Manufacturing • Public administration and safety • Construction	• Public administration and safety • Health care and social assistance • Construction	• Public administration and safety • Wholesale trade • Information media and telecom
Snowy Valleys	• Agriculture, forestry and fishing • Manufacturing • Construction	• Agriculture, forestry and fishing • Manufacturing • Construction	• Agriculture, forestry and fishing • Electricity, gas, water, and waste services • Manufacturing
Cootamundra-Gundagai Regional	• Not available	• Not available	• Agriculture, forestry and fishing • Manufacturing • Transport, postal and warehousing
Yass Valley	• Agriculture, forestry and fishing • Construction • Rental, hiring and real estate services	• Agriculture, forestry and fishing • Construction • Health care and social assistance	• Agriculture, forestry and fishing • Accommodation and food services • Professional, scientific and technical services
Upper Lachlan Shire	• Agriculture, forestry and fishing • Electricity, gas, water, and waste services • Construction	• Agriculture, forestry and fishing • Electricity, gas, water, and waste services • Construction	• Agriculture, forestry and fishing • Electricity, gas, water, and waste services • Other services
Hilltops	• Agriculture, forestry and fishing • Construction • Mining	• Agriculture, forestry and fishing • Health care and social assistance • Mining	• Agriculture, forestry and fishing • Wholesale trade • Mining
Goulburn-Mulwaree	• Construction • Manufacturing • Public administration and safety	• Health care and social assistance • Public administration and safety • Transport, postal and warehousing	• Public administration and safety • Transport, postal and warehousing • Construction

12.4. Potential impacts – construction

12.4.1. Impacts from construction expenditure and employment on economic activity

Design and construction of the project would require substantial capital investment, which would support employment in the regional (ie the economic study area) and national economies. The indicative design and construction cost was sourced from the Project Assessment Conclusions Report (PACR) 2019 and is estimated at $3.27 billion, of which about $266 million would be 'soft costs' (eg design, biodiversity offsets, project management, accounting fees, application fees etc) and the remaining $3 billion would be 'hard costs' related to the construction of the project (eg heavy and civil engineering construction and construction services[6]). As such, construction of the project is expected to directly generate economic activity in the following industries:

- construction, including:
  - heavy and civil engineering construction, which includes businesses whose primary activity is the construction of entire engineering projects or infrastructure such as transmission lines, along with specialty trade contractors, whose primary activity is the production of a specific component for such projects
  - construction services, which includes all establishments and contractors involved in the construction of all other components of the project, including land development and site preparation services
- professional, scientific and technical services.

The construction industry is a significant component of the economy accounting for nine per cent gross domestic product (GDP) and employing over 1.16 million workers across Australia in 2021 (Australian Industry and Skills Committee, 2022). The industry has strong linkages with other sectors, so the impacts on the economy go further than the direct contribution of construction. This is known as the multiplier effect. Multipliers refer to the level of additional economic activity generated by a source industry.

There are two types of multiplier effects:

- production induced effects, which are made up of direct effects (all outputs and employment required to produce the inputs for construction) and indirect effects (the induced extra output and employment from all industries to support the increased production of the construction sector)
- consumption-induced effects, which relates to the demand for additional goods and services due to increased spending by the wage and salary earners across all industries arising from employment.

The forecast increase in total output is $9.4 billion at a national level, $8.9 billion at the State level and $6.4 billion at the regional economy level. The Gross Value Added (GVA) of an industry refers to the value of outputs minus the costs of inputs. GVA measures the costs that the industry makes to the region's wealth. The main components of GVA are workers' remunerations, profits and government taxes.

Design and construction of the project would result in a direct contribution of around $1.3 billion to the regional economy. Accounting for the multiplier impacts, a total of $2.8 billion would be contributed and/or supported in the regional economy. This includes worker spending at local businesses and retailers in the economic study area. The GVA at the State and national levels is higher at $4 billion and $4.3 billion,

[6] The cost of HumeLink was based on real 2021 dollars and has been recently revised to reflect 2023 real prices, taking into consideration cost increases in construction, building, material, skilled labour costs and global supply factors.

respectively (refer to Table 12-3). Refer to *Technical Report 6 - Economic Impact Assessment* for a detailed explanation of these figures.

Table 12-3 Design and construction GVA impact

GVA location	Total ($billion)
The region	2.8
The State	4.0
Australia	4.3

Source: HillPDA Estimate using data from ABS Australian National Accounts: Input-Output Tables 2019-20 (ABS, 2021i)

12.4.2. Employment generated from construction

According to the ABS, every million dollars of design and construction work undertaken generates an equivalent of 1.97 job years[7] (ABS, 2021a). Based on this assumption, an estimated 6,450 job years (full time jobs per year) are predicted to be generated by the project at a national level.

With the application of multiplier effects, approximately 27,294 job years are predicted to be supported in the national economy from the construction of the project; of which 95 per cent would be generated and/or supported within NSW and 65 per cent within the regional economy.

In 2022, there were 7,181 residents within the economic study area who worked in the construction industry (ABS, 2021b-h). About 34 per cent of these workers travelled outside the economic study area for work. The project could provide local employment opportunities for those skilled workers that have had to travel beyond the economic study area. This would in turn contribute to improving the regional job containment ratio (the ratio of jobs in the area to working residents) in the construction industry.

12.4.3. Worker remuneration

Worker remuneration is what drives consumption related impacts in the region. As workers earn more money, their disposal income would also likely increase resulting in increased spending on other living expenses such as food and services, which would flow through the economy.

Based on the ABS Australian National Accounts, for every dollar spent on construction, $0.22 goes to the construction workers in increased salaries (ABS, 2023). Based on the estimated capital cost, workers' remuneration nationally is predicted to increase by $728 million directly as a result of the project. Including multipliers, the forecast increase in total salaries at a national level is $2.2 billion, $2.1 billion at the State level and $1.5 billion in the regional economy.

[7] Note that one job year = 1 FTE job over one year. For example, 20 jobs each year over three years = 60 job years and 20 jobs over 6 months = 10 job years.

12.4.4. Other economic impacts from construction

Other economic impacts from construction are discussed in Table 12-4.

Table 12-4 Economic impacts - construction

Impact	Detail
Worker expenditure	Temporary construction jobs would benefit the regional economy as temporary construction workers would purchase local goods and services. Moreover, these workers would spend a proportion of their total retail spending near their place of work, benefiting those businesses and retailers within the economic study area.
Tourism and accommodation	Transgrid identified there would be a shortfall of short-term rental accommodation (motels, hotels and caravan parks) and that a dedicated worker accommodation facility at Tumbarumba would be required to support the construction of the project. Some construction workers are likely to seek accommodation in nearby holiday parks or rental housing given the costs of hotels and motels. This may result in some temporary increase in demand and cost for this type of accommodation over the construction period. This would result in increased competition for accommodation between the project construction workers and others, such as tourists, particularly during peak times. Transgrid will prepare a Worker Accommodation Strategy prior to the commencement of construction in consultation with local councils, accommodation service providers, other key stakeholders and the project's construction contractors. The strategy will aim to maximise benefits for the communities. Chapter 13 (Social) provides further discussion on the impact and management of worker accommodation. The project may also result in an increase in tourism spending in the economic study area, as family and friends of the construction workers visit to spend time with those workers. Conversely, construction activities (such as traffic impacts, noise and visual impacts) near national parks and State forests have the potential to discourage visitors and adversely impact tourism. Any adverse impacts on tourism resulting from the construction disturbances would be more than outweighed by the benefits of consumption-induced impacts[1] in the economic study area resulting from additional workers. This would benefit existing businesses in the economic study area such as retail, hospitality and food services.
Employment crowding out	If labour resources within a region are limited and worker-migration or commuter workers from beyond the region of impact are restricted, the project could result in increased labour market competition. This could drive up local wages and 'crowd out' economic activity in other industries of the economy. Employment crowding out would typically occur when an economy is at full employment, however, as discussed in Section 12.3.2, the regional economy is experiencing about 4.1 per cent unemployment in addition to considerable mobility of labour to and from the economic study area (ie 13 per cent of workers are from beyond the economic study area) (ABS, 2021a). As such, the employment crowding out effect is likely to be minimal.
Temporary impacts on agricultural productivity	The economic impacts of the project on existing agricultural enterprises at the regional level would be minimal. Based on the area of agricultural land that is expected to be directly impacted by construction, $335,120 per annum of agricultural production is estimated to be lost during the construction period. This would result in: • a loss of gross output of around $837,800 over two and a half years of disruption • a loss of one full-time-equivalent job, assuming an average output per worker of around $282,250 (IBIS, 2020) – equivalent to around 1.2 FTE job per year of construction • reduced remuneration of the total workforce by around $28,800 per annum, assuming an average salary of $21,730 (IBIS, 2020) – about $64,000 over 2.5 years • reduced GVA of the total workforce by $117,000 per annum, assuming a GVA per worker of $98,500 (IBIS, 2020) – equivalent to around $292,000 over the construction period.
Impacts on forestry	The project footprint intersects about 1,089 hectares of production native and plantation forest land use areas. This represents around 0.5 per cent of the total production native and plantation forest land use across the directly impacted LGAs. Forestry and timber processing are important land uses to the regional economy, particularly to the Snowy Valleys LGA. Construction of the project may result in temporary impacts on forestry land.

Impact	Detail
	Based on the indicative concept design, construction of the project could impact 375.9 hectares of production native forest and 16.2 hectares of plantation forest, including about 37.5 hectares for temporary construction compounds. This represents a temporary loss of less than 0.2 per cent of the respective total forestry land across the directly impacted LGAs. Refer to Section 12.5.3 for discussion on operational economic impacts on forestry. It should be noted that the total area of forested land has been calculated based on land use mapping and some temporary construction compounds are either not forested (such as Red Hill Road compound (C08)); have recently been harvested (such as Honeysuckle Road compound (C07) and Snubba Road compound (C16)), or have already been assessed to be cleared for other projects (such as the Maragle 500 kV substation compound (C05) which has been approved to be cleared under the Snowy 2.0 Transmission Connection Project). In terms of any permanent losses in private plantation, owners would be compensated under just terms under the *Land Acquisition (Just Terms Compensation) Act 1991* for any loss of forest.

Notes:

1 Consumption induced impacts in the locality or region refer to the additional economic activity generated from increased demand for goods and services from the project workers earning wages. These workers would generate demand in the region for accommodation, food, commercial and personal services, transport, etc.

12.5. Potential impacts – operation

12.5.1. Economic benefits

The project would provide the required support for the electricity network in Southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the State's demand centres. The project would improve the efficiency and reliability of the current energy transfer in this part of the network.

As outlined in the *2022 Integrated System Plan*, the project is estimated to contribute roughly $1.3 billion in net market benefits in the most likely scenario (AEMO, 2022a). These market benefits include:

- avoided unserved energy[8]
- avoided fuel costs
- avoided generation/storage costs (excluding fuel costs)
- avoided renewable energy zone (REZ) transmission capital expenditure
- avoided voluntary load curtailment[9]
- competition benefits (including wholesale market cost savings and demand response benefits).

By increasing the amount of electricity that can be delivered to the National Electricity Market (NEM) and providing greater access to reliable and affordable electricity, the project would increase competition in wholesale energy and help lower and stabilise electricity price and reduce volatility in the longer term. More reliable and affordable energy would in turn help to increased business productivity and lower living expenses.

[8] A measure of the amount of customer demand that cannot be supplied within a region due to a shortage of generation, demand-side participation or interconnector capacity (AEMO, 2019)

[9] The voluntary specific removal or reduction of electrical loads for a limited period of time from a utility grid system in response to a request from the utility or electrical grid system operator.

12.5.2. Impacts on the agricultural industry

As described in Chapter 11 (Land use and property), agricultural land uses in the project footprint predominantly consist of livestock, cropping and horticultural enterprises, which together comprise around 84 per cent of the project footprint. The total gross value of agricultural production across the agricultural study area, which includes the five LGAs of Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Yass Valley and Upper Lachlan Shire, averaged $590 per hectare in 2020-21. This varied from about $88,800 per hectare for horticulture production and $1,100 per hectare for broadacre cropping, to $418 per hectare for grazing production.

The potential impact of any disruption to agricultural enterprises caused by the project would be limited due to the small fraction of total agricultural land directly and permanently impacted.

The total area of agricultural land affected by the project would be about 1,911.6 hectares. This includes an estimated 230.2 hectares of permanently lost agricultural land (refer to Chapter 11 (Land use and property)).

It is estimated that this would:

- reduce gross output by around $130,000 per annum, which equates to around 0.01 per cent of total agricultural, forestry and fishing gross output in the economic study area
- result in a loss of half a full-time equivalent job, assuming an average output per worker of around $282,250 (IBIS, 2020)
- reduce total GVA by $50,000 per annum, assuming a GVA per worker of $98,500 (IBIS, 2020).

Therefore, adverse economic impacts of the project on existing agricultural enterprises would be minimal.

12.5.3. Impacts on forestry

The impact of construction compounds on forest land identified in Section 12.4.4 would no longer apply once construction work is complete, in part due to construction compounds being returned to their previous condition. It is assumed that vegetation within the easement would be cleared or restricted in height for safety and operation reasons. Forestry would no longer be an appropriate land use within the transmission line easements.

Based on the indicative concept design, the project could result in 351.8 hectares of forestry land being permanently removed from production. However, in a worst-case scenario based on construction impacts, up to 391.2 hectares of forestry land could be permanently lost if not replaced.

Assuming a $1,300[10] gross revenue per annum of each hectare of timber forest removed, this would amount to a loss of almost $510,000 each year. This would equate to about $7.84 million of loss to the timber industry over 30 years (net present value assuming a five per cent discount). This is not considered significant compared to the GRP of $9.3 billion of the economic study area.

In terms of any permanent losses in private plantation, owners would be compensated under just terms under the *Land Acquisition (Just Terms Compensation) Act 1991* for any loss of forest land. Whereas easement through State forests would be by agreement with Forestry Corporation of NSW (FCNSW) via a

[10] Economic cost was calculated by dividing total value of logs harvest by total hectares available for logging. Source: "Australian forest and wood production statistics" Australian Government Department of Agriculture, 2018 and 2022"

Deed of Easement, or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

Refer to Chapter 11 (Land use and property) for additional information on land use impacts.

12.6. Management of impacts

12.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management).

12.6.2. Avoidance and minimisation of impacts

The project has been designed to maximise economic benefits and minimise economic costs. Chapter 2 (Strategic context and project need) details the Regulatory Investment Test For Transmission (RIT-T) assessment process, which is an economic cost benefit test that applies to all major network investments in the NEM to enhance transparency and consistency in investment decision making.

The location of the project was chosen in response to the need of the grid to unlock REZs, which would have benefits for the State.

As discussed in Chapter 4 (Project description – construction), the Tumbarumba accommodation facility (AC1) is proposed to address a potential shortfall in available accommodation close to the project footprint. Transgrid will prepare a Worker Accommodation Strategy prior to the commencement of construction in consultation with local councils, accommodation service providers, other key stakeholders and the project's construction contractors. The strategy will aim to maximise benefits for the communities.

The ultimate delivery of the project may include multiple temporary worker accommodation facilities in various forms, which would be outlined in the Worker Accommodation Strategy for the project. Any new or changed worker accommodation facility would be subject to additional environmental assessment, as required.

Chapter 11 (Land use and property) provides discussion on how land use and property impacts have been avoided and minimised during development of the project. With avoidance and minimisation of these impacts, potential related economic impacts have also been avoided and minimised.

12.6.3. Mitigation measures

Operation of the project would be managed through Transgrid's Environmental Management System (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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential economic impacts are listed in Table 11-10. Other mitigation measures that are also relevant for minimising potential economic impacts are provided in Chapter 11 (Land use and property) and Chapter 13 (Social).

Table 12-5 Summary of mitigation measures - economic

Reference	Impact	Mitigation measure	Timing	Relevant location
EC1	Local employment	A Local Industry Participation Plan, an Australian Industry Participation Plan, a Workforce and Workforce Development Plan and an Aboriginal Participation Plan will be prepared and implemented.	Detailed design and construction	All locations
EC2	Potential business impacts	Liaison will occur with local councils, interest groups, economic development organisations, local chambers of commerce and State government to: • notify local businesses of the goods and services required by the project, service provision opportunities and compliance requirements of businesses to secure contracts • encourage and support local business in meeting the requirements of the project for supply contracts • assist qualified local businesses to tender for provision of goods and services to support the construction of the project, where possible.	Detailed design and construction	All locations

12.6.4. Managing residual impacts or uncertainties

The economic impact assessment was prepared by qualified and experienced practitioners who used I-O modelling to estimate the economic impacts at the national, State and regional level. A major limitation of economic impact analysis using I-O multipliers is the implicit assumption that the economy has no supply-side constraints. The actual impact will likely depend on the extent to which the economy is operating at or near capacity. In addition to the general limitations of I-O analysis, the modelling assumes that the ratio of GVA and workers' remuneration to gross output in any industry at the regional level is the same as at the national level. In general, the level of uncertainty increases as the region or economic study area becomes smaller. Hence the outputs should be considered as a 'most likely' or reasonable/probable estimate but not necessarily outputs that will be achieved. *Technical Report 6 - Economic Impact Assessment* addresses further limitations with the economic modelling.

Residual economic impacts associated with direct loss of productive land, such as agricultural or forestry land, would be minimised through compensation of landowners by agreement and/or in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.

13. Social

This chapter provides a detailed summary of the assessment of potential social impacts resulting from the construction and operation of the project. A full copy of the assessment results is provided in *Technical Report 7 - Social Impact Assessment* (HillPDA, 2023c).

During the development of HumeLink and the preparation of social impact assessment, Transgrid has undertaken extensive consultation with community and stakeholders. Transgrid will continue to engage with community and stakeholders on social impact through the detailed design, construction and operation of HumeLink.

13.1. Environmental Assessment Requirements

13.1.1. Secretary's Environmental Assessment Requirements

Table 13-1 outlines the SEARs relevant to social impacts and where these requirements are addressed in this EIS.

Table 13-1 Secretary's Environmental Assessment Requirements – Social

Reference	SEARs	Where principally addressed in the EIS
Social		
Key issues	The EIS must address the following matters: • an assessment of the social impacts in accordance with *Social Impact Assessment Guideline* (DPIE, July 2021) and consideration of construction workforce accommodation.	Section 13.4 provides an assessment of the social impacts resulting from construction of the project, including consideration of temporary worker accommodation. Section 13.5 provides an assessment of the social impacts resulting from operation of the project.

13.2. Assessment approach

13.2.1. Legislative and policy context

The Social Impact Assessment (SIA) was guided by the following state, regional and local plans and policies that are relevant to the project:

- Social Impact Assessment Guideline for State Significant projects (Department of Planning and Environment (DPE), 2023b) (SIA Guideline), which sets out a method for conducting SIAs for State Significant projects and groups social impacts into eight categories (refer to Table 13-3)
- regional plans including the Riverina Murray Regional Plan 2041 (DPE, 2023a) and South East & Tablelands Regional Plan 2036 (DPE, 2017a)
- regional economic development strategies, which set out long-term economic vision and priorities including Cootamundra Gundagai Tourism and Economic Development Strategy (Cootamundra Gundagai Regional Council, 2020), Snowy Valleys Regional Economic Development Strategy 2018-2020 (Snowy Valleys Council, 2018) and Southern Tablelands Regional Economic Development Strategy 2018-2022 (Yass Valley Council, 2018)
- relevant community strategic plans including Cootamundra Gundagai Community Strategic Plan 2022, Goulburn-Mulwaree Community Strategic Plan 2042, Hilltops Community Strategic Plan 2022, Snowy Valleys Community Strategic Plan 2028 and Wagga Wagga Community Strategic Plan 2040

- LSPS including Cootamundra-Gundagai Regional LSPS 2020, Snowy Valleys LSPS 2020, Upper Lachlan Shire LSPS 2020, Wagga Wagga City LSPS 2020, Yass Valley LSPS 2020, Hilltops LSPS 2020 and Goulburn-Mulwaree LSPS 2020.

13.2.2. Methodology

Projects can impact communities both positively and negatively. Social impacts consider the consequences that people experience when a new project brings change. The methodology for assessing the potential social impacts of the project was designed to align with the SIA Guideline, which involves three key phases for the SIA as follows:

- Phase 1: Scoping, which involved:
  - identifying the social locality (the social study area) and scoping potential impacts
  - data gathering and desktop analysis of the social baseline within the social locality, including a review of 2021 census data population and demographic information
  - reviewing state, regional and local plans and policies relevant to the project
  - engaging with the community and stakeholders to understand concerns and perceived social impacts from the project
  - reviewing relevant technical reports supporting the EIS that may influence the assessment of social impacts
- Phase 2: Impact Assessment, which involved assessing social impacts associated with the construction and operation of the project by applying a social impact matrix of likelihood (probability) and magnitude (duration/intensity/sensitivity) to obtain a rating for the significance of the social impact (refer to Table 13-6)
- Phase 3: Social Impact Management, which involved identifying mitigation and management measures to minimise social impacts of the project.

Transgrid commenced ongoing engagement with affected landowners, government agencies and other stakeholder in early 2020, which is outlined in Chapter 6 (Engagement) and Appendix C (Engagement Outcomes Report). Targeted stakeholder engagement was also undertaken as part of the development of the social impact assessment. A summary of the targeted engagement and its outcomes is provided in *Technical Report 7 – Social Impact Assessment.* The social issues and concerns raised from the general and targeted engagement were considered as part of the social impact assessment.

The social locality has been defined as the combined boundaries of seven Local Government Area (LGAs) that contain or are close to the project footprint. In addition to this, *Technical Report 7 - Social Impact Assessment* confirms that social impacts arising from the project may occur at different geographic levels within the social locality including the project footprint and the key communities, which are urban areas that would provide services and worker accommodation. These three areas are defined in Table 13-2 and illustrated in Figure 13-1.

Table 13-2 Relevant geographies adopted for the purpose of the social impact assessment

Area	Description
The social locality	The social locality is defined by the combined boundaries of the following LGAs: • Wagga Wagga City • Cootamundra-Gundagai Regional • Snowy Valleys • Hilltops • Yass Valley • Upper Lachlan Shire • Goulburn-Mulwaree.
Key communities	The key communities are the urban areas within the social locality that would be most affected by the project. They have been defined using the Australian Statistical Geography Standard's 'Urban Centres and Localities' framework, as used in the 2021 Census (Australian Bureau of Statistics, 2021a). The key communities and their definition in terms of Australian Bureau of Statistics (ABS) references are: • Wagga Wagga (ABS Reference UCL112015) • Tumbarumba (ABS Reference UCL115137) • Tumut (ABS Reference UCL114030) • Batlow (ABS Reference UCL115012) • Gundagai (ABS Reference UCL115073) • Yass (ABS Reference UCL114034) • Goulburn (ABS Reference UCL112008).
Project footprint	The area likely to be directly affected by the construction and operation of the project is referred to as the 'project footprint'. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.

Potential social impacts were grouped as per the social categories outlined in the SIA Guideline and shown in Table 13-3.

Table 13-3 Categories of social impacts (DPE, 2023)

Category	Description
Way of life	How people live, how they get around, how they work, how they play, and how they interact each day.
Community	Composition, cohesion, character, how the community functions, resilience and people's sense of place.
Accessibility	How people access and use infrastructure, services and facilities, whether provided by a public, private, or not-for-profit organisation.
Culture	Both Aboriginal and non-Aboriginal culture, including shared beliefs, customs, practices, obligations, values, and stories, and connections to country, land, waterways, places, and buildings.
Health and wellbeing	Physical and mental health, especially for people vulnerable to social exclusion or substantial change, psychological stress resulting from financial or other pressures, access to open space and effects on public health.
Surroundings	Ecosystems services such as shade, pollution control, erosion control, public safety and security, access to and use of the natural and built environment, and its aesthetic value and amenity.
Livelihoods	People's capacity to sustain themselves through employment or business.
Decision-making systems	These include the extent to which people can have a say in decisions that affect their lives, and have access to complaint, remedy and grievance mechanisms.

Social impacts were identified and assessed through the application of data and research outcomes to provide an evidence-based assessment. This included:

- considering the characteristics of the social locality, key communities and the project footprint
- identifying outcomes of other technical studies prepared for the EIS that have social implications for these areas
- understanding the outcomes of stakeholder and community engagement.

The assessment then applied a social risk matrix method to rank all identified impacts. Table 13-6 provides the social impact significance matrix utilised in *Technical Report 7 - Social Impact Assessment* (HillPDA, 2023c). It considers:

- the likelihood of a social impact occurring, which reflects the chance or probability that the impact would occur (refer to Table 13-4 for the definition of each likelihood level)
- the magnitude of the predicted impacts, which considers the extent, duration, intensity or scale, sensitivity and level of concern regarding potential impacts (refer to Table 13-5 for the definition of each magnitude level)
- the significance of each predicted social impact based on a combination of likelihood and magnitude.

Impacts have been evaluated both before and after the implementation of the recommended mitigations in Section 13.6.3 to provide a residual impact.

Table 13-4 Likelihood levels of social impacts

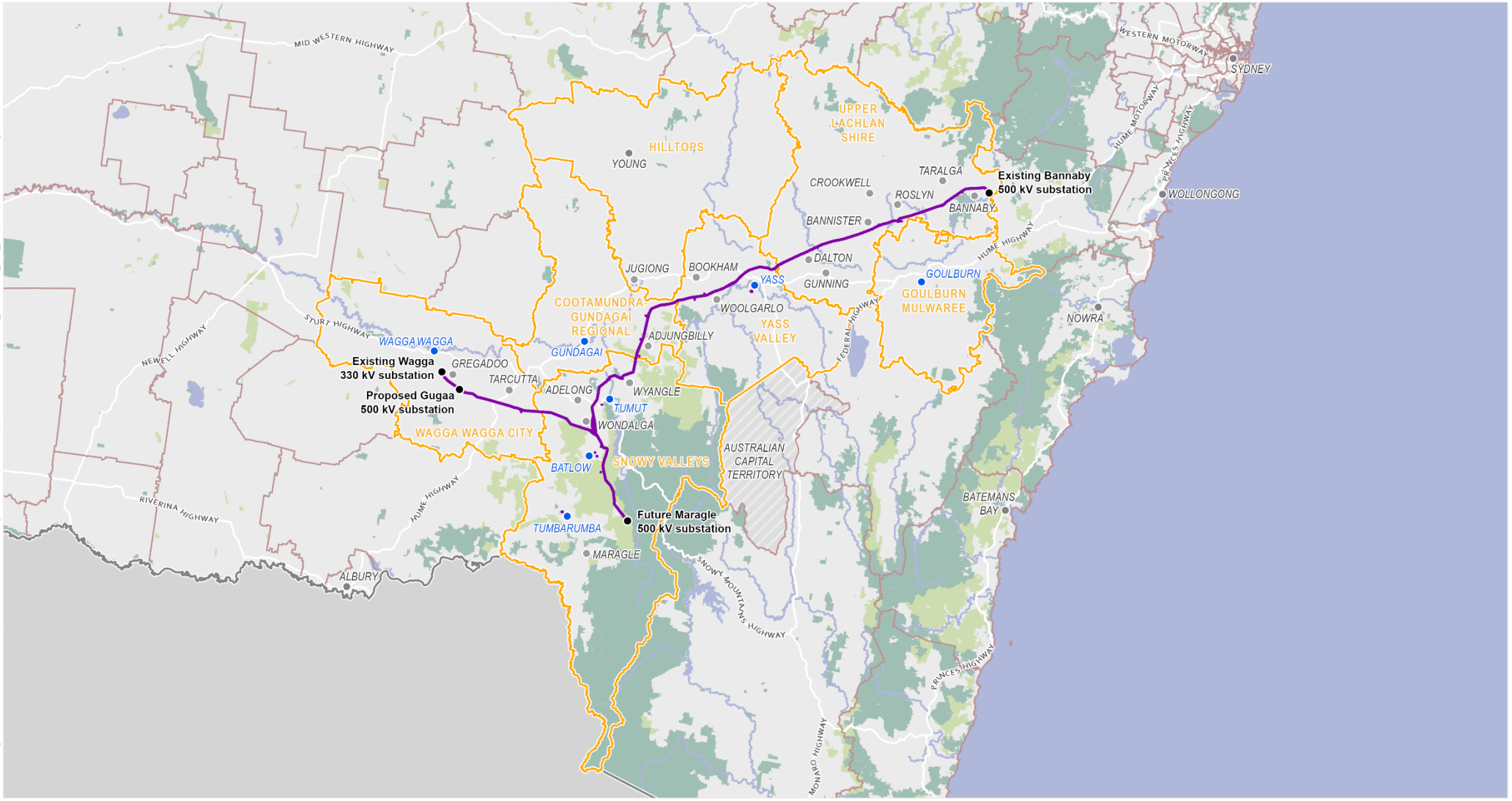
Likelihood level	Meaning
Almost certain	Definite or almost definitely expected (eg has happened on similar projects)
Likely	High probability
Possible	Medium probability
Unlikely	Low probability
Very unlikely	Improbable probability

Table 13-5 Magnitude levels for social impacts

Magnitude level	Meaning
Transformational	Substantial change experienced in community wellbeing, livelihood, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20% of a community.
Major	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area.
Moderate	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
Minor	Mild deterioration/improvement, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable.
Minimal	Little noticeable change experienced by people in the locality.

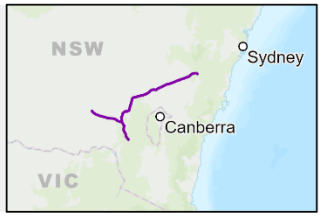
Table 13-6 Social impact significance matrix

Likelihood	Magnitude level				
	Minimal	Minor	Moderate	Major	Transformational
Almost certain	Low	Medium	High	Very high	Very high
Likely	Low	Medium	High	High	Very high
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Very unlikely	Low	Low	Low	Medium	Medium



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State of Victoria
Local Government Area
Social locality
State forest
National park and reserve
Waterway
Major road
Substation
Key community



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

1:1,750,000
0 40 80 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 13-1: Social locality

13.3. Existing environment

13.3.1. Social characteristics of the social locality

Table 13-7 provides a summary of key demographic indicators within the social locality, with comparisons made to the rest of NSW as defined by the ABS. All data is from the 2021 Census unless otherwise stated. This forms the 'social baseline' from helps inform and understand how potential impacts may be reasonably perceived or experienced by different people within the social locality.

Table 13-7 Key social characteristics of the social locality

Indicator	Information
Population	• At the 2021 Census, the social locality was home to 171,005 people. • Of the LGAs within the social locality, Wagga Wagga City had the largest population with 67,609 people, followed by Goulburn-Mulwaree with 32,053. Upper Lachlan Shire had the smallest population with 8,514 people.
Growth	• The population of the social locality is growing, albeit at a slower rate (6.61% between 2016 and 2021) than the rest of NSW (7.04% over the same time period). • Between 2016 and 2021, every LGA within the social locality grew in population, except for the Snowy Valleys LGA, which declined slightly. Over this time period, the LGAs of Goulburn-Mulwaree, Upper Lachlan Shire, Yass Valley and Wagga Wagga City all grew at faster rates than the rest of NSW.
Diversity	• 10.1% of residents in the social locality were born overseas, compared to 12.2% in the rest of NSW. • The three most common non-Australian countries of birth across the social locality were England (1.8% of residents), New Zealand (0.9% of residents) and India (0.8% of residents). • Within the social locality, Wagga Wagga City LGA had the strongest concentrations of people born overseas, with 1.5% of the population born in India, 1.2% born in Iraq, 1.2% born in England and 0.7% born in New Zealand. • The proportion of residents who spoke a language other than English at home was 6.5%, slightly lower than the rest of NSW, at 6%. • The most common non-English languages spoken were Arabic (0.4%), Mandarin (0.4%) and Malayalam (0.4%).
Age profile	• 60.7% of people in the social locality (103,760 people) were of working age (15–64 years). This was slightly higher than the proportion in the rest of NSW, which was 6%. • Within the social locality, Wagga Wagga City LGA had both the highest number and proportion of people of working age, at 42,657 people, or 63.1% of the population. By contrast, Cootamundra-Gundagai Regional LGA had the lowest proportion, at 6,186 people or 54.3% of the population.
Housing and households	• There were a total of 71,481 private dwellings and 63,566 households in the social locality, with an average household size of 2.5 people, slightly higher than the rest of NSW at 2.4. • Of the 63,566 households, 43,817 or 68.9% were family households, almost equal to the 68.8% of households in the rest of NSW.
Education	• At the 2021 Census, about 44.9% of residents in the social locality over the age of 15 had completed year 12 or equivalent, slightly higher than 44.5% for the rest of NSW.
Vehicle ownership	• The average number of motor vehicles per dwelling in the social locality was 2, slightly higher than the rest of NSW, with 1.9. • At the 2021 Census, 5.4 % of households within the social locality did not own a vehicle, compared to 5.5% in the rest of NSW. • Households with no vehicles were most common in Cootamundra-Gundagai Regional LGA (6.9% of households), and least common in Yass Valley LGA (2.3% of households).

Indicator	Information
Projected population	• According to the DPE in 2022, the population in the social locality is projected to grow to become 188,414 people in 2041. • Each LGA within the social locality is projected to grow in population over this time, except for Snowy Valleys and Cootamundra-Gundagai Regional LGAs, where the populations are projected to decline slightly. Goulburn-Mulwaree is expected to grow at the fastest rate of 1.2% annually.
Employment and industry	• The most common industry of employment in the social locality is health care and social assistance at 14.87%, which is roughly equivalent to the rest of NSW at 14.36%. • Other common industries in the social locality include public administration and safety (10.14%) and construction (9.12%), which differs from the rest of NSW where retail trade (10.35%) and education and training (9.02%) are common. • The unemployment rate in the social locality is 3.93%, which is lower than the rest of NSW at 4.55%.
Short-term accommodation	• The social locality has an estimated 1,620 rooms available in short-term accommodation including hotels, motels and caravan parks. • Outright home ownership was the most common tenure type within the social locality, at 36.1%, followed by ownership with a mortgage at 32.8%, and renting at 26.7%. • An analysis of the private rental market in the major towns in the social locality showed no more than 19 properties listed for rent in each of the towns Yass, Gundagai, Tumut, Batlow and Tumbarumba. Wagga Wagga had the greatest number of rental properties with a total of 90 available with the weekly rent ranging from $280 to $725.
Social infrastructure	• there is a range of social infrastructure servicing the social locality, including primary, secondary and tertiary educational facilities, transport infrastructure, district and community hospitals and health services, and a considerable range of sport and recreational facilities. • most of the social infrastructure is in the urbanised areas, particularly Wagga Wagga, which includes commercial, employment, education and residential activities. • beyond the key communities in the social locality, social infrastructure is limited due to the rural and dispersed nature of development.
Health and wellbeing	• the social locality had lower levels of need for assistance, psychological distress, and alcohol consumption than the rest of NSW. • the social locality shows positive levels of voluntary work, community support, and accessible social infrastructure.

13.3.2. Key communities

Table 13-8 provides an overview of relevant population and demographics characteristics for the key communities that have been identified within the social locality. These key communities range in size from Wagga Wagga, with a population of about 49,686 people, to Batlow, with about 1,022 people as of the 2021 Census (ABS, 2021). For further demographic data refer to *Technical Report 7 – Social Impact Assessment*.

Table 13-8 Key communities within the social locality

Key communities	Description
Wagga Wagga	Wagga Wagga is located in the centre of the Riverina region, about halfway between Sydney and Melbourne. Wagga Wagga's city centre is located about 10 km (or 20 minutes by road) from the nearest point of the project footprint, the existing Wagga 330 kV substation. Wagga Wagga railway station connects the city to the Main Southern railway line of NSW's railway system. Wagga Wagga airport has daily flights to Sydney and Melbourne. Wagga Wagga has more than 30 hotel/motel operators and five caravan parks. Therefore, Wagga Wagga serves as a transport hub, and hosts a full range of commercial facilities, as well as a large range of medical services, numerous cafes, restaurants, pubs, and vineyards. As of the 2021 Census, Wagga Wagga was home to 49,686 people.

Key communities	Description
	In 2021, 62.1% of residents in Wagga Wagga over 15 were participating in the labour force, a significantly higher proportion than the 56.4% in the rest of NSW. Of those residents in the labour force in Wagga Wagga, 4.6% were unemployed, equal to the rest of NSW.
Tumbarumba	Tumbarumba is a small town in the Snowy Valleys LGA, located on the western edge of the Snowy Mountains, about 20 km west of the project footprint, or 20 minutes by car. It is located on Tumbarumba Creek, a tributary of the Murray River. Today, Tumbarumba has locally significant industries in forestry, cattle and sheep farming, wine and berry production, and tourism. Accommodation in Tumbarumba is provided by several hotel/motel operators and the Tumbarumba Caravan Park. As of the 2021 Census, Tumbarumba was home to 1,505 people. In 2021, 54.4% of residents in Tumbarumba over 15 were participating in the labour force, a lower proportion than the 56.4% in the rest of NSW. Of those residents in the labour force in Tumbarumba, 3.8% were unemployed, compared to 4.8% across the rest of NSW.
Batlow	Batlow is a small town in the Snowy Valleys LGA, located between Tumut to the north, and Tumbarumba to the south. The project footprint is about six km to the east of the town, from which it is about 10 minutes by car at the nearest point. Situated in Wiradjuri country, the town of Batlow is a centre for fruit growing, particularly apples. There are several accommodation providers within Batlow, including the Batlow Hotel, the Apple Inn, and Batlow Caravan Park. As of the 2021 Census, Batlow was home to 1,022 people. In 2021, 48.1% of residents in Batlow over 15 were participating in the labour force, a considerably lower proportion than the 56.4% of residents in the rest of NSW. Of those residents in the labour force in Batlow, 6.3% were unemployed, compared to 4.6% across the rest of NSW.
Gundagai	Gundagai is a small town located on the Murrumbidgee River in the Cootamundra-Gundagai Regional LGA. The surrounding land is used for farming. There are a range of accommodation providers in Gundagai, including hotels, motels, eco-huts, and caravan parks. As of the 2021 Census, Gundagai was home to 1,970 people. In 2021, 50.7% of residents in Gundagai over 15 were participating in the labour force, a lower proportion than the 56.4% of residents in the rest of NSW. Of those residents in the labour force in Gundagai, 3.8% were unemployed, compared to 4.6% across the rest of NSW.
Tumut	Tumut is a town located in the foothills of the Snowy Mountains, around the confluence of Tumut River, Goobarragandra River, and Gilmore Creek, about four km east of the project footprint. Significant industries in the surrounding area of Tumut include sheep and cattle grazing, forestry and tourism and outdoor recreation. As of the 2021 Census, Tumut was home to 6,518 people. In 2021, 56.3% of residents in Tumut over 15 were participating in the labour force, a lower proportion than the 56.4% in the rest of NSW. Of those residents in the labour force in Tumut, 5.2% were unemployed, compared to 4.6% across the rest of NSW.
Yass	Yass is a town in the NSW Southern Tablelands. Its town centre is located about six km south of the project footprint, or less than 10 minutes by car. Sheep farming is still one of the largest employers in Yass, although cool-climate vineyards, the gourmet food and beverage industry, and arts and heritage tourism are growing contributors to the region's economy. Accommodation in Yass is provided by roughly 10 hotel/motel operators and the Yass Valley Caravan Park. As of the 2021 Census, Yass was home to 5,837 people. In 2021, 59.7% of residents in Yass over 15 were participating in the labour force, a higher proportion than the 56.4% in the rest of NSW. Of those residents in the labour force in Yass, 3.3% were unemployed, compared to 4.6% across the rest of NSW.
Goulburn	Goulburn is located roughly 20 km south-east of the project footprint. By car, Goulburn is located less than an hour south of the project footprint, near the Bannaby 500 kV substation end of the footprint. Goulburn is a major regional centre serving the surrounding area due to its wool industry and strategic location on the Main Southern railway line. Accommodation in Goulburn is provided by two caravan parks and about 20 hotel/motel operators. As of the 2021 Census, Goulburn was home to 23,963 people. In 2021, 56.6% of residents in Goulburn over 15 were participating in the labour force, a slightly higher proportion than the 56.4% in the rest of NSW. Of those residents in the labour force, 4.6% were unemployed compared to 4.6% across the rest of NSW.

13.4. Potential impacts – construction

Social impacts may be positive or negative. Potential social impacts have been considered in the context of the social baseline and other background information as existing conditions can affect the likelihood of social impacts occurring, or the magnitude of impacts that do occur.

Potential social impacts likely to arise from construction of the project have been grouped into categories identified in the SIA Guideline and are summarised in Table 13-9. Impacts have been evaluated both before and after the implementation of the recommended mitigations in Section 13.6.3, to provide a residual impact. Refer to *Technical Report 7 – Social Impact Assessment* for further information.

Table 13-9 Key potential social impacts during construction of the project

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Way of life			
Availability and affordability of housing	The introduction of construction workers would reduce available short-term accommodation for tourists, reduce housing affordability, and have flow-on impact on the private rental market. Construction workers would be housed in short-term accommodation (hotels, motels and caravan parks) and a purpose-built worker accommodation facility at Tumbarumba accommodation facility (AC1), which is expected to house up to 200 workers. Impacts arising from availability and affordability of housing are most likely to be felt in the key communities, as these are the locations where short-term accommodation is most concentrated. Should construction of the project cause changes to the private rental market, the impacts would be greatest in the key communities with lower supplies of housing such as Yass, Gundagai, Tumut, Tumbarumba and Batlow. Any impacts on housing availability or affordability would be dependent on what financial interest an individual or household had in housing. Whilst renters may experience negative social impacts, investors or landowners may gain financially through increased rents or sale prices.	• likelihood: possible • magnitude: moderate • significance: medium (negative)	• likelihood: unlikely • magnitude: moderate • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Amenity	Stakeholder engagement identified that quietness offered by the country lifestyle is highly valued by the community. Some people were concerned that construction noise including the movement of heavy machinery would impact on way of life and potentially detract from the pleasantness of the environment. Vulnerable groups (such as those with a daily need for physical assistance or elevated levels of psychological distress) may be more sensitive to construction noise and vibration, including disturbance from movement of construction vehicles. Some exceedances of the relevant criteria are predicted during construction activities. However, construction noise impacts would generally be limited in duration at each location and transmission line construction activities would move along the project footprint. It is also expected that there would be periods where construction noise levels are much lower than the levels predicted as well as times when no equipment is in use and no noise impacts occur. Some construction activities would be required to be undertaken outside the standard construction hours, which could disrupt people and their lifestyles and result in sleep disturbance. However, any noise impacts during out-of-hours work would be limited in duration and minimised through the implementation of mitigation measures, where possible. Chapter 15 (Noise and vibration) provides further detail on the noise levels predicted during construction and the mitigation measures that would be implemented.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)
Community			
Population changes from temporary construction workforce	It is anticipated that the project would require up to 1,200 workers during peak construction. Workers would be dispersed across the extent of the project and numbers would vary over the construction period. Peak concentrations of workers in the social locality are expected in the latter half of 2025. The construction workforce is expected to comprise a combination of workers who are local (or from within the social locality) (20%), Australian (60%) and international (20%). The maximum workforce of 1,200 workers represents a 0.7 per cent increase over the 2021 population of the social locality. While this is unlikely to be noticeable across the overall social locality, key communities where construction workers are accommodated are likely to notice the temporary population increase. Despite stakeholders having some concerns about the potential for non-resident workers to impact on housing availability and tourism, they were generally positive about the potential introduction of construction workers into the region. For example, it was felt that Tumbarumba has plenty to offer incoming construction workers with an abundance of sports clubs and facilities, new cycle paths, mountain biking and equestrian activities.	• likelihood: almost certain • magnitude: minor • significance: medium (negative)	• likelihood: almost certain • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
	The worker population, at its peak would represent a 15.7% increase to the population of Tumbarumba and 6.1% increase to the population of Tumut. In all other cases, the worker population would increase the overall population of the community by less than 3.9%. As construction work is completed, there would be a gradual decline in the temporary workers in the social locality. By project completion, the population within the social locality would likely return to levels similar to the existing population.		
Social cohesion	Some stakeholders in Tumbarumba expressed concern in relation to the Tumbarumba accommodation facility at the potential for temporary workers not integrating into the town and not respecting the values and culture of the local community. The project may impact on existing residents' feelings of connection to their community. This may lead to an increased sense of anxiousness and uncertainty, due to strangers moving into the area. About 480 workers (40%) would likely be sourced regionally and internationally for construction of the project. The introduction of domestic and international workers into the key communities could generate temporary positive social impacts through new relationships and interactions, shared experiences and exchanges that may expand residents' contacts and knowledge. Impacts on social cohesion may arise within the key communities through conflict between community members in support of the project and those against it, with potential for frustration or anger. Non-resident workers may be more susceptible to antisocial behaviour associated with disconnectedness and/or drug/alcohol use. Workers would be provided with a Code of Conduct to minimise the incidence of antisocial behaviour.	• likelihood: possible • magnitude: moderate • significance: medium (negative)	• likelihood: unlikely • magnitude: moderate • significance: medium (negative)
Accessibility			
Transport and movement	Project construction would generate temporary increased traffic including movement of construction vehicles. Chapter 20 (Traffic, transport and access) provides a detailed assessment of these impacts. Impacts on transport and movement would occur in the project footprint with sections of the road network to be partially or completely closed for short durations to allow for construction activities to safely take place, particularly during stringing of the transmission line over roads. This may result in the requirement for temporary detours which may result in minor impacts on traffic. This may increase travel time and petrol consumed, and potentially impact on response times for emergency vehicles. However, these impacts would only affect each road crossing for a short period of time and any affected landowners or stakeholders would be consulted prior to any change to minimise potential impacts.	• likelihood: possible • magnitude: moderate • significance: medium (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Social infrastructure	The peak construction workforce of up to 1,200 is likely to be present for less than three months. However, more than 800 workers may be present for six months, more than 600 workers may be present for 14 months and more than 400 workers may be present for around 23 months, not allowing for holiday season departures. Impacts on social infrastructure would be experienced in the following service types: • increased demand for hospital services • increased demand for emergency services • increased patronage for leisure and recreation facilities. Anecdotal evidence suggests that access to GPs is already challenging in most parts of the social locality. However, given the relatively short-term and mobile nature of the construction program, it is likely that many of the non-local workers would continue to seek general health advice from their existing GPs via telehealth or wait until they return home if able. Overall, access to hospital services is sufficient to accommodate the needs of the temporary non-resident construction workers. The worker accommodation facility would also likely have medical services onsite for general medical needs. It was evident during stakeholder engagement that the community still feels the effects of the recent bushfires and has strong concerns that the project could contribute to future risks of bushfire. The project would be designed and constructed in accordance with a Bush Fire Emergency Management and Evacuation Plan in consideration of recommendations from the Rural Fire Service to minimise risks associated with bushfires. Ambulance services may be required in the event of worker injury, and police services may be required to manage worker behaviour or other project emergency incidents. Consultation with these services indicated that construction of the project is not likely to have significant impacts on service capacity. While increased patronage from non-resident workers is expected to be small, it may provide some support for the operation of recreation facilities through increased payment of entry fees and expenditure at kiosks and the like. Local sporting teams could see some increased participation as workers seek out sporting pursuits for socialisation and healthy lifestyles.	• likelihood: likely • magnitude: moderate • significance: high (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Availability of goods and services	The key communities may experience changes in the availability of goods, services and labour as local businesses seek to meet any increased demand from non-resident workers. While this could lead to minor positive social outcomes through improved livelihoods for businesses and operators receiving increased income, residents in the key communities may be subject to negative outcomes to way of life or health and wellbeing by being forced to access goods and services at higher prices, or may need to switch to lower quality offerings. This is most likely to impact low income residents. However, any such negative impacts are expected to be minor in scale and short-term in duration and minimised through liaison with local businesses.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: possible • magnitude: minimal • significance: low (negative)
Utilities and telecommunications	There is potential for the project to result in temporary interruptions to utilities (eg electricity, water and sewerage) and telecommunication services (eg phone and internet). There could also be inadequate capacity in systems due to an increase in demand from non-resident workers. However, any impacts would be temporary and short-term. This would be further minimised through provision of appropriate utilities and services at the worker accommodation facility in Tumbarumba.	• likelihood: possible • magnitude: moderate • significance: medium (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)
Culture			
Connection to Country	The project would be developed in a region of complex and diverse Aboriginal culture, with valued natural assets, sacred sites and objects of cultural heritage significance. The project has the potential to impact on: • the ability of Aboriginal people to maintain and develop culture • the sense of trust that Aboriginal people have in the management of matters of cultural heritage. Infrastructure developments, due to their scale, pose a risk to the surrounding environment and potential sites of cultural heritage significance. Aboriginal and Torres Strait Islander parties through the consultation process have participated in the assessment of heritage and archaeological significance in the project footprint, by providing comment on reporting and on the assessment methodology, and identifying significant sites or items. Additionally, all Local Aboriginal Land Councils (LALCs) within the social locality were contacted as part of the consultation undertaken for this SIA. Those that participated in the consultation raised no specific concerns with the project in terms of culture or connection to country. The SIA consultation found that the project was viewed positively by the LALCs as it is expected to provide local Aboriginal and Torres Strait Islander communities an opportunity to access employment and training. Ongoing engagement would occur with the LALCs as the project progresses.	• likelihood: possible • magnitude: moderate • significance: medium (negative)	• likelihood: unlikely • magnitude: moderate • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
	Chapter 9 (Aboriginal heritage) provides further information on this issue and mitigation measures to assist with minimising impacts on Aboriginal cultural heritage.		
Non-Aboriginal culture	Non-Aboriginal people and communities within and near the project footprint have strong cultural ties and shared histories that are associated with the exploration and settlement of land, natural and built environment features, and stories and relationships. The non-Aboriginal heritage assessment concluded that there would be no direct impact on the heritage significance of any of the identified items with non-Aboriginal heritage significance within the project footprint. The project may, however, have indirect visual impacts on one listed item of local significance and two items of national significance. These indirect visual impacts would arise through the proximity of the transmission line structures and any required clearance of vegetation. Chapter 10 (Non-Aboriginal heritage) provides a detailed assessment of these impacts. Whilst visual changes to the landscape can indirectly impact the heritage value of significant items or areas, it is unlikely that the anticipated changes arising from the project would cause social impacts.	• likelihood: unlikely • magnitude: minor • significance: low (negative)	• likelihood: unlikely • magnitude: minor • significance: low (negative)
Health and wellbeing[11]			
Community health	Dust from vehicles travelling on unsealed roads or other construction activities may impact air quality. Chapter 21 (Air quality) provides a detailed assessment of these impacts. Noise and vibration may impact nearby residents' enjoyment of their home or result in potential sleep disturbance from plant and machinery movements or other construction activities. Chapter 15 (Noise and vibration) provides a detailed assessment of these impacts. Dust and noise can have an adverse impact on the health and the wellbeing of residents depending on their distance from the project footprint and consistency of the noise. However, any potential impacts on health and wellbeing would be minimised by implementing mitigation measures for dust and noise generated from construction.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: unlikely • magnitude: minor • significance: low (negative)
Health and wellbeing of construction workers	Temporary workers can suffer from increased stress levels and poorer health including depression, binge drinking, recreational drug use and obesity (Morris, 2020). There is potential for behavioural issues to occur in key communities during leisure time, particularly where alcohol is involved. Risks to worker health would be felt in the key communities, being the locations where most workers would be accommodated and where they would seek out social connections and services.	• likelihood: likely • magnitude: moderate • significance: high (negative)	• likelihood: possible • magnitude: moderate • significance: medium (negative)

[11] Potential impacts associated with stress and anxiety are also discussed further in the 'Surroundings' and 'Livelihoods' category

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
	A Workforce and Workforce Development Plan would be prepared to manage this potential risk, which would include provision of information on services to promote health and wellbeing, which would be implemented during construction of the project.		
Surroundings			
Landscape and visual amenity	Throughout the project footprint and nearby (distance would vary depending on topography and visibility), direct impacts would arise from visible construction activities, plant and equipment and removal or pruning of vegetation within the project footprint. This may temporarily disrupt the views and amenity of residences located near the project footprint, causing stress and anxiety and may affect people's enjoyment of their local areas and sense of pride. Community members may also feel concern about loss of biodiversity where clearing is undertaken within the project footprint. However, impacts on landscape and visual amenity are expected to be localised and not experienced throughout the entire social locality. Chapter 14 (Landscape character and visual amenity) provides a detailed assessment and mitigation of these impacts.	• likelihood: almost certain • magnitude: moderate • significance: high (negative)	• likelihood: likely • magnitude: moderate • significance: high (negative)
Livelihoods			
Employment opportunities	The construction of the project would create a positive impact as there would be substantial employment opportunities. Up to 1,200 construction workers would be required, with about 20% of these expected to be from within the social locality. Chapter 12 (Economic) provides an assessment of the benefits of employment opportunities to the social locality. Increased employment typically benefits livelihoods of individuals and creates substantial indirect benefits to communities, culture, wellbeing and social cohesion.	• likelihood: almost certain • magnitude: moderate • significance: high (positive)	• likelihood: almost certain • magnitude: major • significance: very high (positive)
Aboriginal and Torres Strait Islander employment	The project would provide opportunities for local employment and upskilling of Aboriginal workers in the social locality. The project's Indigenous Engagement Plan 2022–2023 indicates that direct engagement with Aboriginal people, groups and communities would be undertaken to identify employment and business opportunities, as well as any barriers to employment on the project. There would be no negative impacts on Aboriginal employment in the project footprint.	• likelihood: possible • magnitude: major • significance: high (positive)	• likelihood: likely • magnitude: major • significance: high (positive)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Property changes	The project would require temporary or permanent alterations to property tenure or ownership arrangements to facilitate construction. Whilst nine dwellings have been identified within the project footprint, the transmission line route would be refined to avoid or minimise impacts on dwellings where possible. For these landowners, uncertainty, stress and disruption to day-to-day life would be significant impacts. However, based on the indicative concept design only one dwelling is likely to require removal. All required property acquisition, leasing and easement arrangements would be carried out in accordance with relevant legislation. Transgrid has and will continue to undertake extensive consultation with affected landowners to establish necessary property arrangements and confirm the extent of property acquisition. Also, under the NSW Government's Strategic Benefit Payments Scheme, private landowners would receive $200,000 per kilometre of new transmission infrastructure hosted on their land. This compensation may be financially beneficial to the identified landowners and may offset costs associated with the project (such as the relocation of farmhouses or sheds to a different section of their properties). Compensation may be used to secure additional land to maintain agricultural productivity and livelihoods associated with the industry or to relocate if wanted or required as a result of acquisition. Chapter 11 (Land use and property) provides a detailed assessment of these impacts.	• likelihood: almost certain • magnitude: moderate • significance: high (negative)	• likelihood: likely • magnitude: moderate • significance: high (negative)
Tourist accommodation	Impacts arising from the construction of the project may reduce the availability of short-term accommodation for tourists such as the caravan parks, hotels and motels. This could be a concern at peak times, where accommodation shortages may already occur (such as during Tumbafest in Tumbarumba and seasonal harvesting periods). These changes have the potential to impact on the livelihood of those in the social locality who benefit from tourism. Potential impacts from worker accommodation would be considered further during development of the Worker Accommodation Strategy for the project.	• likelihood: likely • magnitude: moderate • significance: medium (negative)	• likelihood: possible • magnitude: moderate • significance: medium (negative)
Increased tourism	It is anticipated that some of the project workers may have visitors to the key communities and they would most likely undertake tourism activities such as sightseeing or cultural activities within the key communities, creating a new source of tourism. Operators of tourism accommodation in the social locality would benefit from the additional demand for short-term accommodation arising from the project. Impacts on tourism in the social locality are difficult to predict. In all likelihood, any adverse impacts on tourism resulting from the construction disturbances would be more than outweighed by the benefits of consumption-induced impacts in the social locality resulting from additional workers and their families. This would benefit existing businesses in the social locality in retail, hospitalities, food services and the like.	• likelihood: possible • magnitude: moderate • significance: medium (positive)	• likelihood: possible • magnitude: moderate • significance: high (positive)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Adjustments to land use and primary production	Land use changes may impact the livelihood of residents and businesses located in or near the project footprint, through loss of income, stress and subsequent decreased quality of life. Changes to livelihood may arise from land use changes to primary production land during construction which may impact primary producers through the removal of farm infrastructure such as dams or sheds, or accommodation structures that may be used to house seasonal workers. Additional construction noise and movement of workers through the construction period may indirectly impact agricultural operations by impacting livestock or loss through accidental injury or escaping. Furthermore, primary producers may have increased stress arising from concerns around the security of productive lands and potential spread of weeds, pests, disease and/or contamination from construction activities. These impacts could result in costs and/or reduced ability to earn income to the primary producer. However, the area of impacted agricultural or forestry land would be minimal as a proportion of the available land in the LGAs surrounding the project footprint. The magnitude of the impact is considered to be minor due to the small area of impact and temporary nature of construction. Agricultural production would only be temporarily affected across most of this area during construction and for a limited time after construction. Most areas impacted during construction would be rehabilitated (if required) and returned to their former land use after construction is completed or as agreed with the landowner. Therefore, it is highly unlikely that significant social impacts would arise from changes to primary production land. Chapter 11 (Land use and property) provides a detailed assessment of these impacts and relevant mitigation measures such as development of Property Management Plans to minimise land use impacts, including biosecurity risks and access impacts.	• likelihood: likely • magnitude: minor • significance: medium (negative)	• likelihood: likely • magnitude: minor • significance: medium (negative)
Decision-making systems			
Acquisitions and leases	Property acquisition, creation of easements and temporary leasing arrangements would be required for the project. These changes may affect how landowners use their properties and how they go about their day-to-day activities. This has the potential to cause uncertainty, stress and impacts on way of life. Chapter 11 (Land use and property) provides a detailed assessment of these impacts.	• likelihood: almost certain • magnitude: major • significance: very high (negative)	• likelihood: almost certain • magnitude: moderate • significance: high (negative)

13.5. Potential impacts – operation

The key potential social impacts during the operational phase of the project are identified in Table 13-10. The impacts have been grouped into categories identified in the SIA Guideline (refer to Table 13-3) and evaluated both before and after the recommended mitigations would be implemented to provide a residual impact. Mitigation measures are provided in Section 13.6.3. Refer to *Technical Report 7 – Social Impact Assessment* for further information.

Table 13-10 Key potential social impacts during operation of the project

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Way of life			
Noise disturbance	Operational noise from the project would primarily include electrical hum along the transmission line and noise generated from new or modified substations. This may potentially impact nearby residents' quiet enjoyment of their homes and, therefore, way of life. This could have an adverse impact on their health and wellbeing, depending on their distance to the project footprint and consistency of operational noise. An increase in noise levels is predicted in the surrounding area for the proposed Gugaa 500 kV substation. However, the proposed Gugaa 500 kV substation would be designed to comply with the relevant noise criteria (eg through barriers), which would minimise impacts on residential receivers during operation. The operational noise assessment indicated that night-time noise thresholds have potential to be exceeded for up to 11 residential receivers in fair weather conditions, and up to 62 residential receivers in light rain or mist conditions. However, the noise impacts assessed was based on conservative assumptions and mitigation measures would be implemented. Overall, it is considered unlikely that the project would have any material impact on residents' way of life once operational. The day-to-day operational impacts arising from the project would be low. Chapter 15 (Noise and vibration) provides a detailed assessment of these impacts.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: unlikely • magnitude: minor • significance: low (negative)
Radio interference	The Audible Noise and Radio Interference Report (Aurecon, 2022a) (provided in *Technical Report 9 – Noise and Vibration Impact Assessment*) identified that, depending on a number of factors (eg the frequency of the radios), the project has the potential to interfere with recreational radio use close to the transmission line. Beyond design optimisations, the Audible Noise and Radio Interference Report recommended monitoring be undertaken for receivers close to the transmission line to determine if radio interference eventuates. Should issues arise, Transgrid can offer to upgrade receiving systems.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Community			
Social benefits	Community impacts from the project could include changes to composition, character, cohesion, function, and sense of place (as defined in the SIA Guideline). As operation of the project would not change the composition or structure of any communities, no negative impacts are expected. Transgrid has prepared the HumeLink Community Investment and Benefits Plan (HCIBP) to guide investment in communities along the project footprint to address identified impacts and deliver social outcomes and benefits. Positive impacts could arise from Transgrid's community support initiatives which could improve the provision of community infrastructure through partnerships with and resourcing of community groups.	• likelihood: possible • magnitude: minor • significance: medium (positive)	• likelihood: possible • magnitude: minor • significance: medium (positive)
Health and wellbeing[12]			
Perceived risk of EMF and bushfire	The predicted levels of electric and magnetic fields (EMF) are expected to be well below the relevant guidelines. Notwithstanding the operational design, concerns may remain regarding perceived health and wellbeing impacts of EMF amongst community members, which could lead to impacts on mental health (stress and anxiety). Chapter 19 (Hazards and risks) provides further information on the predicted levels of EMF. In addition, the perceived risk of bushfire along the project footprint may elicit anxieties from those located in or near the project footprint. Chapter 19 (Hazards and risks) provides an assessment of this issue and mitigation measures to avoid and/or minimise potential risks associated with EMF and bushfires.	• likelihood: unlikely • magnitude: minimal • significance: low (negative)	• likelihood: unlikely • magnitude: minimal • significance: low (negative)
Transmission line noise and air quality	Health and wellbeing impacts could arise from air quality and noise impacts, both of which would be limited to the immediate vicinity of the project footprint. Air quality impacts may result as a result of maintenance and service vehicles travelling along unsealed roads. These journeys would be relatively infrequent and short-term and would not result in any material impacts on nearby residential receivers. Noise impacts could arise from the operation of the transmission line in certain conditions[13]. These impacts would be mitigated on an individual receiver basis through consultation, noise monitoring and (where required) architectural treatment of dwellings to reduce noise ingress. Chapter 15 (Noise and vibration) and Chapter 21 (Air quality) provide further information on these impacts.	• likelihood: unlikely • magnitude: minimal • significance: low	• likelihood: unlikely • magnitude: minimal • significance: low

[12] Potential impacts associated with stress and anxiety are also discussed further in the 'Livelihoods' category
[13] This impact is further discussed in 'Way of life'.

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Surroundings			
Ongoing visual impacts and changes to landscape character	Impacts on surroundings includes impacts on people's access to, and use of, services that ecosystems provide, public safety and security, access to and use of the natural and built environment, and its aesthetic value and amenity. Consultation identified concerns regarding the visual impact of the transmission line structures including that the project would change the character of smaller rural communities and may cause the industrialisation of scenic rural areas. During consultation, some people in or near the project footprint noted their concern that the change in surroundings combined with concerns for their livelihood could impact mental health. However, the potential impacts on landscape character would be localised and are unlikely to be high for the entire social locality. The most notable changes to landscape character would occur within the ridgelines and hills of the western part of the social locality. The addition of the proposed Gugaa 500 kV substation and presence of large scale transmission line structures would alter the prevailing character of the rural landscape. A desktop assessment of landscape character and visual amenity identified 90 dwellings as having the potential for a moderate or higher visual impact from their private viewpoints. The visual impact of the project may contribute to a sense of loss when viewed by local residents who may have formed an attachment to particular viewpoints and vistas within the landscape. However, for the dwellings identified to have a high visual impact, opportunities for visual screening would be investigated in consultation with the affected landowner. Chapter 14 (Landscape character and visual amenity) provides an assessment of landscape character and visual impacts and mitigation measures to minimise visual impacts, such as micro-siting of transmission line structures and consideration of visual screening where practicable.	• likelihood: almost certain • magnitude: moderate • significance: high (negative)	• likelihood: almost certain • magnitude: moderate • significance: high (negative)
Livelihoods			
Changed land uses and reduced agricultural capacity	Operational impacts on livelihoods within the social locality could arise from changes in land use, loss of agricultural land and impacts on property values for land within the project footprint. While grazing and some cropping activities can still be carried out beneath transmission lines, the easement and associated transmission line may restrict or alter how some landowners manage their property. This could potentially decrease productivity on some portions of land, which could have an effect on livelihoods. For example, transmission line infrastructure above cropping areas may restrict the use of some agricultural plant and equipment due to their height, which may disrupt agricultural productivity. This would impact the livelihoods of landowners required to adjust the types of crops and location of yields, and could cause them stress.	• likelihood: likely • magnitude: minor • significance: medium (negative)	• likelihood: likely • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
	Transgrid would continue to consult with landowners to minimise local impacts to agricultural land as far as possible and any loss of productive land would be compensated under the *Land Acquisition (Just Terms Compensation) Act 1991*. In addition, Strategic Benefit Payments for landowners who host the transmission line, received for 20 years once the project is operational, are likely to go some way towards compensating landowners for land use changes. These payments would ensure they share directly in the benefits of the project. Primary producers may also have increased stress arising from concerns around the potential biosecurity risks associated with construction Chapter 11 (Land use and property) provides a detailed assessment of these impacts and proposed mitigation measures to minimise land use impacts.		
Restricted access for machinery	The loss or reduced functionality of productive land could reduce the yields and, therefore, potential revenues from agriculture. However, the areas where this land is no longer available for agriculture only comprise a small proportion of the social locality. Any loss of productive land would be compensated under the *Land Acquisition (Just Terms Compensation) Act 1991*. The transmission lines may impact on aerial agricultural activities such as spraying of fertilisers with fixed-wing aircraft or helicopters. Transgrid would continue to refine the transmission line route to avoid or minimise impacts on aerial activities where possible, and investigate alternative technologies that could be used to lessen impact. Chapter 11 (Land use and property) provides further information on these impacts and proposed mitigation measures to minimise land use impacts.	• likelihood: likely • magnitude: minor • significance: medium (negative)	• likelihood: likely • magnitude: minor • significance: medium (negative)
Perceived impacts on land values	Consultation has also identified a perception by some landowners that property values may be adversely impacted due to the presence of overhead transmission lines. This may cause stress regardless of whether the impact on property prices is real. Impacts on land values would not materially affect day-to-day livelihoods, but could induce anxiety as a result of concern regarding land sale prices when or if the current landowner decide to sell. Chapter 11 (Land use and property) provides further information on impacts on property values. Compensation would be paid under the *Land Acquisition (Just Terms Compensation) Act 1991* as well as Strategic Benefit Payments for landowners who host the transmission line, received for 20 years once the project is operational. These payments are likely to go some way towards compensating landowners for changes to property values should they be found to occur.	• likelihood: likely • magnitude: minor • significance: medium (negative)	• likelihood: likely • magnitude: minor • significance: medium (negative)

Topic	Impact description	Impact before mitigation	Residual impact after mitigation
Decision-making systems			
Ongoing access to land	During operation of the project, Transgrid would require access to the transmission line easement for maintenance. Access arrangements would be agreed to in consultation with landowners and maintenance crews would largely use the new or upgraded access tracks established during construction. Transgrid recognises that acquiring a transmission line easement over land can cause stress, however seeks to achieve a long term partnership with its landowners. Transgrid has commenced early engagement with landowners and is working to minimise their stress and anxiety with regard to the project. Transgrid would maintain ongoing relationships with landowners including providing opportunities for complaints and dispute resolution in the event that conflicts arise in the future.	• likelihood: possible • magnitude: minor • significance: medium (negative)	• likelihood: possible • magnitude: minor • significance: medium (negative)

13.6. Management of impacts

13.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach as detailed in Chapter 26 (Environmental Management). This would also include the implementation of the following plans to help deliver positive outcomes for the community and achieve a positive social legacy from the project as identified in the *Technical Report 7 – Social Impact Assessment*:

- A Social Impact Management Plan will be prepared to monitor, enhance and refine mitigation and management measures to address social impacts. The plan would also address the potential for unanticipated social impacts during the construction stage of the project and set out how the community can provide feedback as part of an adaptive management approach.
- The Workforce and Workforce Development Plan aims to provide equitable and balanced distribution of training and employment opportunities while giving priority to communities where Transgrid operates. The purpose of the plan includes training and upskilling for local and regional communities to enhance access to employment opportunities while meeting the project needs.
- The Worker Accommodation Strategy will provide an overall framework, including objectives and outcomes for construction worker accommodation for the project. The strategy will document the outcomes from consultation with key stakeholders and provide an overview of the worker accommodation requirements and identified need for the duration of construction.
- The Australian Industry Participation Plan will be guided by the requirements outlined by the Australian Industry Participation Authority. The objective of the plan is to ensure that Transgrid, in collaboration with our delivery partners, actively works to engage local businesses. This initiative aims to provide fair and reasonable opportunities for these businesses to bid for the supply of goods and/or services throughout the delivery of the project. The plan will foster local industry involvement, strengthening the economic landscape and contributing towards the successful delivery of the project.
- The Local Industry Participation Plan aims to optimise the participation of local and regional suppliers and contractors into the project supply chain including indigenous businesses and women-owned businesses. The plan will support the delivery of the Australian Industry Participation Authority objectives and commitments outlined in the project specific Australian Industry Participation Plan.
- The Aboriginal Participation Plan aims to foster meaningful engagement and collaboration between Aboriginal communities and stakeholders during the project life cycle. Its primary objectives are to promote the inclusion of Aboriginal perspectives, knowledge, and interests. The plan will also facilitate economic opportunities and capacity building for Aboriginal communities, and ensure environmental and cultural considerations are incorporated into the project's decision-making processes.
- The HumeLink Community Investment and Benefits Plan aims to investigate opportunities to leave positive legacy outcomes for the communities in proximity to the project. Opportunities for implementing legacy initiatives will be considered in four broad theme areas:
    - care for Country
    - connectivity
    - opportunities for all
    - access to accommodation.

13.6.2. Avoidance and minimisation of impacts

The following approaches to avoid and minimise social impacts have been considered in the development of the project:

- The initial study corridor was modified as a result of consultation with landowners and stakeholders, site visits, design development and improvement in constraints understanding through field studies and environmental assessment.
- Impacts on amenity from transmission line structures were minimised by refining locations, spacing and the size and height of structures, based on community and landowner feedback.
- Impacts on the amenity of sensitive receivers near the proposed Gugaa 500 kV substation and construction compounds were minimised by including adequate separation from residential buildings.
- The impact on regional accommodation availability was minimised by the provision of the Tumbarumba accommodation facility in the project.
- The number of landowners and dwellings affected by the project, and the extent of impact, was minimised by optimising the project footprint where possible.

Transgrid will continue to avoid impacts by consulting with landowners, communities and stakeholders and it is anticipated that further design refinements (eg micro-siting of transmission line structures) would be made prior to construction with consideration of the feedback received. Chapter 2 (Strategic context and project need) and Appendix E (Options Report) provide further information on how the project has been developed in response to community feedback and to minimise social impacts.

13.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to manage potential social impacts during the construction and operation of the project are provided in Table 13-11. In addition to these mitigation measures, mitigation measures from the following chapters would contribute to reducing the social impacts identified within the SIA and have been considered in the residual impact ratings summarised in this chapter.

- Chapter 9 (Aboriginal heritage)
- Chapter 11 (Land use and property)
- Chapter 12 (Economic)
- Chapter 14 (Landscape character and visual amenity)
- Chapter 15 (Noise and vibration)
- Chapter 19 (Hazards and risks)
- Chapter 20 (Traffic, transport and access)
- Chapter 21 (Air quality).

Property specific impacts would be addressed through Property Management Plans that would be prepared in consultation with landowners and described in Chapter 11 (Land use and property).

Table 13-11 Social impact mitigation measures

Reference	Impact	Mitigation measures	Timing	Relevant location
SO1	Accommodating temporary construction workers	Prepare and implement a Worker Accommodation Strategy for the construction workers during the construction period.	Detailed design and construction	All locations
SO2	Impacts on local services and social cohesion from introduction of temporary workers	Information will be provided to the construction workers that includes: • information on community services and recreation facilities, events and tourism activities • details on how to access health services including dedicated telehealth services organised by Transgrid • a company contact if help is needed. • Code of Conduct to minimise the incidence of risk drinking and drug behaviours.	Detailed design	All locations
SO3	Impacts on emergency services	Emergency services will be regularly updated on work plans and access routes in the event of an emergency.	Construction	All locations
SO4	Opportunities for long-term investment	Any opportunities for appropriate long-term use for the worker accommodation facilities will be identified in consultation with councils.	Detailed design	Worker accommodation facility

13.6.4. Managing residual impacts or uncertainties

The project would result in long-term positive social benefits to the social locality, including those as a result of implementation of the HumeLink Community Investment and Benefits Plan.

Residual negative impacts would be predominantly localised and temporary. No impacts with a very high residual negative significance have been identified. Some social impacts have been assessed to still have a high residual significance rating for some communities and people, and these relate to changes to property as well as landscape and visual amenity (refer to Sections 13.4 and 13.5).

Potential social impacts would continue to be mitigated where feasible and practicable through consultation with landowners, communities and stakeholders.

14. Landscape character and visual amenity

This chapter provides a detailed summary of the assessment of the potential landscape character and visual amenity impacts of the project and identifies mitigation measures to address these impacts. The full assessment is provided in *Technical Report 8 - Landscape Character and Visual Impact Assessment* (IRIS, 2023).

During the development of HumeLink and the preparation of the EIS, including the landscape character and visual impact assessment, Transgrid has undertaken extensive consultation with community and stakeholders. Engagement included consultation with Department of Planning and Environment (DPE) and potentially affected landowners on matters relating to visual impacts since early 2020. The summary of consultation undertaken for landscape character and visual impact is detailed Chapter 6 (Engagement) with specific feedback provided in Appendix C (Engagement Outcomes Report). Transgrid will continue to engage with community and stakeholders on landscape character and visual impact through the detailed design, construction and operation of HumeLink.

14.1. Environmental Assessment Requirements

14.1.1. Secretary's Environmental Assessment Requirements

Table 14-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to landscape character and visual amenity impacts and where these requirements are addressed in this EIS.

Table 14-1 Secretary's environmental assessment requirements – Landscape character and visual amenity

Reference	SEARs	Where principally addressed in the EIS
Amenity		
Key issues	The EIS must address the following matters: • an assessment of the likely visual impacts of the project on surrounding residences, scenic or significant vistas, night lighting, air traffic and road corridors in the public domain	Sections 14.4.4 and 14.5.4 provides an assessment of the likely visual impacts of the project on surrounding residences. Sections 14.4.2 and 14.5.2 provides an assessment of the likely visual impacts of the project on scenic or significant vistas. Sections 14.4.3 and 14.5.3 provides an assessment of the likely visual impacts of the project at night. Sections 14.4.2 and 14.5.2 provides an assessment of the likely visual impacts of the project on air traffic. Section 14.5.2.3 provides an assessment of the likely visual impacts of the project on road corridors in the public domain.

14.2. Assessment approach

14.2.1. Legislative and policy context

The assessment considers policies and plans relevant to landscape and visual amenity, including:

- regional and management plans, including:
  - *Riverina Murray Regional Plan 2041* (DPE, 2023)
  - *Riverina Murray Destination Management Plan 2018* (Destination Riverina Murray, 2018)
  - *South East and Tablelands Regional Plan 2036* (DPE, 2017)
  - *Destination Southern NSW Destination Management Plan 2018-2020* (Destination Southern NSW, 2018)
- local strategic planning statements (LSPS) and development control plans of Wagga Wagga City Council, Snowy Valley Council, Cootamundra-Gundagai Regional Council, Yass Valley Council and Upper Lachlan Shire Council, which outline how to maintain a high level of environmental amenity, liveability and landscape quality
- Local Environmental Plans (LEPs) of Wagga Wagga, Tumut, Tumbarumba, Gundagai, Yass Valley, Upper Lachlan, which provide land zoning and local development controls for each LGA (noting that the project is not required to comply with environmental planning controls outlined in LEPs)
- other policies and guidelines that provide more specific guidance for the assessment methodology including:
  - *Guideline for Landscape Character and Visual Impact Assessment EIA-N04* (TfNSW, 2020)
  - *Guidance Note for Landscape and Visual Assessment* (Australian Institute of Landscape Architects QLD, 2018)
  - *Guidelines for Landscape and Visual Impact Assessment*, Third Edition (Landscape Institute and Institute of Environmental Management & Assessment, 2013)
  - *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019).

14.2.2. Methodology

The landscape character and visual amenity assessment involved:

- reviewing the legislative and policy context and applicable guidelines
- defining the landscape character study area and dividing the landscape character study area into landscape character zones (defined by qualities of the built, natural and cultural environment) and sub-character areas (which reflect local landscape features)
- defining the visual assessment study area to assess views from the public domain and views from dwellings
- carrying out site inspections in March and September 2022 to take photographs from representative viewpoints and verify the preliminary viewshed analysis
- assessing visual impact on public domain views and landscape character by:
  - defining the visual catchment and potential visibility of the project using a digital terrain model
  - assessing the daytime and night-time landscape character and visual impacts using a risk-based matrix approach (refer to Table 14-2), which involved assessing:
    > the sensitivity of each landscape character zone and representative viewpoint, which considers the capacity to absorb change without losing its valued attributes

  - > the magnitude of change, which considers the extent of change expected from construction and operation of the project within each landscape character zone and representative viewpoint

- assessing visual impact on views from private dwellings by:
  - completing a desktop analysis of aerial photography, topography and observations from nearby publicly accessible areas to identify dwellings with affected views
  - completing a detailed assessment of impacts on views including describing the visual impact level as high, moderate, low or negligible
- preparing photomontages for both public domain views and private dwellings based on an indicative concept design for representative viewpoints along the project footprint to show indicative visual changes as a result of the project
- recommending mitigation measures for both public domain views and private dwellings to minimise the potential landscape character and visual impacts expected from the project.

For the full methodology refer to *Technical Report 8 - Landscape Character and Visual Impact Assessment*.

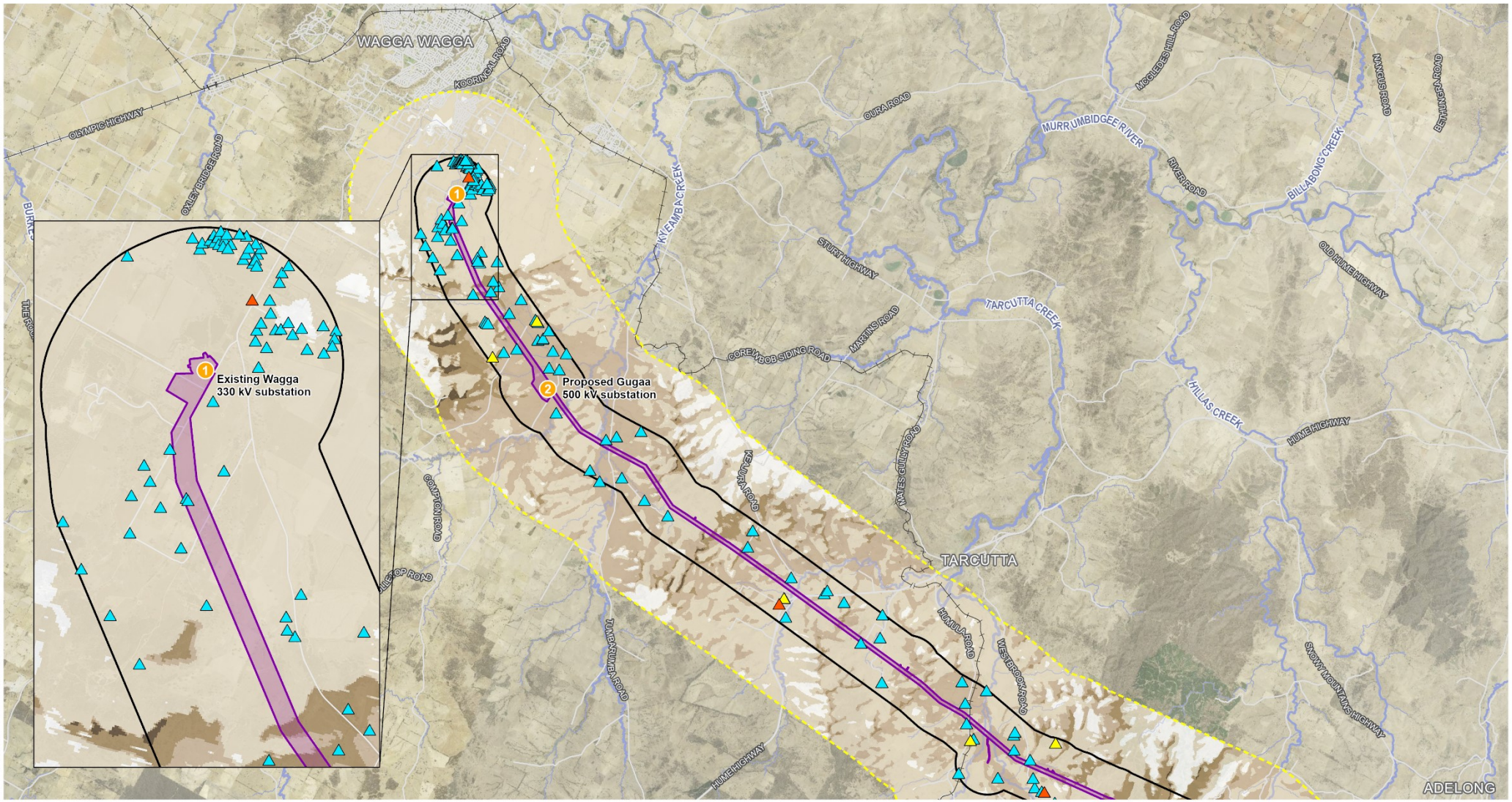
The study area extends to approximately five kilometres from the project footprint for landscape character and to about two kilometres from the project footprint for visual impacts. This study area is approximate because distance is not the only factor that determines landscape character impact. Within the landscape character study area, the visibility of the project varies according to the topography and land cover (vegetation and built form) of the landscape (refer to Figure 14-1).

The visual impact study area is about two kilometres from the project footprint and assessed views from the public domain and views from dwellings.

Table 14-2 provides the matrix that was used in the assessment of impacts for landscape character and public viewpoint impacts. The ‘national’, ‘state’, ‘regional’, ‘local’ and ‘neighbourhood’ sensitivity levels relate to the day-time assessment, and have different considerations for landscape character impacts compared to visual impacts. The ‘very high’, ‘high’, ‘moderate’, ‘low’ and ‘very low’ sensitivity levels relate to the night-time assessment. The magnitude of change is the same for both assessments. *Technical Report 8 – Landscape Character and Visual Impact Assessment* provides further detail on the definitions of magnitude and sensitivity for the various impact assessment approaches.

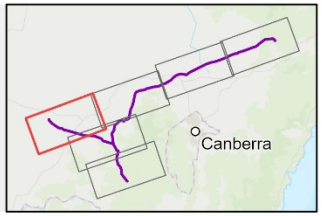
Table 14-2 Landscape and visual impact matrix

		Sensitivity				
		National / Very high	**State / High**	**Regional / Moderate**	**Local / Low**	**Neighbourhood / Very low**
Magnitude	**Very high**	Very high	Very high	High	High-Moderate	Moderate
	High	Very high	High	High-Moderate	Moderate	Moderate-Low
	Moderate	High	High-Moderate	Moderate	Moderate-Low	Low
	Low	High-Moderate	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible



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Project footprint
Landscape character study area
Visual study area
Railway
Waterway
Substation
Sensitive receiver within visual study area
Residential
Possible residence
Firestation - Bush
Construction ancillary facilities
1 Wagga 330 kV substation compound (C01)
2 Gregadoo Road compound (C06)
Visibility
No Visibility Identified
Low
Low-Moderate
Moderate
High



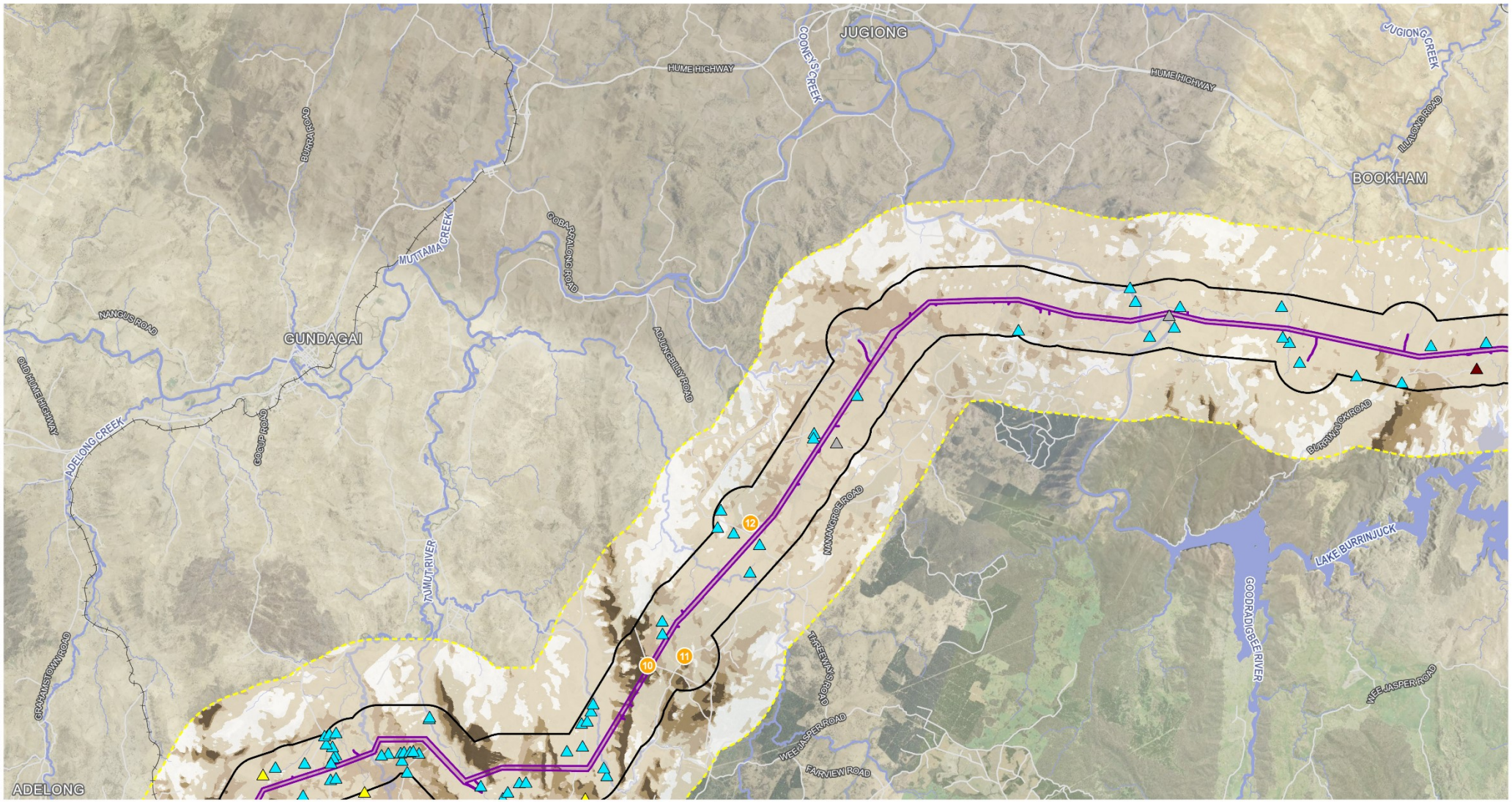
Source: *Aurecon, Transgrid, IRIS, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 14-1a: Landscape and visual study area and potential visibility of the project



Project footprint
Landscape character study area
Visual study area
Railway
Waterway
Substation

Sensitive receiver within visual study area

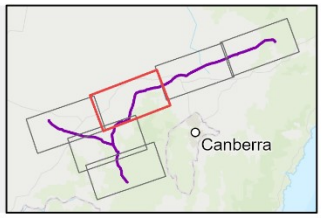
Camping Ground
Dilapidated dwelling
Residential
Possible residence

Construction ancillary facilities

10 Honeysuckle Road compound (C07)
11 Red Hill Road compound (C08)
12 Adjungbilly Road compound (C09)

Visibility

No Visibility Identified
Low
Low-Moderate
Moderate
High



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

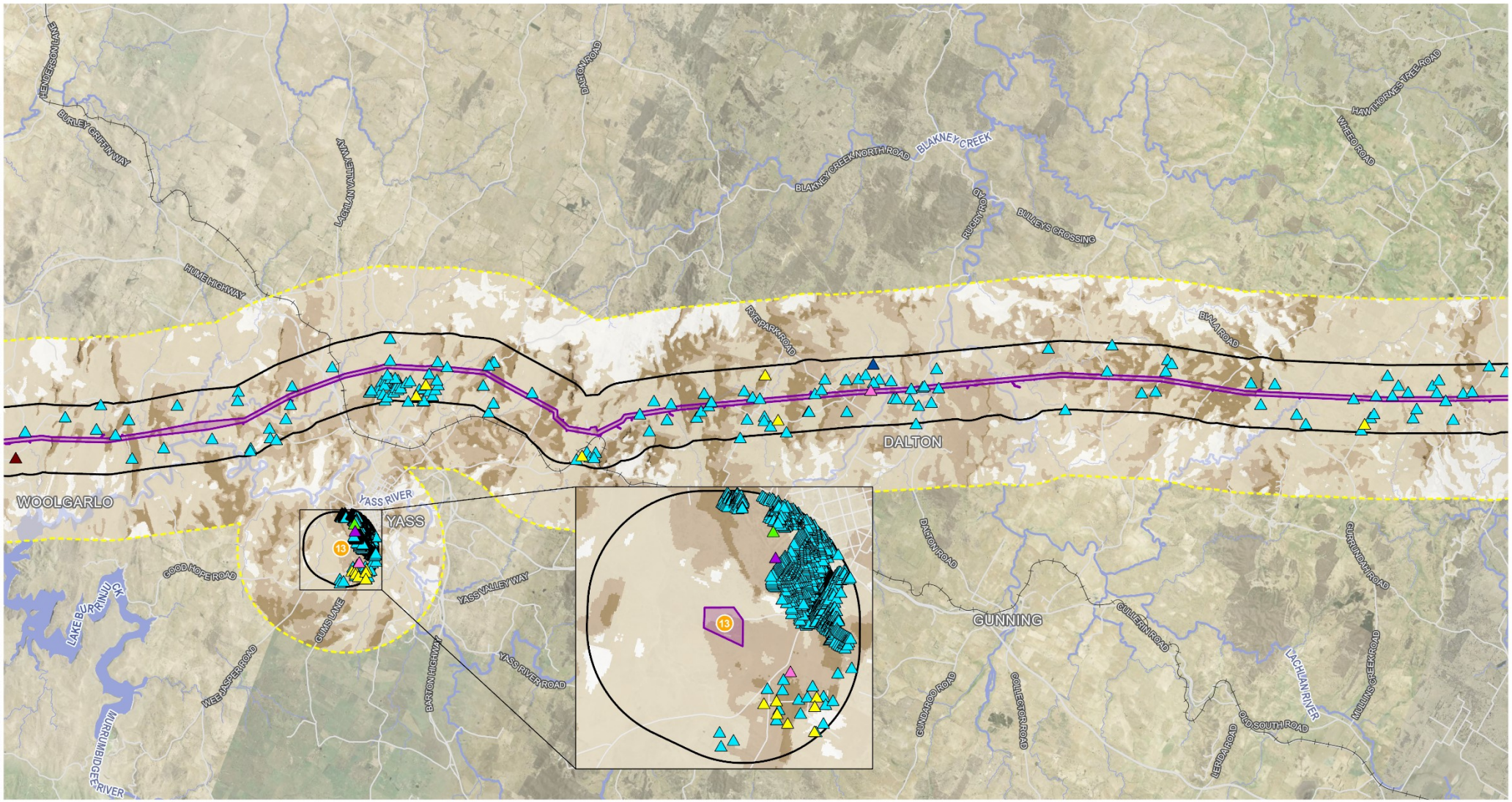
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0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 14-1b: Landscape and visual study area and potential visibility of the project

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Project footprint
Landscape character study area
Visual study area
Railway
Waterway
Substation

Sensitive receiver within visual study area

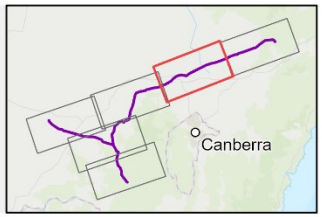
Camping Ground
Club
Residential
Possible residence
Gas Facility
Golf Course
Place of Worship

Construction ancillary facilities

13 Yass substation compound (C10)

Visibility

No Visibility Identified
Low
Low-Moderate
Moderate
High



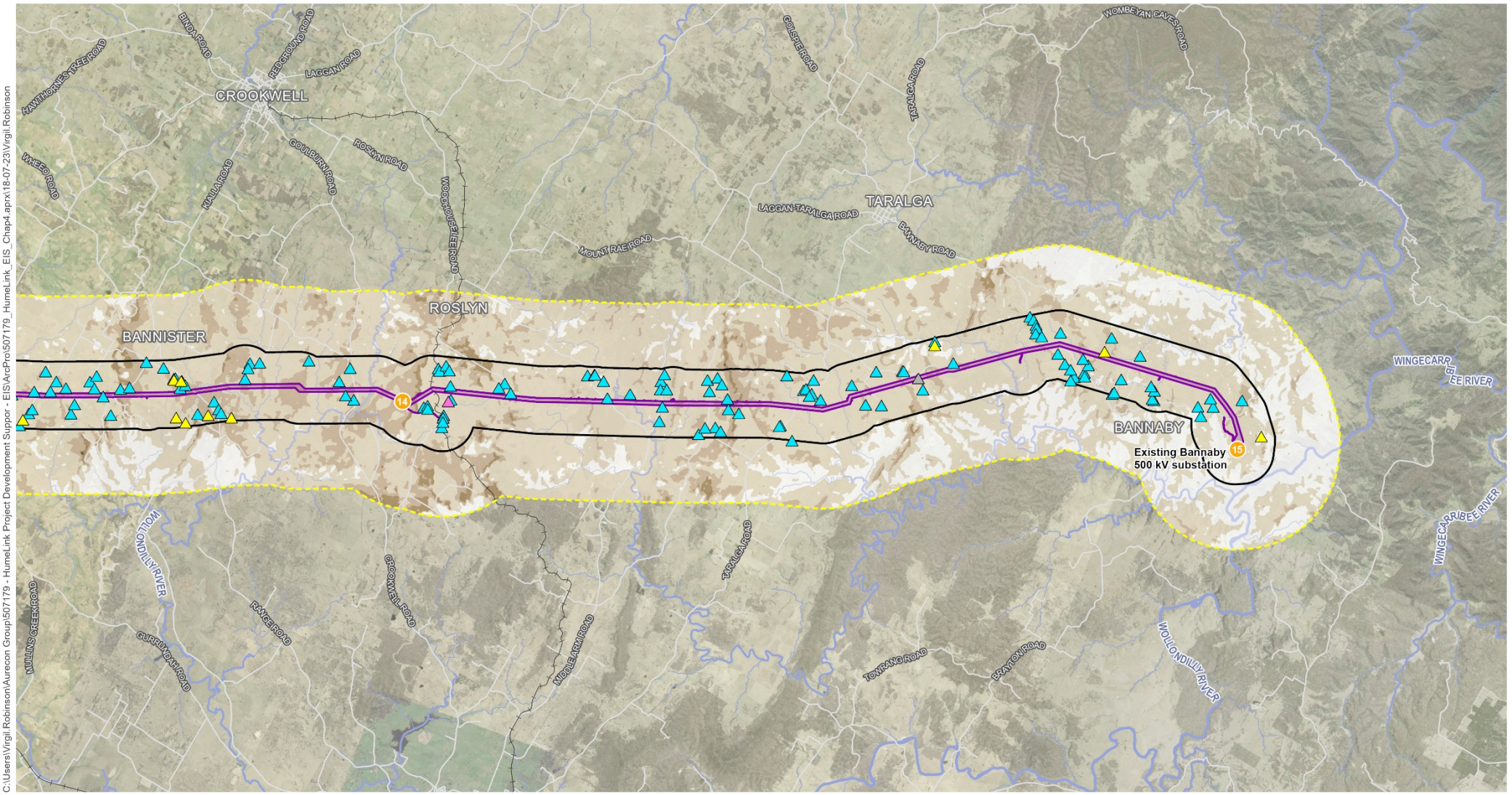
Source: *Aurecon, Transgrid, IRIS, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 14-1c: Landscape and visual study area and potential visibility of the project



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Project footprint
Landscape character study area
Visual study area
Railway
Waterway
Substation

Sensitive receiver within visual study area

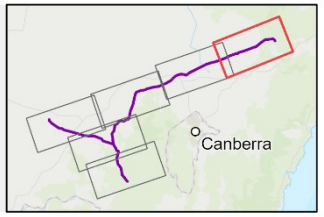
Dilapidated dwelling
Residential
Possible residence
Place of Worship

Construction ancillary facilities

14 Woodhouselee Road compound (C11)
15 Bannaby 500 kV substation compound (C12)

Visibility

No Visibility Identified
Low
Low-Moderate
Moderate
High



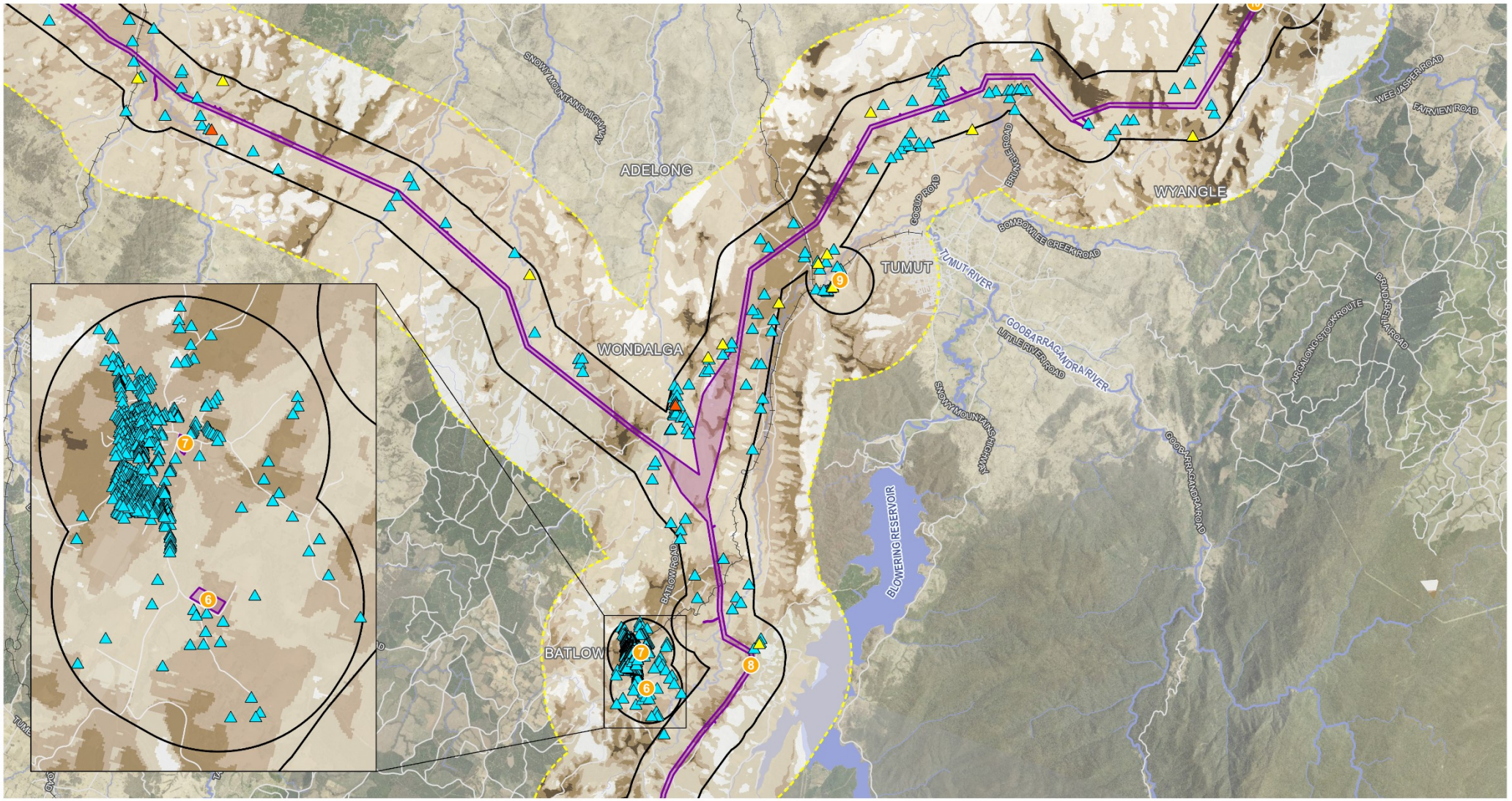
Source: *Aurecon, Transgrid, IRIS, Spatial Services (DCS), ESRI Basemap*

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0 4 8km

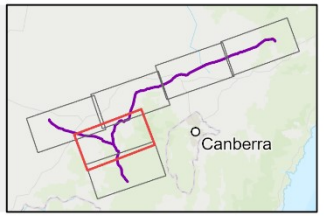
Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 14-1d: Landscape and visual study area and potential visibility of the project



Project footprint
Landscape character study area
Visual study area
Railway
Waterway
Substation
Sensitive receiver within visual study area
Residential
Possible residence
Firestation - Bush
Construction ancillary facilities
6 Bowmans Lane compound (C15)
7 Memorial Avenue compound (C14)
8 Snubba Road compound (C03)
9 Snowy Mountains Highway compound (C02)
10 Honeysuckle Road compound (C07)
Visibility
No Visibility Identified
Low
Low-Moderate
Moderate
High



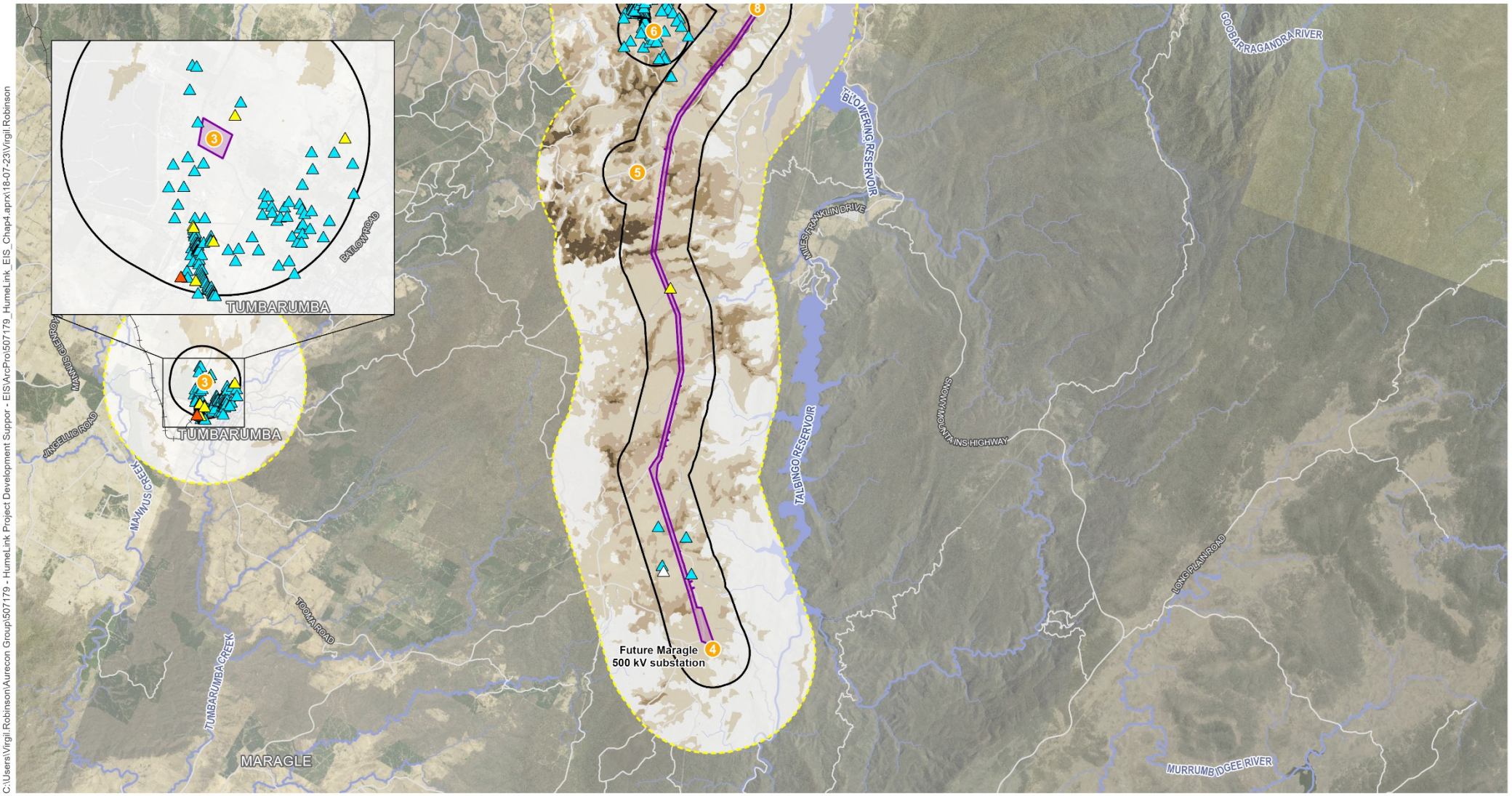
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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-1e: Landscape and visual study area and potential visibility of the project



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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-1f: Landscape and visual study area and potential visibility of the project

14.3. Existing environment

14.3.1. Landscape character zones

Due to the scale of the project, the landscape character study area has been divided into landscape character zones. These zones are further divided into sub-character areas (refer to Table 14-3). The landscape character zones have been defined primarily by geology, topography, vegetation, waterways, built form patterns and land use. The sub-character areas are based on the locality and reflect local landscape features.

Table 14-3 Landscape character zone description and sensitivity levels

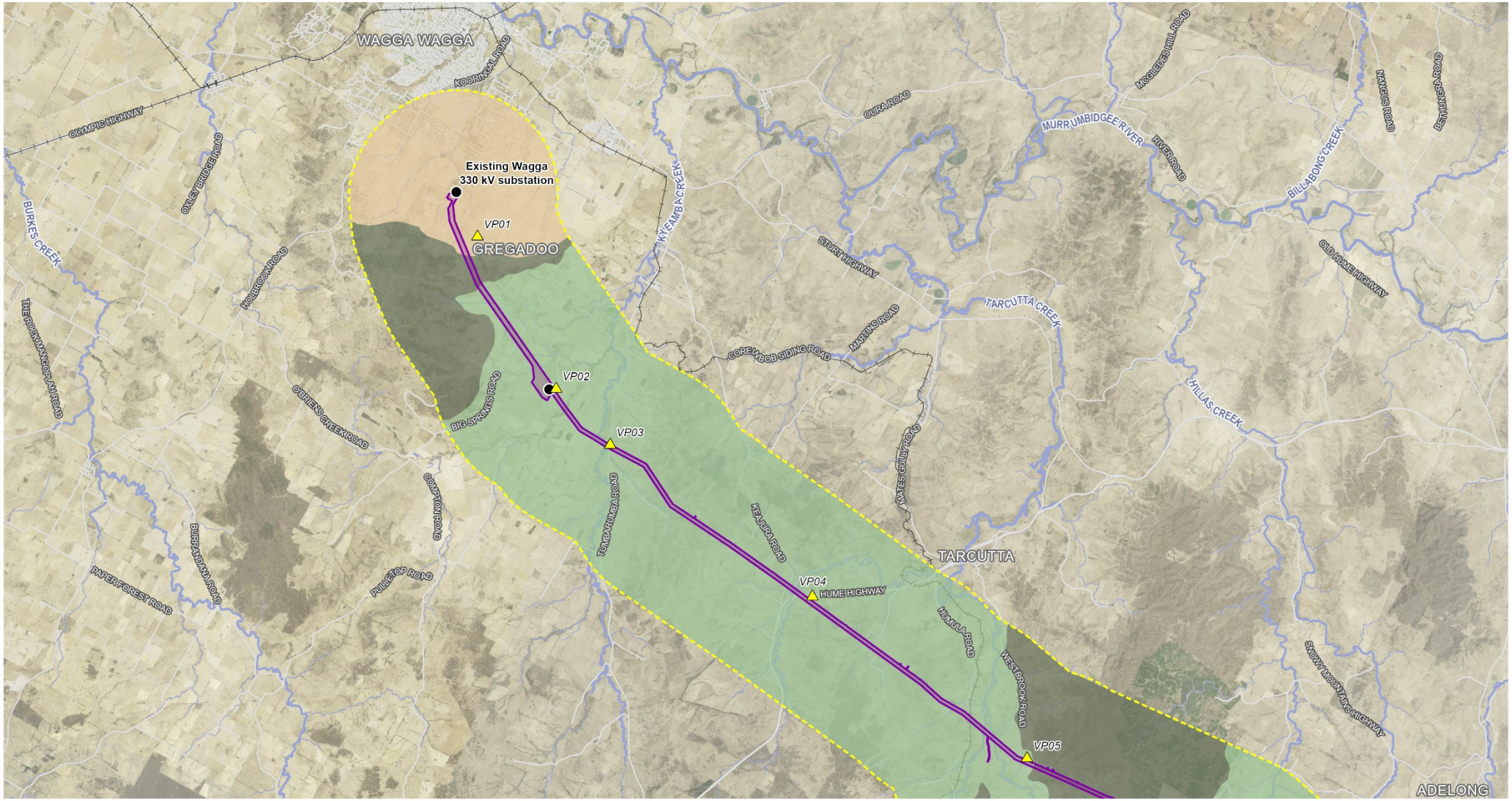
Landscape character zone / sub-character areas	Landscape character zone description	Landscape sensitivity (refer to Table 14-2)	Example image from landscape character zone
Rural fringe landscape: • rural areas to the south of Wagga Wagga	• semi-rural landscape, including small farms and acreage properties as well as rural residential development which form the outskirts of Wagga Wagga • light industrial activities such as waste and recycling facilities as well as the existing Wagga 330 kV substation • land is generally flat to gently undulating plains • vegetation is present alongside roads, creeks and surrounding rural dwellings, which encloses some views • variety of transmission line structure types and sizes.	Neighbourhood	

Landscape character zone / sub-character areas	Landscape character zone description	Landscape sensitivity (refer to Table 14-2)	Example image from landscape character zone
Great Dividing Range foothills landscape: • Gregadoo Great Dividing Range foothills • Ellerslie Range Great Dividing Range foothills	• elevated highly undulating landscape including deep valleys and ridges • larger areas of mature vegetation • some residences scattered on some of the low-lying and flatter areas • transmission line easements and roads cross the lower ridgelines.	Regional	
Rural valleys landscape: • Gregadoo to Book Book rural valleys • Yaven Creek and Adelong Creek rural valleys • Tumut rural valleys • Adjungbilly rural valleys • Tumbarumba rural valleys	• flat to gently undulating, open plains containing mainly grazing pastures, with some areas of arable fields • low-lying landscape, generally following the alignment of creek and river valleys • infrastructure such as sheds, yards and workshops, as well as local roads supporting the surrounding agricultural uses • network of rural roads, homesteads and cottages on rural properties and a collection of small towns • transmission lines cross the area.	Local	

Landscape character zone / sub-character areas	Landscape character zone description	Landscape sensitivity (refer to Table 14-2)	Example image from landscape character zone
Forested hills landscape: • Green Hills forested hills • Bago forested hills • Minjary forested hills • Red Hill and Bungongo forested hills	• undulating terrain, with mountains and interlinking ridgelines and valleys • concentration of managed pine plantations (including Green Hills, Bago, Red Hill and Bungongo State Forests), which are clearly visible and different from nearby tracts of native forest and areas of farmland and at various stages of management with different tree coverages and heights • native forest reserve areas of Minjary National Park and Mudjarn Nature Reserves • very few residences due to the forestry land use • roads (mostly restricted to forestry vehicles) and the Lower Tumut to Wagga and Yass 330 kV transmission lines cross the area.	Local	
Undulating rural hills and ridges landscape: • Wondalga to Batlow undulating rural hills and ridges • Tumut undulating rural hills and ridges • Murrumbidgee undulating rural hills and ridges • Black Range to Yass undulating rural hills and ridges • Jerrawa to Dalton undulating rural hills and ridges	• elevated and undulating rolling hills and ridges, which rise above the surrounding low-lying rural valleys • landscape has mostly been cleared for agricultural use, predominantly pastoral grazing, creating an open, rural landscape character • land use is more varied near Batlow with horticulture and some areas of arable farmland in flatter areas • vegetation is generally limited to road verges, fence lines, scattered within fields and on hill sides and deep valleys • several small historic towns, including Batlow, Jerrawa and Dalton • transmission line easements and roads cross this landscape, including the hills east of Batlow and the Black Range, south-west of Yass.	Local	

Landscape character zone / sub-character areas	Landscape character zone description	Landscape sensitivity (refer to Table 14-2)	Example image from landscape character zone
Upland forest landscape: • Snowy Mountains upland forest	• located in the northern part of the Australian Alps (Snowy Mountains bioregion) • elevated and highly undulating, including deep valleys with mountain and hill ranges, and peaks such as Granite Mountain • much of this landscape character zone forms part of Bago State Forest • largely covered by forest, including large tracts of native forest with an area of managed pine plantation in the northern section where tree cover is dense • includes the Hume and Hovell Walking Tracks • very few residences • privately owned land at Nurenmerenmong is partially cleared and includes a caravan park • roads and transmission line easements cross the area, including the Lower Tumut to Upper Tumut 330 kV transmission lines.	Regional	
Rural tablelands landscape: • Crookwell rural tablelands	• elevated tableland country, including a broad plateau of smooth rolling hills dissected by shallow creeks and valleys • greater undulations approaching the Tarlo River, including deep valleys and steep hills and pronounced ridgelines, with patches of native forest as the landscape transitions to the Cookbundoon Range • Pejar Dam is a feature and is used for passive recreation including boating, fishing and visitor amenities • extensively cleared and used for grazing purposes • long history of rural settlement, with a network of rural roads, homesteads, cottages, sheds, yards and workshops on rural properties and several small towns • infrastructure includes wind farms, the existing Crookwell to Bannaby 330 kV transmission lines, and substations associated with the wind farms.	Local	

Landscape character zone / sub-character areas	Landscape character zone description	Landscape sensitivity (refer to Table 14-2)	Example image from landscape character zone
Rural highland and deep valley landscape: • Taralga to Bannaby rural highland and deep valley	• elevated landscape, including rolling hills with wide sheltered valleys and ridgelines along Bannaby Road • steep forested country in eastern and southern parts along the Cookbundoon Range and the Tarlo River gorge • flatter areas are cleared and are used for sheep and cattle grazing • transmission line structures, including the Bannaby 500 kV substation.	Local	

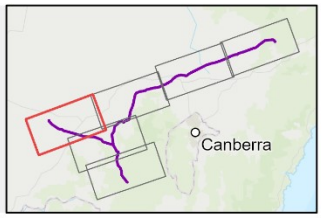


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Project footprint
Landscape character study area
Railway
Waterway
Substation
Viewpoint

Landscape Character Zones

Great Dividing Range foothills landscape
Rural fringe landscape
Rural valleys landscape



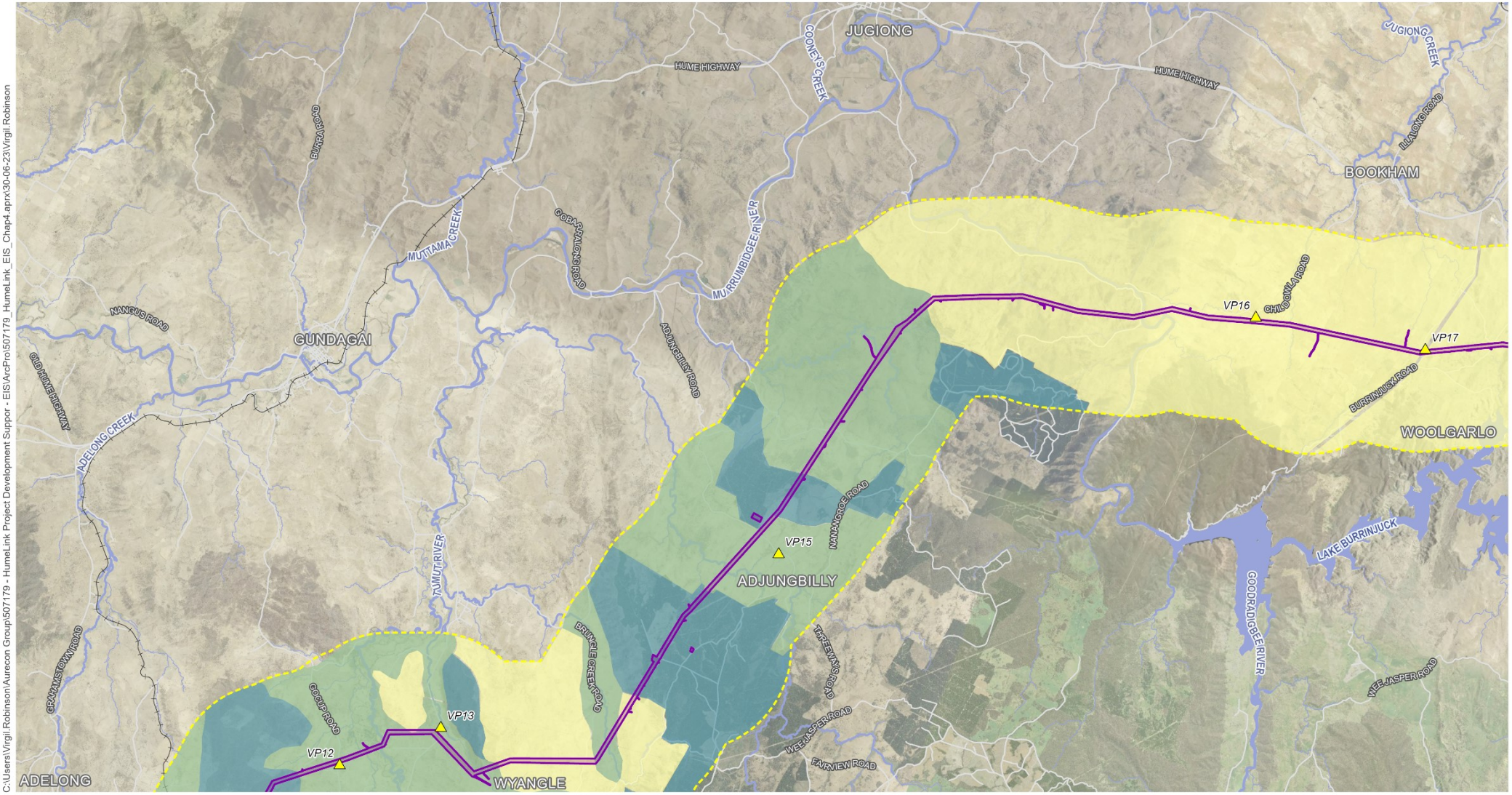
Source: *Aurecon, Transgrid, IRIS, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-2a: Landscape character zones and selected viewpoints



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

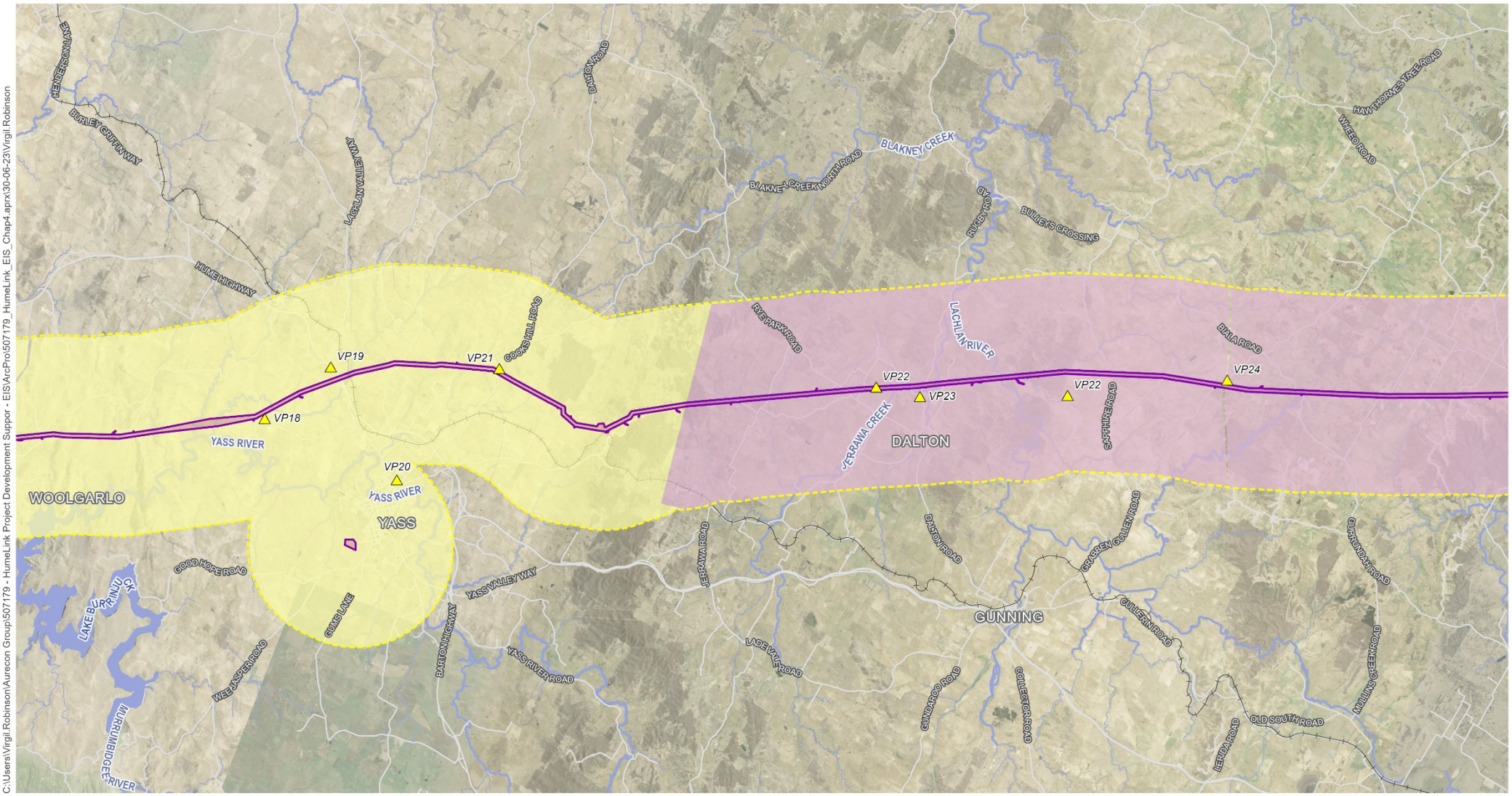
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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-2b: Landscape character zones and selected viewpoints

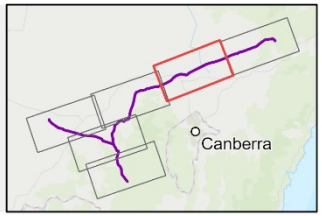


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Project footprint
Landscape character study area
Railway
Waterway
Substation
Viewpoint

Landscape Character Zones

Rural tablelands landscape
Undulating rural hills and ridges



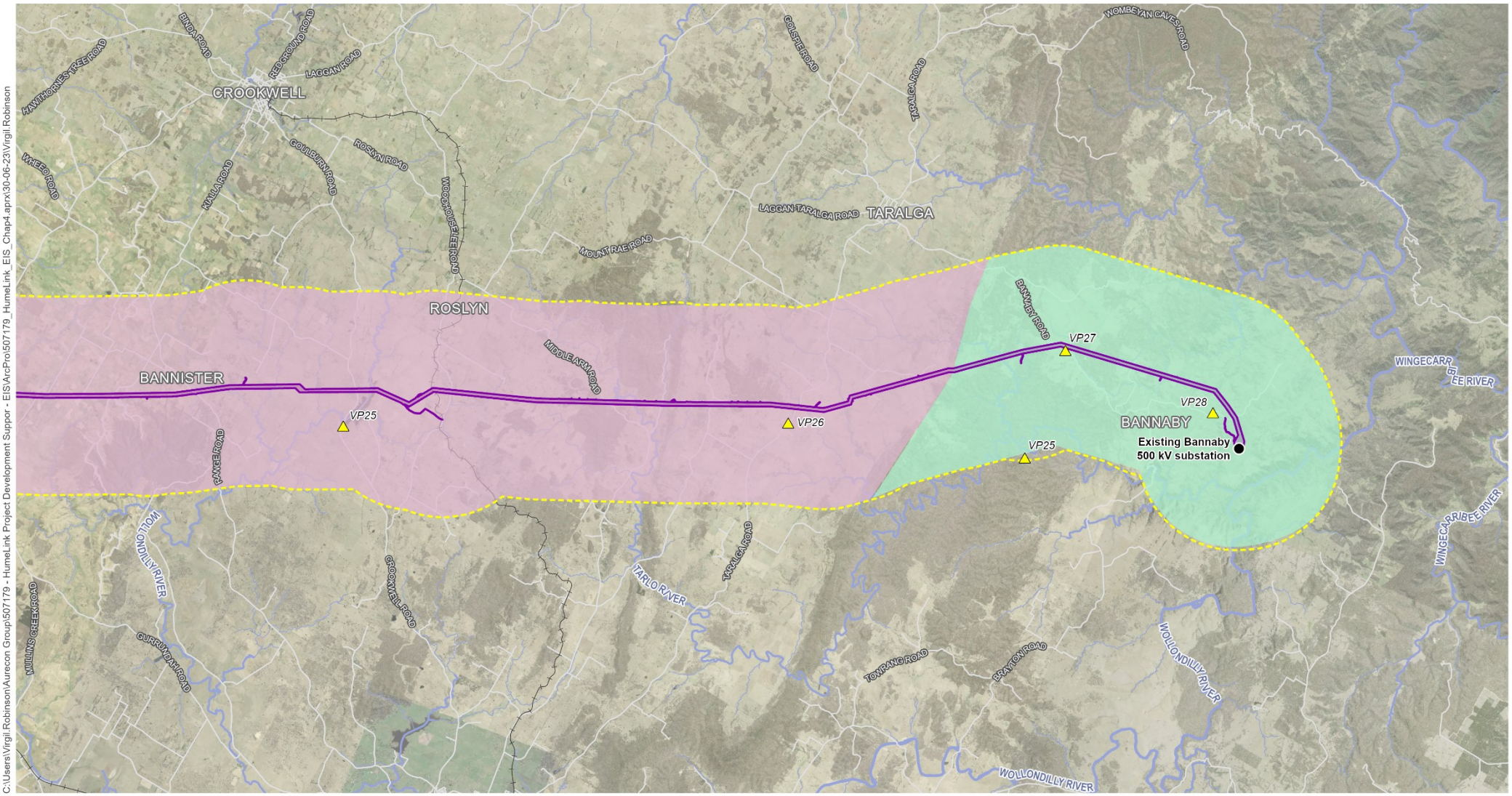
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Projection: GDA 1994 MGA Zone 55

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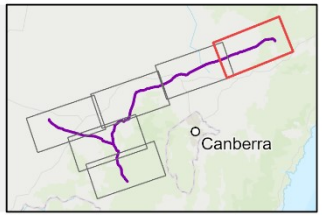
FIGURE 14-2c: Landscape character zones and selected viewpoints



Project footprint
Landscape character study area
Railway
Waterway
Substation
Viewpoint

Landscape Character Zones

Rural highlands and deep valleys
Rural tablelands landscape



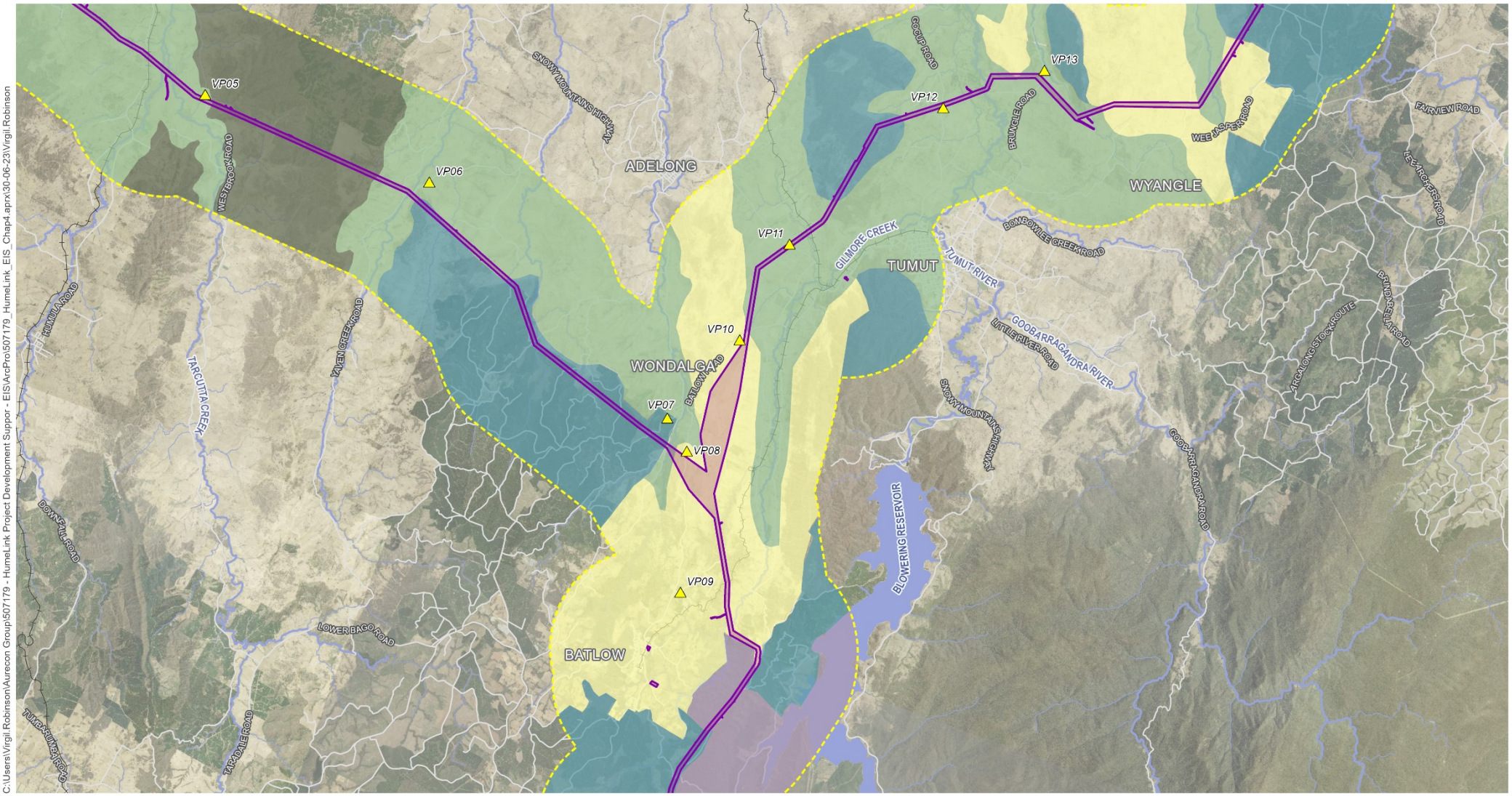
Source: *Aurecon, Transgrid, IRIS, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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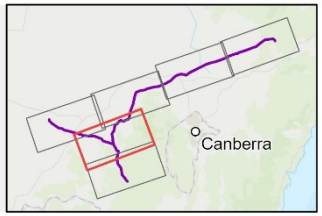
FIGURE 14-2d: Landscape character zones and selected viewpoints



Project footprint
Landscape character study area
Railway
Waterway
Substation
Viewpoint

Landscape Character Zones

Forested hills landscape
Great Dividing Range foothills landscape
Rural valleys landscape
Undulating rural hills and ridges
Upland forest landscape



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

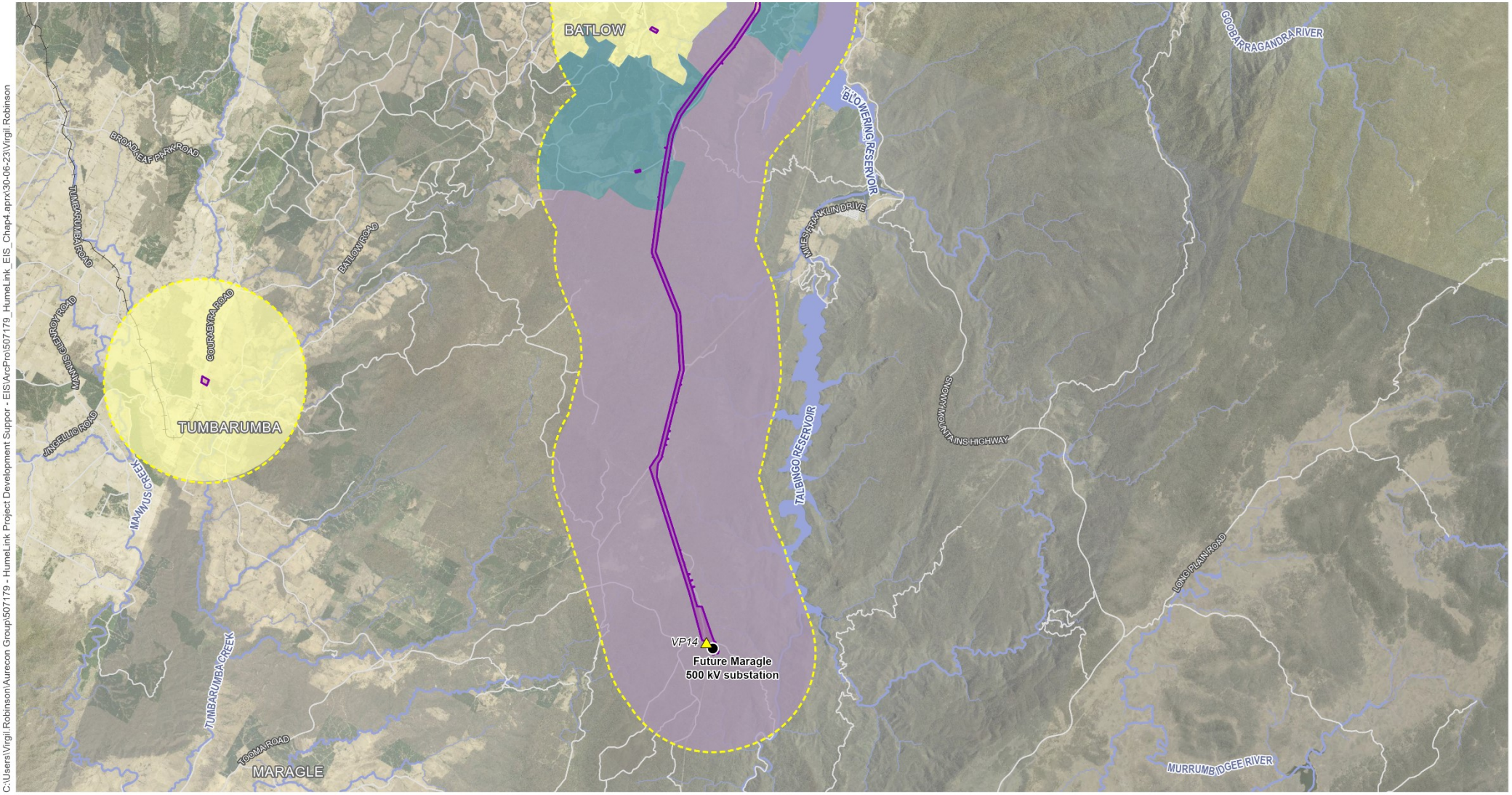
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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-2e: Landscape character zones and selected viewpoints

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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 14-2f: Landscape character zones and selected viewpoints

14.3.2. Viewpoints

The following viewpoints were selected as representative of the range of views to the project. They include views from publicly accessible locations, which have been identified as places with increased visual sensitivity or places where people are likely to congregate. The representative viewpoints identified along the project footprint are summarised in Table 14-4 and shown in Figure 14-2.

Table 14-4 Daytime viewpoints

Viewpoint	Description of viewpoint	Reference image
Viewpoint 1: View south from Gregadoo East Road (VP01)	This view shows the rural fringe landscape south of Wagga Wagga, looking south from Gregadoo East Road. Gregadoo East Road is a two-lane sealed road providing access to local homesteads and properties south of Wagga Wagga.	
Viewpoint 2: View south from Livingstone Gully Road (VP02)	This view shows the Gregadoo to Book Book rural valleys landscape character area, south-east of Wagga Wagga. Livingstone Road in this location is an unsealed/gravel road providing access to local properties.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 3: View south-west from Tumbarumba Road (VP03)	This view shows the Gregadoo to Book Book rural valleys landscape character area, south-east of Wagga Wagga. Tumbarumba Road in this location is a two-lane sealed road providing access between the Sturt and Hume highways.	
Viewpoint 4: View south-west from the Hume Highway (VP04)	This view shows the undulating rural valley landscape surrounding the Hume Highway, south-east of Wagga Wagga, including pasture fields with scattered trees, and corridors of vegetation aligned to creek valleys, fence lines and road corridors. The Hume Highway in this location is a dual carriageway road, grade separated by a partially vegetated embankment.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 5: View south-east from Westbrook Road (VP05)	This view shows the Gregadoo to Book Book rural valleys landscape character area, as it transitions to the Ellerslie Range Great Dividing Range foothills landscape character area. Westbrook Road in this location is a sealed road providing access between the Hume Highway and Lower Bago Road.	
Viewpoint 6: View south from Yaven Creek Road (VP06)	This view shows the Yaven Creek rural valley landscape character area south-west of Adelong, a narrow low-lying landscape between the Ellerslie Range and Green Hills State Forest. Yaven Creek Road in this location is a sealed road providing access between the Snowy Mountains Highway and Lower Bago Road.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 7: View south from Wondalga Road (VP07)	The view is located on the northern edge of Green Hills State forest. The landscape in the background of this view is highly undulating, and includes rolling hills of partially cleared pasture land and forested areas, descending to various creek valleys south of Wondalga, including the Adelong and Wilsons Creek valleys.	
Viewpoint 8: View north-east from Batlow Road, Wondalga (VP08)	This view shows the Wondalga to Batlow undulating rural hills and ridges landscape character area, north-east of Batlow. This part of Batlow Road forms part of Snowy Valleys Way, a scenic touring route between Gundagai and Beechworth, passing through the western foothills of the Snowy Mountains.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 9: View east from The Big Apple, Stewarts Road, Batlow (VP09)	This view is located on the northern outskirts of Batlow, which contains a high concentration of apple orchards, and the site of Batlow's 'Big Apple'. The Big Apple is located near the Snowy Valleys Way, a scenic touring route between Gundagai and Beechworth, passing through the orchards north of Batlow.	
Viewpoint 10: View north from Batlow Road, Windowie (VP10)	This view shows the rural valley landscape extending along the Windowie Creek valley southwest of Tumut. It includes largely cleared pasture fields and scattered rural dwellings. This part of Batlow Road forms part of Snowy Valleys Way, a scenic touring route between Gundagai and Beechworth.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 11: View south from Snowy Mountains Highway (VP11)	This view shows the Tumut rural valley landscape character area southwest of Tumut. It consists of a wide low-lying rural landscape at the foothills of Tabletop Mountain, Gadara.	
Viewpoint 12: View north from Gocup Road (VP12)	This is an elevated view across the flat, low-lying rural landscape extending along the Gocup Creek and Tumut River valleys, north of Tumut. Gocup Road forms part of Snowy Valleys Way, a scenic touring route between Gundagai and Beechworth.	
Viewpoint 13: View south-east from Brungle Road (VP13)	This view shows the undulating landform between the Tumut River and Killimicat Creek, which includes rolling hills and valleys. Brungle Road in this location is a sealed road, winding through the hills, providing access north of Tumut towards Brungle.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 14: View east from Elliott Way (VP14)	This view is located along Elliott Way, in Bago State Forest. This part of Bago State Forest is close to the north western part of Kosciuszko National Park, known as the Tumut area, which includes extensive areas of native forest.	
Viewpoint 15: View west from Adjungbilly Road (VP15)	This view shows the gently undulating rural landscape along Adjungbilly Creek valley, west of Adjungbilly. It consists of cleared agricultural land used for grazing. Adjungbilly Road in this location is a sealed road providing access between the Hume Highway and Adjungbilly.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 16: View south-east from Childowla Road (VP16)	This view shows the remote elevated rural area north of Burrinjuck Nature Reserve, rising east from the Murrumbidgee River. Black Range Road in this location is a sealed road providing access to the rural areas south-west of Yass.	
Viewpoint 17: View east from Burrinjuck Road (VP17)	This view shows the elevated, undulating rural landscape east of Burrinjuck Road and north of Burrinjuck Dam. It consists of cleared agricultural land used for grazing. Burrinjuck Road is a two-lane sealed road providing access to local homesteads and properties south of Yass.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 18: View west from Black Range Road (VP18)	This view shows the elevated rural landscape west of Yass, rising from the Murrumbidgee River to undulating and hilly pasture land with scattered trees. Black Range Road in this location is a sealed road providing access to the rural areas south-west of Yass.	
Viewpoint 19: View east from the Hume Highway, Yass (VP19)	This view shows a section of the Hume Highway, northwest of Yass, as it curves towards the intersection of Yass Valley Way and bypasses the town. The highway in this location is a dual carriageway, separated by a vegetated median.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 20: View north-west from Orion Street, Yass (VP20)	This view is from a historic part of north Yass. It features unique stone and brick dwellings (local heritage items in Yass Valley LEP 2013).	
Viewpoint 21: View south from Cooks Hills Road (VP21)	This view shows the rolling hills and ridges to the north of Yass, rising from the Murrumbidgee River towards Bango and Cooks Hill. Cooks Hills Road in this location is a two-lane sealed road providing access to the rural areas north of Yass.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 22: View south-east from Greendale Church (VP22)	This view shows the flat rural fields south of Greendale Church, along the Jerrawa Creek valley, rising to rolling hills and ridges in the background of view towards Dalton. The landscape has mostly been cleared for agricultural use, predominantly grazing, creating an open, rural landscape character.	
Viewpoint 23: View north from Rugby Road (VP23)	This view shows the gently undulating rural landscape north of Dalton. Jerrawa Creek meanders along the eastern side of the road, surrounded by pasture land with scattered trees and rural dwellings, generally orientated to capture views over the Jerrawa Creek rural valley. Rugby Road in this location is a sealed road providing access to the rural areas north of Jerrawa.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 24: View south-west from Grabben Gullen Road (VP24)	This view shows the rural tableland landscape extending north of Gunning, towards Crookwell. Grabben Gullen Road in this location is a two-lane sealed road providing access to the rural areas north of Gunning.	
Viewpoint 25: View north from Pejar Dam visitor area (VP25)	This view from the southern end of Pejar Dam, at the visitor facilities, shows the dam and spillway in the foreground and extending about three kilometres north into the background. This visitor facilities include a lookout, shelter and visitor information boards.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 26: View north from Taralga Road (VP26)	This view shows the undulating tableland landscape south of Taralga. It is an elevated landscape, which has mostly been cleared for agricultural use, predominantly grazing, creating an open, rural landscape character. Taralga Road in this location is a two-lane sealed road providing access to the rural areas between Goulburn and Taralga.	
Viewpoint 27: View west from Bannaby Road (VP27)	This view shows the elevated rural landscape east of Taralga, along Bannaby Road. It includes gently undulating pasture land with scattered trees within fields and a corridor of trees along the road verge. Bannaby Road in this location is a sealed road providing access to the rural areas between Taralga and Bannaby.	

Viewpoint	Description of viewpoint	Reference image
Viewpoint 28: View north-west from Hanworth Road (VP28)	This view shows the elevated rural landscape extending north of the Tarlo River, along Hanworth Road. Hanworth Road in this location is a sealed road providing access to the rural areas of Bannaby.	
Views from the air	Recreational flights operate from Wagga Wagga and Tumut airports and include adventure and scenic flights. Flights from Wagga Wagga offer views over Wagga Wagga, Lake Albert and the surrounding agricultural areas. There are also longer flights that provide scenic views of Blowering Dam. Flights from Tumut offer views over the vineyards and wineries of the high country, the rolling hills of Tumut and Tumbarumba, along the three dams of Talbingo, Journama and Blowering, and the Snowy Hydro Scheme. The views from these flights are the focus of these journeys. No hot air ballooning flights were identified near the project.	N/A

14.4. Potential impacts – construction

14.4.1. Landscape character zone impact assessment

Across all landscape character zones and areas, construction activities would involve the temporary mobilisation of plant and equipment throughout the project footprint and establishment of ancillary infrastructure (eg construction compounds and access tracks). Vegetation removal would be required across all landscape character zones with some vegetation within easements trimmed to lower heights. Full removal of all trees, shrubs and ground cover vegetation is expected at each transmission line structure site and for construction of access tracks.

Table 14-5 summarises the construction impact assessment for landscape character zones or sub-character areas with impacts greater than ‘low’.

Technical Report 8 – Landscape Character and Visual Impact Assessment provides details on the landscape sensitivity, magnitude of change and impacts for the remaining landscape character zones and sub-character areas that are expected to have 'low' landscape impacts, namely:

- rural fringe landscape: Wagga Wagga rural fringe landscape character area
- forested hills landscape: Green Hills forested hills, Red Hill and Bungongo forested hills landscape character areas.

No landscape character zones and sub-character areas are expected to have 'negligible' landscape impacts.

Table 14-5 Summary of landscape impact during construction

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Great Dividing Range foothills landscape character zone			
Gregadoo landscape character area	Regional This landscape would be appreciated by small numbers of people travelling along the network of rural roads, including tourists and visitors to the region.	Moderate The transmission line route would parallel the existing Lower Tumut to Wagga 330 kV transmission lines passing through the Gregadoo landscape sub-character area. All vegetation within the area used for construction would be removed including the site at each transmission line structure and at construction access tracks. Trees and vegetation within the transmission line easement would also be removed or trimmed as required. There are no construction compounds proposed in this landscape.	Moderate
Ellerslie Range landscape character area		Moderate The transmission line route would parallel the existing Lower Tumut to Wagga 330 kV transmission lines. As this area has a greater vegetation coverage, there would be more vegetation removal required, particularly where the project crosses the ridgelines. Due to the hilly landform, there would be some landform modification required to prepare each transmission line structure site and install the foundations.	Moderate
Rural valleys landscape character zone			
Gregadoo to Book Book landscape character area	Local This rural landscape would be appreciated by small numbers of people travelling along the network of rural roads- mainly local residents and their visitors, as well as	Moderate The transmission line would pass through undulating landform with several small hills and larger peaks eg Mount Flakney. The project would introduce large-scale construction activity, particularly associated with the proposed Gugaa 500 kV substation and adjacent Gregadoo Road compound (C06). There would also be vegetation removed for construction of access tracks and construction compounds at Gregadoo Road compound (C06).	Moderate-low
Yaven Creek and Adelong Creek landscape character area		Moderate The transmission line would parallel the existing Lower Tumut to Wagga 330 kV transmission line on the southern side. The transmission line route would pass through a predominantly flat area which would require	Moderate-low

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
	some tourists visiting and passing through the area.	small and localised modifications to the terrain. The project would introduce large-scale construction activity in these quiet rural landscapes.	
Tumut landscape character area		Moderate The transmission line would be a new feature in this area located two kilometres west of the existing Burrinjuck to Tumut 132 kV transmission lines, crossing the existing Tumut to Gadara 132 kV transmission lines near the paper mill. There would also be vegetation removed for construction of access tracks and construction compounds at the Snowy Mountains Highway compound (C02). The project would introduce large-scale construction activity in these quiet rural landscapes.	Moderate-low
Adjungbilly landscape character area		Moderate The transmission line would pass through a predominantly flat area which would require small and localised modifications to the terrain. The project would introduce large-scale construction activities in this peaceful rural landscape away from existing transmission line easements.	Moderate-low
Tumbarumba landscape character area		Moderate The establishment of the Tumbarumba accommodation facility (AC1) would introduce large-scale construction support facilities into an otherwise rural landscape. There would also be vegetation removed for construction of access tracks and construction compounds at the Tumbarumba accommodation facility (AC1).	Moderate-low
Forested hills landscape character zone			
Bago landscape character area	Local This landscape would generally be appreciated by a small number of residents and people travelling along roads and forestry trails accessible to the public, including tourists and visitors to the area using forestry trails.	Moderate The Bago landscape character areas has greater vegetation cover and absence of transmission infrastructure. The project would introduce a new parallel transmission line easement.	Moderate-low
Minjary landscape character area		Moderate The Minjary landscape character area has greater vegetation cover and an absence of transmission infrastructure. The project would introduce a new parallel transmission line easement.	Moderate-low

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Undulating rural hills and ridges landscape character zone			
Wondalga to Batlow landscape character area	Regional This landscape would be valued and experienced by users of local roads, as well as visitors and tourists to the area travelling along roads including the Hume Highway.	Moderate The project follows the Lower Tumut to Wagga 330 kV transmission line easement. However, north of Wondalga the transmission line route diverts north creating a new easement. Although this rural landscape is largely cleared of vegetation, there would be some areas including the hills north-east of Batlow where vegetation is more mature and dense, requiring more clearing of vegetation and a greater change in landscape character. The Memorial Avenue compound (C14) in Batlow and Bowmans Lane compound (C15) south-east of Batlow would also alter landscape character during construction.	Moderate
Tumut landscape character area		Moderate The project would create a new transmission line easement, crossing the Honeysuckle Range, between the Tumut River and Brungle Creek valleys, north of Tumut. Although this rural landscape is largely cleared of vegetation, there would be some areas between the Tumut River and Brungle Creek where vegetation is more mature and dense, requiring more clearing of vegetation and a greater change in landscape character.	Moderate
Murrumbidgee landscape character area		Low The project would not be parallel with the existing easements, but there is existing electricity infrastructure in the area. This rural landscape is largely cleared of vegetation. However, the hills west of the Murrumbidgee River have more mature and dense vegetation that would require more clearing, leading toa greater change in landscape character.	Moderate-low
Black Range to Yass landscape character area		Low The project would be parallel with the Lower Tumut to Yass 330 kV transmission line, before diverting to the north near Black Range Road. All vegetation within the area directly used for construction would be removed including at each transmission line structure site and for construction access tracks.	Moderate-low
Jerrawa to Dalton landscape character area		Low The project would be parallel to the existing Yass to Gullen Range 330 kV transmission line easement. This rural landscape is largely cleared of vegetation. However, areas east of Bango Nature Reserve and between the Lachlan River and Sapphire Road have more mature and dense vegetation that would require more clearing, leading to a greater change in landscape character.	Moderate-low

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Upland forest landscape character zone			
Snowy Mountains landscape character area	Regional This landscape would be appreciated by small numbers of people travelling along roads and walking trails, including tourists and visitors to the region.	Moderate The project would introduce new electricity infrastructure through forest areas in the northern part of the landscape character area. In the central part, the project would be parallel to the existing Lower Tumut to Murray and Upper Tumut 330 kV transmission line easements. The southern part of this landscape would stay parallel to the existing Lower Tumut to Upper Tumut 330 kV transmission line easement. The Maragle substation compound (C05) would be located on the southern side of Elliott Way, east of the existing easement and in an area mostly cleared as part of the Snowy 2.0 Transmission Connection project.	Moderate
Rural tablelands landscape character zone			
Crookwell landscape character area	Local This rural landscape would be appreciated by small numbers of people travelling along the network of rural roads, including mainly local residents and their visitors, as well as some tourists visiting the region.	Moderate All vegetation within the area directly used for construction would be removed including at each transmission line structure site, for construction access tracks and at the Woodhouselee Road compound (C11), east of Pejar Dam. Trees and vegetation within the transmission line easement would be removed or trimmed as required. The transmission line route would follow the existing Crookwell to Bannaby 330 kV transmission line. However, at the Pejar Dam crossing, the transmission line would divert to the south, away from Crookwell wind farm, closer to the visitor facilities at the southern end of the dam.	Moderate-low
Rural highland and deep valley landscape character zone			
Taralga to Bannaby rural highland and deep valley landscape character area	Local This landscape is remote and would be appreciated by small numbers of people travelling along roads, including residents and visitors to the area.	Moderate The transmission line route would parallel the existing Crookwell to Bannaby 330 kV transmission line easement until it diverts north creating a new easement through this landscape. All vegetation within the area used for construction would be removed including at each transmission line structure site, for construction access tracks and the Bannaby 500 kV substation compound (C12). Trees and vegetation within the transmission line easement would be removed or trimmed as required. This rural landscape is partially cleared of vegetation. However, there are some areas where vegetation is more mature and dense, and would require clearing, leading to a greater change in landscape character.	Moderate-low

14.4.2. Daytime visual impact assessment

Table 14-6 summarises the construction impact assessment for day-time visual amenity for viewpoints with impacts greater than 'low'. *Technical Report 8 - Landscape Character and Visual Impact Assessment* provides details on the visual sensitivity, magnitude of change and impacts for the remaining viewpoints that are expected to have 'negligible' or 'low' visual impacts, namely:

- Viewpoint 9 (view east from The Big Apple, Stewarts Road, Batlow)
- Viewpoint 15 (view west from Adjungbilly Road)
- Viewpoint 18 (view west from Black Range Road)
- Viewpoint 20 (view north-west from Orion Street, Yass)
- Viewpoint 25 (view north from Pejar Dam visitor area)
- Viewpoint 28 (view north-west from Hanworth Road).

Table 14-6 Summary of daytime visual impacts during construction

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 1: View south from Gregadoo East Road (VP01)	Local This road is used mainly by residents, visitors and staff at nearby properties and facilities such as the existing Wagga substation and waste and recycling facility.	Moderate The transmission line would be parallel to the existing Lower Tumut to Wagga 330 kV transmission line (Line 51). A small section of Line 51 would be demolished and rebuilt with the installation of transmission structures ranging between 24 m and 50 m tall. Construction work for the transmission lines would be seen in this view due to the largely flat, rural landscape, however screened by some vegetation within adjacent fields and along the road verge.	Moderate-low
Viewpoint 2: View south from Livingstone Gully Road (VP02)	Neighbourhood This road is used mainly by nearby residents and visitors to this area. Rural views such as this are common.	High Construction of the proposed Gugaa 500 kV substation would be prominent in this view, with the adjacent Gregadoo Road compound (C06) also visible. Construction of transmission line structures would also be visible, located behind (south) of the existing transmission line easement and extending over the road, due to the flat, open landform with very little vegetation.	Moderate-low
Viewpoint 3: View south-west from Tumbarumba Road (VP03)	Local This road is used mainly by nearby residents and their visitors.	High The transmission line would be parallel and to the south of the existing transmission line easement. The clearing of vegetation and the construction of several transmission structures would be seen from this location, extending into the background of the view.	Moderate

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 4: View south-west from the Hume Highway (VP04)	Local Rural views such as this are experienced by a higher number of receivers, including tourists, residents and workers travelling on the road.	Moderate The project footprint would be located about 300 m away, beyond and aligned generally parallel to the existing easement, extending either side of the highway. The vegetation along the highway and within adjacent fields would partially screen views to the construction work at some of the transmission line structures, however the structure installation and stringing would be visible. The construction would be seen from fast moving vehicles on the highway, although partially screened by intervening vegetation and landform.	Moderate-low
Viewpoint 5: View south-east from Westbrook Road (VP05)	Neighbourhood This road is used mainly by nearby residents and their visitors. Rural views such as this are common within this area around Oberne Creek.	High The project footprint is located beyond and aligned generally parallel to the existing transmission line easement, which crosses the view and rises to the east from the road towards the hills. The vegetation within this view would partially screen views to the construction work at some of the transmission line structures. However, the removal of vegetation, installation and stringing of transmission line and structures would be seen rising above the intervening vegetation. Construction vehicles and machinery would also be seen in this view, travelling along the road and the access track within the easement.	Moderate-low
Viewpoint 6: View south from Yaven Creek Road (VP06)	Neighbourhood This road is used mainly by nearby residents and their visitors. Rural views such as this are common within this area around Darlow.	High The project footprint would be located beyond, to the south and parallel to the existing transmission line. There would be construction vehicles and machinery visible working within the easement including work on the top of the ridge. While the undulating terrain and scattered trees would partially screen views to some of the transmission line structures, the machinery used to install and string the transmission line and structures would be visible and seen against the backdrop of hills.	Moderate-low
Viewpoint 7: View south from Wondalga Road (VP07)	Local This road is used mainly by staff and visitors to Green Hills State Forest, as well as nearby residents and their visitors. Views such as this are common to the south of Wondalga.	Moderate The project footprint would be seen in the background of this view, extending through the Adelong Creek valley, between Green Hills State forest to the south-west, and the hill to the south-east. From this location, the progressive removal of vegetation within a new transmission line easement would be visible. Machines installing the transmission line structures and stringing, including large machines such as cranes, would be seen rising above the intervening vegetation. Due to the distance to the project footprint, the screening effect of vegetation would slightly reduce the prominence of the work in this view.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 8: View north-east from Batlow Road, Wondalga (VP08)	Local Rural views such as this are experienced by a moderate to high number of receivers, including tourists, residents and freight transporters.	Moderate The project footprint would be located about 800 m away, beyond but not parallel to the existing easement, extending through the hills in the middle ground of view. There would be construction work at each transmission line structure, including structure installation and stringing with large machinery such as cranes. The construction activity would also be seen further to the south, crossing Batlow Road, about 350 m away.	Moderate-low
Viewpoint 10: View north from Batlow Road, Windowie (VP10)	Local Rural views such as this are experienced by a moderate to high number of receivers, including tourists, residents and freight transporters.	Moderate The project footprint would extend north from Batlow Road, through the rural landscape. The work at several transmission line structures would be visible in the background of the view. Construction vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would also be visible. The construction activity would be viewed against the backdrop of hills and would detract from the rural character of this view.	Moderate-low
Viewpoint 11: View south from Snowy Mountains Highway (VP11)	Local The Snowy Mountains Highway is a major touring route through the Snowy Valleys region, experienced by a moderate to high number of receivers, including tourists, residents and freight transporters.	High The project footprint would be located to the south of the highway, in the centre of this view. The proposed transmission line would extend through the flat rural landscape, towards the background of view. The work at multiple transmission line structures would be visible. Vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would also be visible. The construction activity would contrast with and detract from the rural character of this view.	Moderate
Viewpoint 12: View north from Gocup Road (VP12)	Local Rural views such as this are experienced by a moderate to high number of receivers, including tourists and residents.	High The project footprint would extend north-east of Gocup Road, through the flat rural river valley landscape, in the centre of this view, and across the hills in the background of view. The work at multiple transmission line structures would be visible. Vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would also be visible. The construction activity would detract from the rural character of this view and be viewed against the scenic backdrop of hills.	Moderate
Viewpoint 13: View south-east from Brungle Road (VP13)	Local This road is used mainly by nearby residents and their visitors. The vegetated hills in Mudjarn Nature Reserve are a feature in this view.	High From the hills to the south, the project footprint would extend south-east of Brungle Road, through the undulating pasture fields, towards the centre background of the view, around the foothills of Mudjarn Nature Reserve. The works at several transmission line structures would be visible. Vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The construction activity would detract from the amenity of the view and introduce new transmission line infrastructure into an otherwise rural view.	Moderate

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
		Mudjarn Nature Reserve is an Aboriginal place about 300 metres from the project. Mudjarn is associated with significant ceremonial sites, burials and a source of natural materials to manufacture traditional weapons and tools. It is the dwelling place of the spirit being Dulargul. Mudjarn represents the long-term occupation of the Wiradjuri, Ngunnawal and Walgalu of the Tumut River Valley. The distance of Mudjarn Nature Reserve from the project footprint means that the indirect visual impact to the significance of this site is assessed to be negligible.	
Viewpoint 14: View east from Elliott Way (VP14)	Local Bago State Forest draws recreational tourists for the bushwalking tracks, scenic lookouts and camping locations. Views such as this are common within this part of Bago State Forest and are experienced by a low number of receivers, including tourists and residents in the area.	Moderate The Maragle 500 kV substation compound (C05) would be seen in the centre of this view, to the south of the road, beyond the existing easement. The vegetation in this area will have been mostly removed as part of the Snowy 2.0 Transmission Connection Project and the future Maragle 500 kV substation would be prominent in this view. The project footprint would extend north of the road, including vegetation clearance along the easement and construction of several transmission line structures parallel to the existing easement. Construction activity, including the use of vehicles and machinery within the project footprint, would be clearly seen from this location, from a short section of the road, close to the site.	Moderate-low
Viewpoint 16: View south-east from Childowla Road (VP16)	Neighbourhood This road is used mainly by nearby residents and their visitors. Rural views such as this are common within this area around Derringullen Creek.	High The project footprint would extend generally parallel to Childowla Road, through the rural landscape in the centre of this view, about 200 m away and set below the ridgeline. The work at several transmission line structures would be visible, extending across the view. Construction vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would be visible on the hills and rising above the skyline, increasing their prominence.	Moderate-low
Viewpoint 17: View east from Burrinjuck Road (VP17)	Local This road is used mainly by residents, visitors and staff at nearby properties as well as tourists visiting Burrinjuck Dam.	High The transmission line would be parallel and in front of (north of) the existing easement. In this hilly rural landscape, the construction at several transmission structures would be visible, although partially screened by the vegetation within adjacent fields and hilly terrain. Construction vehicles and machinery would be seen in this view, travelling along an access track within the easement. Installation of the transmission line structures and stringing would also be visible rising above the undulating landscape, increasing their prominence in the view.	Moderate

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 19: View east from the Hume Highway, Yass (VP19)	Local Rural views such as this are experienced by a higher number of receivers travelling on the highway, including tourists, residents and workers travelling on the road.	Moderate The project footprint would be located about 600 m away, beyond the overhead steel gantry structure and extending either side of the highway. The vegetation along the highway and within adjacent fields would partially screen views of construction at some of the transmission line structures. Machines installing the transmission line structures and stringing, including large machines such as cranes, would be visible, rising above the vegetation and low hills. The construction activity would be seen in the background of this view, from fast moving vehicles on the highway and would be partially screened by vegetation.	Moderate-low
Viewpoint 21: View south from Cooks Hills Road (VP21)	Local This road is used mainly by nearby residents and their visitors, as well as tourists and staff of nearby facilities such as the Rye Park Wind Farm project, currently under construction.	Moderate The project footprint would extend either side of the road, through undulating terrain, closer to the viewer than the existing easement. Due to the varying landform and vegetation along the road and within adjacent fields, the works at a small number of transmission line structures would be seen in this view, with further sites visible in the background west of the road. Construction vehicles and machinery would be visible, travelling along an access track within the new easement. The installation of the transmission line structures and stringing would be visible, crossing over the road and obstruct a view across the valley and towards the distant hills. While there are existing transmission line structures in this view, the project would introduce large-scale works into the foreground of a view that includes attractive background features.	Moderate
Viewpoint 22: View south-east from Greendale Church (VP22)	Local. Greendale Church is a local church, servicing the surrounding rural areas north-east of Yass, used mainly by nearby residents and their visitors.	High The project footprint would be parallel to and in front of the existing easement. The work at a small number of transmission line structures would be seen in this view, against a backdrop of hills. Construction vehicles and machinery would be visible, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would also be visible, crossing over roads and through fields.	Moderate
Viewpoint 23: View north from Rugby Road (VP23)	Neighbourhood This road is used mainly by nearby residents and their visitors. Rural views such as this are common within this area north of Dalton.	High The project footprint would extend either side of Rugby Road, through the undulating rural river valley landscape, beyond and parallel to the existing easement. The work at multiple transmission line structures would be visible. Vehicles and machinery would be seen in this view, travelling along an access track within a new easement. The installation of the structures and stringing would also be visible, crossing over the road.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 24: View south-west from Grabben Gullen Road (VP24)	Local This road is used mainly by nearby residents and their visitors, as well as tourists visiting nearby locations such as the Gullen Range wind and solar farm.	Moderate The project footprint would extend through the undulating terrain, in front of the existing easement. Due to the varying landform and vegetation within fields, the work at a small number of transmission line structures would be seen in this view, receding into the background. Construction vehicles and machinery would be visible, travelling along an access track within a new easement. The installation of the transmission line structures and stringing would also be visible, crossing over the road.	Moderate-low
Viewpoint 26: View north from Taralga Road (VP26)	Local This road is used mainly by nearby residents and their visitors, as well as tourists visiting the area.	Moderate The project footprint would extend either side of Taralga Road, through the undulating tableland landscape in the centre of this view, in front of and parallel to the existing easement. The work at multiple transmission line structures would be visible. Vehicles and machinery travelling along an access track within a new easement would be seen. The installation of the transmission line structures and stringing would also be seen, crossing over the road.	Moderate-low
Viewpoint 27: View west from Bannaby Road (VP27)	Neighbourhood This road is used mainly by nearby residents and their visitors. Rural views such as this are common within this area around Bannaby Road, north of Tarlo River National Park.	High The project footprint would extend either side of the road, through the gently undulating rural landscape, in the centre of this view. The work at multiple transmission line structures would be visible. Vehicles and machinery would be seen in this view, travelling along an access track within a newly formed easement. The installation of the structures and stringing would also be visible, crossing over the road diagonally. The construction activity would be seen nearby, introducing transmission line infrastructure into the view and detracting from the rural character of this view.	Moderate-low
Views from the air (Area 1 - Bago State Forest, south of Tumut, near Kosciuszko National Park)	Regional. The scenic flights offered from these airports are for tourist and recreational purposes, from both helicopters and planes. The views from these flights are the focus of these journeys.	Moderate The views from the air would be impacted by the removal of vegetation for the construction of new transmission lines and construction compounds, which would reduce the amenity of the views. The project would be viewed together with the future Maragle 500 kV substation and the existing Snowy Hydro Scheme infrastructure.	Moderate
Views from the air (Area 2 – other areas)	Regional. The scenic flights offered from these airports are for tourist and recreational purposes, from both helicopters and planes. The views from these flights are the focus of these journeys.	Low The views from the air would be impacted by the removal of vegetation for the construction of new transmission lines and construction compounds. The project would be seen from the air within a complex landscape where other transmission and related infrastructure are seen and largely absorbed.	Moderate-low

14.4.3. Night-time visual impact assessment

The night-time visual amenity impacts associated with the construction of the project would result from the lighting required for the Tumbarumba accommodation facility (AC1) (operating 24 hours a day, seven days a week), construction compounds and transmission line structures. Table 14-7 summarises the construction impact assessment results for night-time visual impacts. There would be no visual impact on views from aircraft at night as scenic flights are operated during daylight hours and there is limited lighting proposed as a part of the project.

Table 14-7 Summary of night-time visual impacts during construction

Landscape character zone	Visual sensitivity	Magnitude of change	Visual impact
Rural fringe landscape	Low • there are medium light levels with scattered rural residences and a greater density of residences on the southern outskirts of Wagga Wagga • vegetation would provide some screening of light sources • bright skyglow is present associated with Wagga Wagga from vehicle lights and the Wagga Wagga airport.	Low Lighting may be required during the construction and operation of the Wagga 330 kV substation compound (C01). There would be work during standard hours within the project footprint, which may require lighting during winter (and, potentially, other periods) for a short duration in the early evening. Lighting would be from construction of each transmission line structure and from headlights of vehicles in the project footprint and on nearby roads. This lighting is likely to be absorbed within the surrounding area of medium district brightness. This effect would only occur for a short duration.	Low
Great Dividing Range foothills landscape	Moderate • there are low light levels with sparse rural residences and a greater density of trees on the steeper, hilly landscape • landform and vegetation cover would provide some screening of light sources • fewer roads cross the hilly terrain, and therefore fewer vehicle headlights are seen in these areas • there are no densely settled areas; towns and highways in the surrounding landscapes would influence the light levels.	Low There would be work during standard hours within the project footprint, which may require lighting during winter (and, potentially, other periods) for a short duration in the early evening. Lighting would from construction of each transmission line structure and from headlights of vehicles in the project footprint and on nearby roads. The lighting is likely to contrast somewhat with the surrounding area, but this would only occur over a short duration.	Moderate-low

Landscape character zone	Visual sensitivity	Magnitude of change	Visual impact
Rural valleys landscape	Moderate • there are low light levels with scattered rural residences across the landscape • there are some denser clusters of residences near towns such as Tumut and Batlow • more vehicles travel along local roads and highways • there are a timber mill and manufacturing plant, a waste and recycling centre, and a large paper mill on the northern side of the Snowy Mountains Highway, west of Tumut • there is general skyglow above the settlements of Tumut and Batlow.	Low The Gregadoo Road compound (C06) and Snowy Mountains Highway compound (C02) (including site offices, amenities and construction support facilities) may operate outside standard construction hours, requiring lighting. The Tumbarumba accommodation facility (AC1) would be located in this zone, north of the town, which would require lighting. There would also be work at the proposed Gugaa 500 kV substation and along the transmission line route within the project footprint that would occur during the standard hours for construction, which would require lighting during winter (and potentially for other periods) for a short duration in the early evening. This would include lighting from construction at the substation, at each transmission line structure site as well as headlights of staff and construction vehicles accessing and moving along the transmission line easement. Overall, while there would be a noticeable change to the character of localised areas within the rural valleys landscape due to lighting of the compounds and worker accommodation facility during construction, this comprises a small area of the overall landscape character area. The lighting would be in accordance with *AS4282 Control of the Obtrusive Effects of Outdoor Lighting* and therefore there would be a low magnitude of change.	Moderate-low
Forested hills landscape	High • low light levels across state forest and reserves • this landscape contains no dwellings • lights from vehicles travelling along local roads and occasional night-time works at forestry sites contribute to the light levels.	Low The facilities at the Honeysuckle Road compound (C07), Red Hill Road compound (C08) and Adjungbilly Road compound (C09) may operate outside standard construction hours, requiring lighting. There would be work along the transmission line route within the project footprint that would occur during the standard hours for construction, which would require lighting during winter (and, potentially, other periods) for a short duration in the early evening. Lighting would be from construction at each transmission line structure site and from headlights of vehicles in the project footprint and on nearby roads. The lighting would contrast with the surrounding predominantly dark landscape.	Moderate

Landscape character zone	Visual sensitivity	Magnitude of change	Visual impact
Undulating rural hills and ridges landscape	Moderate • there are low level light sources at night associated with the scattered homesteads and agricultural buildings on rural properties and vehicles travelling along local roads • some denser clusters of residences are situated near townships such as Batlow and Yass • more vehicles travel along local roads as well as the Hume Highway northwest of Yass • there is general sky glow above the settlements, particularly around Yass.	Low The facilities at the Memorial Avenue and Bowmans Lane construction compounds (C14 and C15) would include site offices, amenities and construction support facilities, which may operate outside standard construction hours, and would require lighting. Lighting may be required during the construction and operation of the Snubba Road compound (C03). However, the vegetation to the east and west of this site would somewhat contain the light spill and associated views to this lighting. The Yass substation compound (C10) would be located within the existing substation site and would be largely absorbed within the existing lighting in this location, on the southern outskirts of Yass. There would be work during standard hours within the project footprint, which may require lighting during winter (and, potentially, other periods) for a short duration in the early evening. Lighting would be from construction of each transmission line structure and from headlights of vehicles in the project footprint and on nearby roads. The lighting is likely to contrast somewhat with the surrounding area, however this would only occur over a short duration.	Moderate-low
Upland forest landscape	High • low light levels • few residences are scattered throughout this landscape • there is some light lights from vehicles travelling along local roads • this is predominantly a dark landscape with substantial areas of forest reserves.	Low Lighting may be required during the construction and operation of the Maragle 500 kV substation compound (C05). This compound would be constructed within the area cleared for the future Maragle 500 kV substation. The facilities at the Maragle 500 kV substation compound (C05) may operate outside standard construction hours, requiring lighting. There would be work during standard hours within the project footprint, which may require lighting during winter (and, potentially, other periods) for a short duration in the early evening. Lighting would be from construction of each transmission line structure and from headlights of vehicles in the project footprint and on nearby roads. The lighting would contrast with the surrounding predominantly dark landscape.	Moderate
Rural tablelands landscape	Moderate • the area has low light levels • the area is sparsely settled with scattered rural residences across the landscape with some denser clusters of residences near townships such as Taralga.	Low Lighting may be required during the construction and operation of the Woodhouselee Road compound (C11). There would be work during standard hours within the project footprint, which may require lighting during winter (and potentially for other periods) for a short duration in the early evening. Lighting would be to enable construction of each transmission line structure and headlights from vehicles in the project footprint and nearby roads. The lighting is likely to contrast somewhat with the surrounding area, however this would only occur over a short duration.	Moderate-low

Landscape character zone	Visual sensitivity	Magnitude of change	Visual impact
Rural highland and deep valley landscape	High • there is some light from vehicles travelling along local roads such as Bannaby Road • lighting at the existing Bannaby 500 kV substation may influence the visual sensitivity of this landscape.	Low The Bannaby 500 kV substation compound (C12) would be located in a deep valley beside the existing substation and may operate outside standard construction hours. In this area, there is vegetation and landform which would largely contain views to this lighting. There would be work during standard hours within the project footprint, which may require lighting during winter (and, potentially, periods) for a short duration in the early evening. Lighting would be from construction of each transmission line structure and from headlights of vehicles in the project footprint and on nearby roads. The lighting would contrast with the surrounding predominantly dark landscape.	Moderate

14.4.4. Private dwellings visual impact assessment during construction

14.4.4.1. Views to proposed temporary construction compounds and accommodation facility

There may be temporary visual impacts from dwellings located with a view to one of the proposed construction compounds with the level of impact varying according to the visibility (distance and intervening landform and vegetation) and sensitivity of the viewing location. This would include views from private dwellings towards some construction compounds in rural areas, including the Gregadoo Road compound (C06), Honeysuckle Road compound (C07), Red Hill Road compound (C08), Adjungbilly Road compound (C09), Woodhouselee Road compound (C11) and Bowmans Lane compound (C15).

Where the construction compounds are located near existing substations (Wagga 330 kV substation compound (C01), Maragle 500 kV substation compound (C05), Yass substation compound (C10) and Bannaby 500 kV substation compound (C12)), there would be limited visibility from private dwellings and therefore negligible visual impacts.

There would also be negligible visual impacts where the construction compounds are located in industrial and commercial areas where there are few residential dwellings. This would apply to the Snowy Mountains Highway compound (C02) and the Memorial Avenue compound (C14). There would also be no visual impact on receivers at private dwellings at the Snubba Road compound (C03), which is enclosed by vegetation.

There would be some temporary visual impacts on views from dwellings surrounding the Tumbarumba accommodation facility (AC1) as the associated built structures would be located within a rural setting and would include the removal of some vegetation.

14.4.4.2. Views to substations

There would be negligible visual impacts on views from dwellings to the Wagga 330 kV substation and Bannaby 500 kV substation, and high-moderate visual impacts from one dwelling with a view to the proposed Gugaa 500 kV substation as well as other construction along the project footprint.

14.4.4.3. Views to transmission line

Transmission line structure construction work could be visible from each dwelling with views to the project for several weeks at a time up to 21 weeks, with the work spread over a year as different construction activities occur progressively. For these periods, temporary visual impacts would be experienced as a result of construction activity, the use of heavy vehicles and construction equipment. This would include impacts ranging from high to negligible along the project footprint, with the higher visual impacts experienced from those dwellings closest to the project footprint and without intervening landforms or vegetation.

14.5. Potential impacts – operation

14.5.1. Landscape character zone impact assessment

Table 14-8 summarises the operational impact assessment results for landscape character areas with impacts greater than 'low'. *Technical Report 8 - Landscape Character and Visual Impact Assessment* provides details on the landscape sensitivity, magnitude of change and impacts for the remaining landscape character zones and sub-character areas that are expected to have 'low' or 'negligible' impacts, namely:

- landscape character zones and sub-character areas that are expected to have 'low' impacts:
  - Rural fringe landscape: Wagga Wagga rural fringe landscape character area
  - Forested hills landscape: Green Hills, and Red Hill and Bungongo forested hills landscape character areas
  - Rural tablelands landscape: Crookwell rural tablelands landscape character area
- Rural valleys landscape: Tumbarumba rural valleys landscape area, which is expected to experience 'negligible' impacts.

Table 14-8 Summary of landscape character impact during operation

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Great Dividing Range foothills landscape			
Gregadoo Great Dividing Range foothills landscape character area	Regional	Moderate The transmission line structures would increase the presence of electricity infrastructure in this landscape and further detract from the semi-rural landscape character. The transmission line route would follow the alignment of an existing easement.	Moderate
Ellerslie Range Great Dividing Range foothills landscape character area	Regional	Moderate The transmission line structures would increase the presence of electricity infrastructure in this landscape and further detract from the semi-rural landscape character. The transmission line route would follow the alignment of an existing easement. There would be localised landform change to create flat areas for the transmission line structures and vegetation along the easement would be either removed or trimmed.	Moderate

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Rural valleys landscape			
Gregadoo to Book Book rural valleys landscape character area	Local	Low The additional transmission line structures would be regularly spaced across these areas, are of similar form and scale to the existing structures, would follow the existing Lower Tumut to Wagga 330 kV transmission line easement, and these areas already contain existing large-scale transmission lines. The landscape would have the capacity to absorb these changes without altering the prevailing character of the rural landscape.	Moderate-low
Yaven Creek and Adelong Creek rural valleys landscape character area			Moderate-low
Tumut rural valleys landscape character area		Moderate The project would introduce large-scale transmission structures in this flat rural landscape. Agricultural land uses would continue under the new transmission lines and around the transmission line structures, within the easement.	Moderate-low
Adjungbilly rural valleys landscape character area		Moderate The project would introduce large-scale transmission line structures within an additional part of the Adjungbilly landscape character area, away from the existing Lower Tumut to Yass 330 kV transmission line easement.	Moderate-low
Undulating rural hills and ridges landscape			
Wondalga to Batlow undulating rural hills and ridges landscape character area	Regional	Moderate In the southern part of the Wondalga to Batlow landscape character area, the project would follow the Lower Tumut to Wagga 330 kV transmission line easement.	Moderate
Tumut undulating rural hills and ridges landscape character area		Moderate North of Wondalga, the transmission line would divert north, creating a new easement. The project would continue to create a new easement, crossing the Honeysuckle Range, between the Tumut River and Brungle Creek valleys, north of Tumut. This is a hilly area, largely cleared of vegetation and under rural use, with an absence of large-scale infrastructure.	Moderate
Murrumbidgee undulating rural hills and ridges landscape character area		Low Although the Murrumbidgee landscape character area contains three transmission line easements, including Lower Tumut to Yass 330 kV, Wagga to Yass 132 kV and Yass to Burrinjuck 132 kV transmission line structures, varying in size from 15 to 40 metres tall, the project would be located away (north) of these, within a new easement. The project would not be aligned with these easements, nor would it be co-located at any point.	Moderate-low

Landscape character zone / sub-character area	Landscape sensitivity	Magnitude of change	Landscape impact
Black Range to Yass undulating rural hills and ridges landscape character area		Low In the southern part of the Black Range to Yass landscape character area, the project would be aligned with the Lower Tumut to Yass 330 kV transmission line route, before diverting away (north) near Black Range Road. In the vicinity of Yass, the project would cross over several existing transmission line easements radiating from the existing Yass substation, including the Yass to Murrumburrah and two sets of Yass to Cowra transmission line structures. The existing Yass substation would be utilised as a construction compound for this project (C10).	Moderate-low
Jerrawa to Dalton undulating rural hills and ridges landscape character area		Low In the Jerrawa to Dalton landscape character area, the project would be parallel to the existing Yass to Gullen Range 330 kV transmission line easement.	Moderate-low
Upland forest landscape			
Snowy Mountains upland forest landscape character area	Regional	Moderate The project would introduce additional transmission line structures of a similar scale and form to those which currently exist. The project would increase the presence of electricity infrastructure in this remote forested landscape and introduce an additional transmission line easement.	Moderate
Rural highland and deep valley landscape			
Taralga to Bannaby rural highland and deep valley landscape character area	Local	Moderate The project would introduce additional transmission line structures which would be larger than the Mount Piper to Bannaby 500 kV transmission lines and have a different form. It would be seen in the context of existing large scale electricity infrastructure, including existing transmission line easements and a substation. The project would increase the presence of electricity infrastructure in this remote forested landscape and introduce an additional transmission line easement.	Moderate-low

14.5.2. Daytime visual impact assessment

14.5.2.1. Summary of impacts

Table 14-9 summarises the impact assessment results for day-time visual amenity during operation of the project for viewpoints with impacts greater than 'low'. *Technical Report 8 - Landscape Character and Visual Impact Assessment* provides details on the visual sensitivity, magnitude of change and impacts for the remaining viewpoints that are expected to have 'negligible' or 'low' visual impacts, namely:

- Viewpoint 5 (view south-east from Westbrook Road)
- Viewpoint 8 (view north-east from Batlow Road, Wondalga)
- Viewpoint 9 (view east from the Big Apple)
- Viewpoint 15 (view west from Adjungbilly Road)
- Viewpoint 18 (view west from Black Range Road)
- Viewpoint 20 (view north-west from Orion Street, Yass)
- Viewpoint 23 (view north from Rugby Road)
- Viewpoint 25 (view north from Pejar Dam visitor area)
- Viewpoint 28 (view north-west from Hanworth Road)
- Views from air – Area 1 and Area 2.

Table 14-9 Summary of day-time visual impacts during operation

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 1: View south from Gregadoo East Road (VP01)	Local	Moderate A new easement containing large-scale 500 kV transmission line structures would be seen beyond and aligned parallel to the existing easement, in the middle ground of view. While the project would include steel lattice structures, they would be a slightly different design and larger than the existing structures. They would also be spaced further apart and would not be grouped together with the existing transmission line structures. While existing rural uses would continue to be seen around and through the transmission line easement, the project would further add to the visual clutter created by the transmission line infrastructure seen in this view. While the presence of transmission line infrastructure in this view increases the capacity of this view to absorb this change, the spacing of the structures would be inconsistent with the existing structures and would therefore be visually prominent.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 2: View south from Livingstone Gully Road (VP02)	Neighbourhood	High The proposed Gugaa 500 kV substation would be a prominent, large-scale piece of infrastructure in this view (refer to Figure 14-3). A new easement containing large-scale 500 kV transmission line structures would be seen beyond and aligned parallel to the existing easement, in the middle ground of view, connecting to the substation. The form of the new steel lattice structures would be similar. However, they would be taller (about double to triple the height of the existing structures) and have a more elongated shape. The new transmission line structures would also be spaced further apart than the existing structures and would not necessarily be grouped together with the existing structures. While the areas impacted by the Gregadoo Road compound (C06) would be reinstated and restored to rural use, the project would further add to the visual clutter of transmission line infrastructure seen in this view.	Moderate-low
Viewpoint 3: View south-west from Tumbarumba Road (VP03)	Local	Moderate The project would be seen in the middle ground of this view, aligned parallel to the existing transmission lines within a wide easement cleared of vegetation. The project would be seen in the context of the existing easement. The new 500 kV transmission line structures would be much larger, ranging between 50 m and 76 m high, about double to triple the height of the existing structures, with a more elongated shape, and spaced at wider intervals. Overall, the proposed transmission line would be seen in proximity, and would be prominent in this view.	Moderate-low
Viewpoint 4: View south-west from the Hume Highway (VP04)	Local	Moderate There would be an additional row of transmission line structures seen beyond and parallel to the existing easement, with 500 kV transmission line structures ranging between 50 m and 76 m high, about double to triple the height of the existing structures. The vegetation along the highway and in adjacent fields would screen the lower section of the structures and the rural uses seen from this location would continue within and around the easement.	Moderate-low
Viewpoint 6: View south from Wondalga Road (VP06)	Neighbourhood	Moderate-high A new easement containing large 500 kV transmission line structures ranging between 50 m and 76 m high would be seen beyond and aligned parallel to the existing easement, in the background of view. The new structures would be spaced across the view, at a wider spacing than the existing structures. As such, there would be several transmission line structures visible, with vegetation and landform partially screening the lower sections of the structures in some instances. The transmission line structures would be visible crossing the Yaven Creek valley and hills, including prominently on the ridgeline crossing, adding to the presence of large-scale infrastructure in this view. While the project would include steel lattice structures, they would be of a different shape and about double to triple the height of the existing structures. The new structures would add to the visual clutter and increase the presence of transmission line infrastructure this view.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 7: View north-east from Wondalga Road (VP07)	Local	Moderate In this view there would be a new cleared easement visible, containing several of the 500 kV transmission line structures ranging between 50 m and 76 m high. The vegetation in the foreground of view would screen the lower section of the structures and the rural and forestry uses seen from this location would continue within and around the easement.	Moderate-low
Viewpoint 10: View north from Batlow Road, Windowie (VP10)	Local	Moderate The project would introduce new, large scale 500 kV transmission line structures ranging between 50 m and 76 m high, in this rural valley setting. The transmission line route would cross Batlow Road and Windowie Creek, traversing in a straight line through the rural landscape in the centre of this view, at the foot of the hills. While the structures would be partly screened by trees, the project would detract from the rural amenity of this view.	Moderate-low
Viewpoint 11: View south from Snowy Mountains Highway (VP11)	Local	High There would be a new transmission line easement in the centre of this view, containing large scale 500 kV transmission line structures ranging between 50 to 76 m tall (refer to Figure 14-4). The project would cross the highway, then extend in a straight line through the flat rural landscape seen in this view and viewed against a backdrop of foothills of the surrounding range. The project would detract from the rural amenity of this view, which does not currently include large scale power infrastructure.	Moderate
Viewpoint 12: View north from Gocup Road (VP12)	Local	High There would be a new transmission line easement seen in the centre of this view, containing large scale 500 kV transmission line structures ranging between 50 m and 76 m high (refer to Figure 14-5). The project would cross Gocup Road, then extend in a straight line through the flat rural landscape seen in this view, cross the Tumut River valley and cross the low hills seen in the middle ground of view. While the project would not cross the hills associated with Mudjarn Nature Reserve, seen in the backdrop, the transmission line structures would detract from the amenity of this view, which does not currently include large scale power infrastructure.	Moderate
Viewpoint 13: View south-east from Brungle Road (VP13)	Local	High There would be a new transmission line seen in the centre of this view, containing large scale 500 kV transmission line structures ranging between 50 m and 76 m high (refer to Figure 14-6). The project would extend from the hills, cross over Brungle Road, and extend in a straight line through the undulating rural landscape, towards the low hills seen in the background of the view. While the project would not cross the hills or remove any vegetation within Mudjarn Nature Reserve, the project would introduce new transmission line infrastructure into an otherwise rural and bushland character view.	Moderate

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 14: View east from Elliott Way (VP14)	Local	Moderate The area impacted by the Maragle 500 kV substation compound (C05) would have been dismantled, opening up views to the Maragle 500 kV substation. Large scale 500 kV transmission line structures would be seen extending from the north, crossing the road and connecting to the substation. The project would be parallel to the existing easement, creating a wider easement area cleared of vegetation. The new steel lattice transmission line structures would have a different form and be higher and much larger than the existing structures. The new structures would be between 50 m and 76 m high, about double to triple the height of the existing structures. As the form, spacing and height of the transmission line structures would be different from the existing structures, it would add to the visual clutter. However, the presence of other existing transmission lines and the future Maragle 500 kV substation (to be built by the Snowy 2.0 Transmission Connection project) would increase the capacity of this view to accommodate the project elements.	Moderate-low
Viewpoint 16: View south-east from Childowla Road (VP16)	Neighbourhood	High The project would introduce a new easement, containing large scale 500 kV transmission line structures ranging between 50 m and 76 m high, in this hilly rural setting. The transmission line route would traverse in a straight line, generally parallel to Childowla Road, through the rural landscape in the centre of this view, at the foot of the ridgeline. The transmission line structures would rise above and be viewed against the skyline in this view. Overall, the project would detract from the amenity of this view.	Moderate-low
Viewpoint 17: View east from Burrinjuck Road (VP17)	Local	Moderate A new easement containing large 500 kV transmission line structures, ranging between 50 m and 76 m high, would be seen in front of and aligned parallel to the existing transmission line, in the middle ground of view. While the project would include steel lattice transmission line structures, they would be about double to triple the height of the existing structures, spaced further apart and would not be grouped together with the existing structures. While existing rural uses would continue to be seen around and within the new easement, the project would further add to the visual clutter seen in this view. Overall, the quantity and scale of transmission line infrastructure seen in this view would increase, detracting from the amenity of the view.	Moderate-low
Viewpoint 19: View east from the Hume Highway, Yass (VP19)	Local	Moderate There would be a new easement seen in the background of this view containing 500 kV steel lattice transmission line structures ranging between 50 m and 76 m high, with overhead wires crossing the highway. The vegetation along the highway and in adjacent fields would partly screen the lower section of the structures and the rural uses seen from this location would continue within and around the easement. The presence of existing transmission line infrastructure and proximity of a busy highway containing multiple lanes of traffic increases the capacity of this view to absorb this change.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 21: View south from Cooks Hills Road (VP21)	Local	High There would be an additional row of transmission line structures seen in front of and adjacent to the existing easement(refer to Figure 14-7). The new 500 kV transmission line structures would be much larger than the existing structures, ranging between 50 m and 76 m high, about double to triple the height of the existing structures, with a different shape, and spaced at wider intervals. The undulating terrain and vegetation along the road and in adjacent fields would screen the lower section of the structures and the rural uses seen from this location would continue within and around the easement. The transmission line structures would obstruct the view to the backdrop of hills in the distance, further reducing the amenity of this view.	Moderate
Viewpoint 22: View south-east from Greendale Church (VP22)	Local	High There would be an additional row of transmission line structures seen in front of and adjacent to the existing easement (refer to Figure 14-8). The new 500 kV transmission line structures would be much larger than the existing structures, ranging between 50 m and 76 m high, about double to triple the height of the existing structures, with a slightly different shape, and spaced at wider intervals. The vegetation along the road and in adjacent fields would screen the lower section of some of the structures. The rural uses seen from this location would also continue within and around the easement.	Moderate
Viewpoint 24: View south-west from Grabben Gullen Road (VP24)	Local	Moderate A new easement containing large 500 kV transmission line structures ranging between 50 m and 76 m high would be seen in front of and aligned parallel to the existing transmission lines, in the middle ground of view. While the presence of transmission line infrastructure increases the capacity of this view to absorb this change, the design and spacing of the structures would be inconsistent with the existing structures. They would also be about double to triple the height of the existing structures, increasing the prominence and presence of electricity infrastructure in this view.	Moderate-low
Viewpoint 26: View north from Taralga Road (VP26)	Local	Moderate A new easement containing large 500 kV transmission line structures ranging between 50 m and 76 m high would be seen in front of and aligned parallel to the existing transmission lines, in the middle ground of view (refer to Figure 14-9). While the project would include steel lattice structures, they would be a different shape and reach about double to triple the height of the existing structures. They would also be spaced further apart and would not be grouped together with the existing structures. The transmission line structures would rise above the undulating landform with little intervening vegetation and landform, and be viewed against the sky, increasing their visual prominence. While there is a transmission line seen in this view, the larger scale of the project structures would increase the visual prominence and presence of electricity infrastructure in this view.	Moderate-low

Viewpoint	Visual sensitivity	Magnitude of change	Visual impact
Viewpoint 27: View west from Bannaby Road (VP27)	Neighbourhood	High There would be a new transmission line easement in the centre of this view, containing large scale 500 kV transmission line structures ranging between 50 m and 76 m high (refer to Figure 14-10). The transmission line would cross the road diagonally, then change direction to the north of the road (right of view), extending in a straight line towards and through the vegetated hills (left, out of view). The project would detract from the rural amenity of this view, which contains no large-scale electricity infrastructure.	Moderate-low
Views from the air (Area 1 – vicinity of Bago State forest, forested landscape Snubba Road and the future Maragle 500 kV substation)	Regional	Low The views from the air would be impacted by new 500 kV transmission line easements which parallel the existing transmission lines and would create a strong line across the landscape.	Moderate-low
Views from the air (Area 2 – areas north of Snubba Road)	Regional	Low The views from the air would be impacted by new 500 kV transmission line easements, which would create a strong line across the landscape. In other areas surrounding Wagga Wagga and Tumut, the new transmission line easement would be seen within a varied and complex landscape where other existing transmission lines and related infrastructure are noticeable. Therefore, the project would be largely absorbed into existing views.	Moderate-low

14.5.2.2. Photomontages

Photomontages of the project based on an indicative concept design during operation from viewpoints with a visual impact of ‘moderate-low’ or higher are illustrated in Figure 14-3 to Figure 14-10. *Technical Report 8 - Landscape Character and Visual Impact Assessment* includes the remaining photomontages for viewpoints that are expected to have ‘low’ or ‘negligible’ visual impacts.



Figure 14-3 Viewpoint 2: view south from Livingstone Gully Road which includes the proposed Gugaa 500 kV substation and existing Lower Tumut to Wagga 330 kV transmission line easement, photomontage (moderate-low impact)



Figure 14-4 Viewpoint 11: view south from Snowy Mountains Highway, photomontage (moderate impact)



Figure 14-5 Viewpoint 12: view north from Gocup Road, photomontage (moderate impact)



Figure 14-6 Viewpoint 13: view south-east from Brungle Road, photomontage (moderate impact)



Figure 14-7 Viewpoint 21: view south from Cooks Hills Road which includes the existing Yass to Gullen Range 330 kV transmission, photomontage (moderate impact)



Figure 14-8 Viewpoint 22: view south-east from Greendale Church which includes the Yass to Gullen Range 330 kV transmission line route, photomontage (moderate impact)



Figure 14-9 Viewpoint 26: view north from Taralga Road which includes the Crookwell to Bannaby 330 kV transmission line route, photomontage (moderate-low impact)



Figure 14-10 Viewpoint 27: view west from Bannaby Road, photomontage (moderate-low impact)

14.5.2.3. Road corridors in the public domain

Views within the visual impact study area were considered with a focus on views from road corridors that are scenic routes and include views to landscapes with scenic value. In most locations, the project footprint crosses roads and highways, rather than being aligned parallel to them, reducing the potential for a visual impact that would be experienced for a long duration. Notably, there would be moderate adverse visual impacts from the Snowy Mountains Highway, Gocup Road and Brungle Road where the landscape is more open and the project would be visible across broad valleys and elevated hills. In these areas, the new transmission line would change direction, extending its visibility within a landscape that currently has no existing transmission line structures in view.

14.5.3. Night-time visual impact assessment

There would be negligible impacts across the majority of the landscape character zones during the night-time operation of the project. This is due to the lack of lighting along the transmission line route as well as the decommissioning of the construction compounds and worker accommodation facilities following construction. There would, however, be low-level lighting at the proposed Gugaa 500 kV substation, affecting the Gregadoo to Book Book rural valleys landscape character area, where there would be a moderate-low visual impact at night.

14.5.4. Private dwellings visual impact assessment

There is no guidance for the assessment of visual impact on views for private property that applies to energy transmission projects in NSW. Due to the scale of this project and number of potential sensitive receivers, a two stage approach has been applied that suits the scale and nature of transmission infrastructure.

- Stage 1 was a preliminary desktop assessment to identify dwellings with the potential for a moderate or higher visual impact.
- Stage 2 was a detailed assessment of the dwellings identified in Stage 1, to confirm their visual impact level, which included a visit to a representative sample of private dwellings to observe and photograph views.

In Stage 1, the desktop assessment reviewed 180 dwellings which are either located in the project footprint, within 500 metres of the project footprint or identified as otherwise having potential for visual impact within the visual impact study area. Of these, 90 dwellings were identified as having the potential for a moderate or higher visual impact based on the transmission line having potential to be located anywhere within the project footprint.

The detailed assessment of visual impact carried out in Stage 2 identified that the project would have:

- a high visual impact for 17 dwellings
- a high-moderate visual impact for 27 dwellings
- a moderate visual impact for 36 dwellings
- a moderate-low, low, or negligible visual impact for all remaining dwelling.

These potential visual impact levels have the potential to be further reduced by the implementation of mitigation measures outlined in Table 14-10.

A more detailed analysis of the visual impact on private residences is detailed in *Technical Report 8 – Landscape Character and Visual Impact Assessment*.

14.6. Management of impacts

14.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). For construction, all mitigation measures would be consolidated in a Construction Environmental Management Plan (CEMP).

14.6.2. Avoidance and minimisation of impacts

Approaches to avoid and minimise landscape character and visual impacts were considered in the refinement of the project footprint. This included:

- paralleling existing transmission line easements where possible to minimise areas where the project would be located in a greenfield location where there is no visual precedent
- minimising the number of intersections with other infrastructure, which would require the use of taller transmission line structures
- maximising the distance from towns along the transmission line easement by following a route, which is located a distance to the south of Yass and Tumut
- minimising impacts on areas of vegetation within conservation areas and cultural heritage places
- using the existing Wagga 330 kV substation and Bannaby 500 kV substation sites for the additional substation infrastructure so as to co-locate and consolidate this infrastructure in a location which is away from residential receivers and other prominent community viewpoints.

14.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

Table 14-10 summarises the mitigation measures that would be implemented to avoid or minimise potential impacts to landscape character and visual amenity.

Table 14-10 Mitigation measures for potential impacts to landscape character and visual amenity

Reference	Impact	Mitigation measure	Timing	Relevant locations
LV1	Vegetation retention	Opportunities for the retention and protection of existing trees within the disturbance area would be identified during detailed construction planning. Identified trees of high conservation significance would be retained and protected where practicable.	Detailed design	All locations
LV2	Vegetation retention	Temporary and permanent access would be designed to minimise vegetation removal, changes to landform, and visual impacts where practicable.	Detailed design	All locations
LV3	Construction lighting	Lighting at construction compounds and the worker accommodation facility would be designed and operated in accordance with *AS 4282 2019 Control of the obtrusive effects of outdoor lighting*.	Detailed design and construction	Construction compounds and worker accommodation facility
LV4	Vegetation protection	The Tree Protection Zone of retained trees within or immediately adjacent to the disturbance area would be managed in accordance with *AS 4970-2009 Protection of Trees on Development Sites* where practicable to minimise the impact of the works on the long-term health of these trees.	Detailed design	All locations
LV5	Visual changes near residences	For residences where the project is predicted to have a moderate to high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options (for example planting of vegetation) would be confirmed in consultation with the affected landowner and implemented where practicable. Vegetative screening would be maintained by the landowner.	Detailed design and operation	Transmission line
LV6	Operational lighting	Lighting at the substations would be designed and operated in accordance with *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting*.	Operation	Substations

14.6.4. Managing residual impacts or uncertainties

The assessment of landscape character and visual amenity impacts for the project used conservative assumptions regarding the potential locations of the transmission line structures in the absence of detailed design.

The location of the transmission line structures would be micro-sited during detailed design with an aim to locate them away from sensitive viewpoints, against a more visually absorptive background or so that intervening landform and vegetation would block views. The visibility of the project may also be decreased with the considered location of the transmission line structures to be screened where there is existing mature vegetation to be retained during construction and operation of the project.

For easement affected landowners, compensation would consider residual visual impacts. Currently, there is no existing legislative mechanism within NSW outlining compensation measures for non-easement affected properties that may have visual impacts as a result of transmission projects. For residences where the project is predicted to have a moderate to high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options would be confirmed in consultation with the affected landowner and implemented where practicable.

15. Noise and vibration

This chapter provides a detailed summary of the assessment of potential noise and vibration impacts of the project. The full assessment is provided in *Technical Report 9 – Noise and Vibration Impact Assessment* (SLR, 2023a).

15.1. Environmental Assessment Requirements

15.1.1. Secretary's Environmental Assessment Requirements

Table 15-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to noise and vibration impacts of the project and where these requirements are addressed in this EIS.

Table 15-1 Secretary's Environmental Assessment Requirements – noise and vibration

Reference	SEARs	Where principally addressed in the EIS
Amenity		
Key issues	The EIS must address the following matters: • an assessment of the construction, operational and road noise and vibration impacts of the project.	Section 15.4 provides an assessment of potential noise and vibration impacts, including traffic noise, during construction. Section 15.5 provides an assessment of potential noise impacts associated with transmission lines and substations during operation. Section 15.5 provides an assessment of road noise impacts during operation.

15.2. Assessment approach

15.2.1. Legislation and policies

Potential noise and vibration impacts resulting from construction and operation of the project were assessed in line with the following key policy guidelines and standards:

- *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) – used to establish standard construction working hours, identify noise management levels (NMLs) for construction of the project, assess construction noise impacts on sensitive receivers, and develop feasible and reasonable mitigation measures.
- *Construction Noise and Vibration Guideline* (CNVG) (TfNSW, 2019) – used to assess construction noise and vibration impacts on sensitive receivers and develop feasible and reasonable mitigation measures. While this guideline was developed for road related projects, it is considered a suitable guideline for the assessment and management of impacts from the project.
- *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006a) – used to assess vibration impacts on sensitive receivers.
- *NSW Road Noise Policy* (RNP) (DECCW, 2011) – used to assess construction traffic impacts.
- *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings – Guide to damage levels from groundborne vibration* (British Standards Institution, 1993) – used for a screening assessment of vibration impacts (cosmetic damage) to sensitive buildings and structures.
- *DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures* (Deutsches Institute fur Normung (DIN), 2016) – used for a screening assessment of vibration impacts (cosmetic damage) to vibration sensitive heritage buildings and structures, where the structure is found to be unsound.

- *Noise Policy for Industry* (NPfI) (NSW EPA, 2017a) – used to assess operational impacts, identify noise trigger levels for operation of the project, assist with ambient noise monitoring and analysis procedures, and assessment of sleep disturbance.
- *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environmental Conservation Council (ANZECC), 1990) – used for an assessment of blasting and overpressure vibration impacts.
- *AS 2187.2-2006 Explosives –Storage and use, Part 2: Use of explosives* (Standards Australia, 2006) – used for an assessment of blasting and overpressure vibration impacts.

Further consideration and application of the above policy guidelines and standards is provided in Sections 15.2.4, 15.2.5, 15.4, 15.5 and 15.6.3.

15.2.2. Methodology

The methodology for the noise and vibration assessment included:

- identifying the noise and vibration study area based on the extent of impacts
- identifying and classifying all potential noise and vibration sensitive receivers within the noise and vibration study area from the construction and operation of the project
- conducting ambient noise monitoring at representative locations in the noise and vibration study area between March and August 2022
- processing the monitored data in accordance with the relevant guidelines to determine the ambient environment and NMLs and noise trigger levels for the project
- modelling the construction and operation activities of the project to predict noise and vibration levels at surrounding sensitive receivers
- assessing the likely airborne noise impacts from the noisiest 15-minute[14] period of construction activities for transmission lines, substations, and construction compounds
- assessing the likely construction and operation road traffic noise levels
- assessing the likely operational noise impacts of transmission lines and substations
- assessing the likely vibration impacts at sensitive receivers during construction
- comparing the predicted noise levels to the current NMLs and noise trigger levels to determine the likely level of impact
- identifying mitigation measures to minimise and manage any predicted noise and vibration impacts.

The noise and vibration study area is defined by a two kilometre buffer around the project footprint. The noise and vibration study area is expected to represent the extent of all sensitive receivers potentially impacted by noise and vibration from construction and operation of the project.

A detailed description of the assessment methodology is provided in *Technical Report 9 – Noise and Vibration Impact Assessment*.

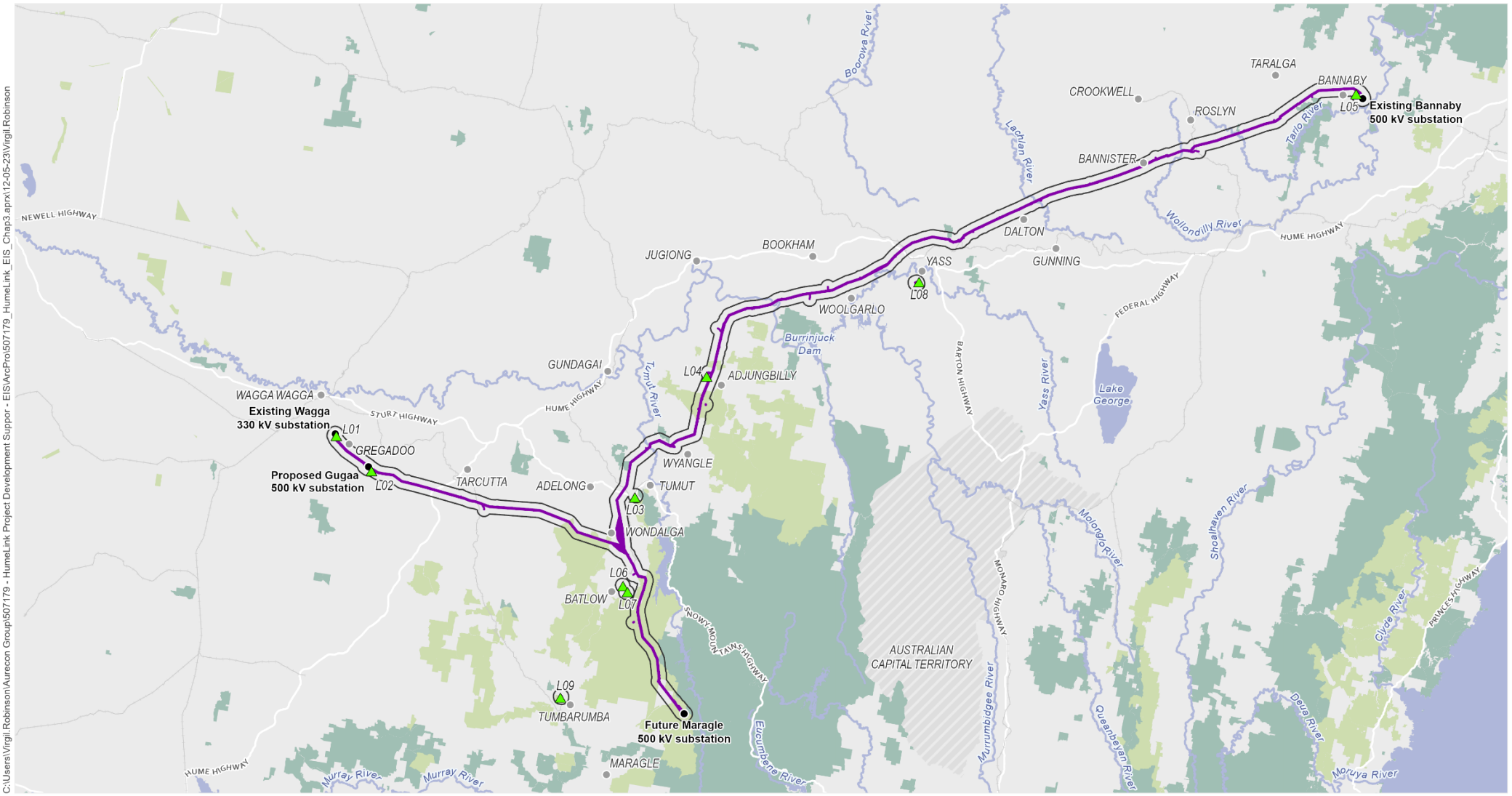
15.2.3. Monitoring approach

Unattended ambient noise monitoring was carried out at nine locations within the noise and vibration study area. Short-term attended noise monitoring was also completed at each ambient monitoring location. The ambient noise monitoring locations were selected with reference to the procedures outlined in the NPfI to establish representative background noise levels across the project footprint and surrounding land uses.

[14] The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project.

The monitoring locations were selected with reference to guidance in the ICNG and NPfI that background noise monitoring should be conducted to represent the reasonably most-affected receivers, considering existing background levels and shielding between sources and receivers.

Figure 15-1 shows the ambient noise monitoring locations (denoted L01 to L09) within the noise and vibration study area. These locations are listed in Table 15-8.



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

1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 15-1: Noise monitoring locations

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15.2.4. Construction noise and vibration assessment approach

15.2.4.1. Construction scenarios

Several representative construction scenarios have been developed to assess the likely airborne noise impacts from the construction activities associated with transmission line and substation work and establishment and operation of the construction compounds and the worker accommodation facility.

The scenarios represent the 'realistic worst-case' potential airborne noise impacts during the noisiest 15-minute period. This approach is generally considered conservative as the calculations for each scenario assume several items of construction plant and equipment are in use at the same time and work occurs at the boundary that is the closest point to each receiver. As such, for most construction activities, it is expected that the actual construction noise levels would frequently be lower than the predictions for these construction scenarios. A brief description of the construction scenarios is presented in Table 15-2 and full descriptions are provided in *Technical Report 9 – Noise and Vibration Impact Assessment*.

Table 15-2 Construction scenario descriptions

Scenario	Description
Substations	
Site establishment	Establishment of temporary construction site offices and amenities for the new and modified substations
Earthwork and vegetation clearance	Bulk earthworks, excavation, site preparation and vegetation removal as required
Civil and building work	Installation of foundations, construction of new ancillary and equipment control buildings and erection of structures to support equipment
Installation of high voltage equipment and associated structures	Use of cranes, installation of electrical equipment and site wiring
Pre-commissioning activities	Erection of the substation site boundary security fencing, including site access gates
Demobilisation and rehabilitation	Surfacing and stabilising works for access, dust and vegetation suppression and drainage
Tie-in work	Connection of the proposed transmission lines to the existing and new substations
Transmission lines	
Site establishment and deliveries	Establishment of transmission line work site and delivery of equipment or materials
Access tracks	Construction of access tracks to accommodate safe access for construction machinery and materials to each transmission line structure work site
Earthwork and clearing	Clearing of vegetation at and between the transmission line structures
Construction of structures	Construction of transmission line structures including with the use of cranes
Brake and winch sites	Stringing, tensioning and pulling of transmission line by a ground-pulled draw wire with brake/winch machines (ie brake and winch sites).
Overhead stringing of conductors and earth wires	Stringing of transmission lines (conductors and earthwires) by a line-stringing drone and ground-based support from winches, cranes, etc
Decommissioning and rehabilitation	Replacement of topsoil and establishment of grass or suitable vegetation, rehabilitation of access roads or tracks where they are not required for further construction activities or operation of the project
Telecommunications hut construction	Construction of one telecommunications hut nearby the transmission line easement

Scenario	Description
Construction compounds and worker accommodation facility	
Site establishment	Clearing and removal of topsoil and vegetation, establishment of ancillary facilities, utility adjustments and establishment of vehicle access and egress points
Construction compound operation	Activities such as: • staging and equipment laydown • temporary storage of materials, plant and equipment • worker parking • concrete batching at Bannaby 500 kV substation compound (C12)
Accommodation facility operation	Power generators, light and heavy vehicle movements The facility's demountable cabins would be connected to existing utilities

The construction scenarios have considered both work during and outside of standard construction hours. Standard construction hours as defined by the ICNG are between 7am to 6pm Monday to Friday and 8am to 1pm Saturday with no construction work on Sundays or public holidays. It is expected that construction activities would largely be undertaken during standard construction hours. However, project-specific constraints may require some construction activities during the evening and night-time.

Work outside of standard construction hours (refer to Section 4.7.3) is referred to as out-of-hours work and can be divided into:

- day-time out-of-hours – Saturday between 7am to 8am and 1pm to 6pm, or Sunday and public holidays between 8am to 6pm
- evening out-of-hours – Monday to Saturday between 6pm and 10pm
- night-time out-of-hours – Monday to Saturday between 10pm and 7am, or Sunday and public holidays between 6pm to 8am.

To provide a worst-case out-of-hours assessment, the entire project footprint was considered as a potential work site.

Three construction scenarios involving substation, transmission line and worker accommodation facility construction have been assumed to require out-of-hours work. Further detail on each construction scenario including a description of work, typical working hours and associated plant and equipment, is provided in *Technical Report 9 – Noise and Vibration Impact Assessment*. Chapter 4 (Project description – construction) also details activities likely to be carried out as out-of-hours work.

It is expected that aircraft including helicopters and drones (officially known as remote piloted aircraft) would be used during construction of the project to transport material where access to remote sites is required and for the stringing of the transmission lines. The Air Navigation (Aircraft Noise) Regulations 2018 applies to the noise emissions from aircraft, including helicopters and drones. Given there would only be intermittent aircraft operations within the project footprint, it is not considered necessary to generate Aircraft Noise Exposure Forecasts (ANEF) for the project.

15.2.4.2. Noise management levels

Table 15-3 outlines the NMLs applicable to residential receivers during construction of the project. These levels have been determined for relevant locations in accordance with the ICNG and using the results from the unattended ambient noise monitoring (refer to Section 15.3.1). The Noise Management Levels (NMLs) are based on the Rating Background Levels (RBLs) +10 decibels (dB) during standard daytime hours and +5 decibels out of hours. Therefore, the minimum RBLs of 35 decibel A-weighted (dBA) and 30 dBA result in 35 + 10 = 45 dBA during standard daytime hours, 35 + 5 = 40 dBA during OOH daytime and 30 + 5 = 35 dBA during the evening and night-time.

Table 15-3 Residential receiver construction NMLs

Location	Representative monitoring location	NML (LA_{eq} (15 minute) –dBA)				Sleep disturbance screening criteria (52 dBA or RBL + 15 dB whichever is higher)
		Standard construction (RBL + 10 dB)	Out-of-hours (RBL + 5 dB)			
		Day-time	Day-time[1]	Evening	Night-time	
Gilmore	L03	55	50	48	46	56
Yass	L08	48	43	43	39	52
Batlow	L06	45	40	40	37	52
All other receivers (rural areas)	L01, L02, L05, L07 and L09	45	40	35	35	52

Notes:

The NMLs in 'All other receivers' have been applied at all rural areas outside of Gilmore, Yass and Batlow. The representative monitoring locations in 'All other receivers' include a range of locations across the project that have demonstrated the RBLs are below the minimum levels in the NPfI, so the minimums have been adopted.

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

2 LAeq is the average noise level during a measurement period, such as the day-time or night-time

The NMLs adopted for non-residential receiver types within and surrounding the project footprint are as follows:

- places of worship – 45 $LA_{eq\ 15\ min}$ dBA (for internal noise levels)
- active recreation areas – 65 $LA_{eq\ 15\ min}$ dBA (for external noise levels)
- passive recreation areas – 60 $LA_{eq\ 15\ min}$ dBA (for external noise levels)
- commercial – 70 $LA_{eq\ 15\ min}$ dBA (for external noise levels)
- industrial – 75 $LA_{eq\ 15\ min}$ dBA (for external noise levels).

The NMLs are not mandatory limits. However, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable mitigation measures to minimise noise emissions should be investigated.

Table 15-4 details the exceedance categories. The categories are taken from the CNVG and have been used in the presentation and discussion of potential noise impacts from the construction scenarios in Section 15.4.1. The representative scenarios cover a range of noise-producing activities, including highly noise intensive equipment, and are therefore considered representative of the worst-case construction noise.

Table 15-4 Exceedance bands and impact colouring

Subject classification	Exceedance of NML		Impact colouring
	Standard construction	Out-of-hours	
Negligible	No exceedance	No exceedance	
Noticeable	-	1 – 5 dB	
Clearly audible	1 – 10 dB	6 – 15 dB	
Moderately intrusive	11 – 20 dB	16 – 25 dB	
Highly intrusive	>20 dB	>25 dB	

Sensitive receivers are classified as highly noise affected (HNA) based on the ICNG definition if they are predicted to experience noise levels greater than 75 dBA.

15.2.4.3. Construction traffic noise criteria

The potential impacts from construction traffic associated with the project when travelling on public roads are assessed under the RNP. An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than two decibels due to construction traffic. Further assessment is required using the RNP criteria detailed in Table 15-5 where an increase in noise levels is considered likely. Refer to *Technical Report 9 – Noise and Vibration Impact Assessment* for the RNP criteria for assessing construction traffic on public roads.

Table 15-5 RNP criteria for assessing construction traffic on public roads

Road category	RNP assessment criteria	
	Day-time (7am – 10pm)	Night-time (10pm – 7am)
Freeways, arterial and sub-arterial roads	60 dB $LA_{eq\ 15hr}$ (external)	55 dB $LA_{eq\ 9hr}$ (external)
Local roads	55 dB $LA_{eq\ 1hr}$ (external)	50 dB $LA_{eq\ 1hr}$ (external)

15.2.4.4. Construction vibration criteria

Table 15-6 outlines the minimum working distances for typical vibration-intensive equipment for both human comfort and cosmetic damage as taken from the CNVG.

Where vibration intensive construction equipment such as vibratory rollers, hydraulic hammers, bored pilling rigs and jackhammers are used at a greater distance from sensitive receivers than the specified minimum working distance, then impacts are not considered likely. However, the minimum working distances are indicative and would vary depending on the item of plant or equipment and local geotechnical conditions.

Heritage buildings and structures have potential to be more sensitive to vibration if they are structurally unsound. Where heritage buildings and structures are found to be structurally unsound, a more conservative cosmetic damage objective would be considered in accordance with *DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures* (DIN, 2016). This guideline has been considered as a conservative approach for the project in the absence of confirmation of the structural condition of nearby heritage buildings and structures.

Table 15-6 Recommended minimum working distances from vibration intensive equipment

Plant item	Rating/description	Minimum distance		
		Cosmetic damage		Human response[3]
		Residential and light commercial[1]	Heritage items[2]	
Vibratory roller	<50 kN (1-2 t)	5 m	11 m	15 m to 20 m
	<100 kN (2-4 t)	6 m	13 m	20 m
	<200 kN (4-6 t)	12 m	25 m	40 m
	<300 kN (7-13 t)	15 m	31 m	100 m
	>300 kN (13-18 t)	20 m	40 m	100 m
	>300 kN (>18 t)	25 m	50 m	100 m
Small hydraulic hammer	300 kg (5-12 t excavator)	2 m	5 m	7 m
Medium hydraulic hammer	900 kg (12-18 t excavator)	7 m	15 m	23 m
Large hydraulic hammer	1,600 kg (18-34 t excavator)	22 m	44 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	5 m to 20 m	20 m
Bored piling rig	≤ 800 mm	2 m (nominal)	5 m	4 m
Jackhammer	Handheld	1 m (nominal)	3 m	2 m

Notes:
1 BS 7385 Part 2-1993 Evaluation and measurement for vibration on in buildings – Guide to damage levels from groundborne vibration (BSI, 1993)
2 DIN 4150: Part 3-2016 Structural vibration – Effects of vibration on structures (DIN, 2016)
3 Assessing Vibration: A Technical Guideline (DEC, 2006a)

15.2.5. Operational noise and vibration assessment approach

15.2.5.1. Transmission lines

Operation of high-voltage transmission lines has the potential to generate audible noise (typically a broadband hum or crackling noise) during certain meteorological conditions, ie during rainy conditions and at higher temperatures.

The potential audible noise from the transmission lines was determined by using the Electric Power Research Institute method and is documented in *HumeLink Audible Noise and Radio Interference* (Aurecon, 2022). As the final transmission line route is not known, the assessment has conservatively assumed that the transmission line easement may be anywhere within the project footprint.

Three weather scenarios were modelled:

- fair weather – maximum ambient temperature and altitude from historical weather data for the region
- L50 (light rain or mist) – maximum altitude for the region with rain simulated at a rate of 0.75 millimetres per hour
- heavy rain – typical expected temperatures during rain and maximum altitude for the region with rain simulated at a rate of 18 millimetres per hour.

In addition to the weather scenarios, existing 132 kV to 500 kV transmissions lines that run parallel to the project footprint were also considered to understand any cumulative noise emissions.

In the absence of standards or guidelines on noise limits applicable to transmission lines, the assessment applied the night-time noise trigger level from the NPfI criteria (refer to Section 15.2.5.3). Due to the likely elevated ambient noise environment during the heavy rain scenario, the light rain scenario is considered to be the scenario that is most likely to exceed the relevant NPfI criteria.

The transmission line infrastructure would not generate any vibration during operation, therefore this has not been assessed.

15.2.5.2. Substations

No additional noise-generating equipment, such as transformers or capacitor banks, are proposed at the Wagga 330 kV substation or the future Maragle 500 kV substation, with the nearest sensitive receivers about 300 metres and one kilometre away, respectively. Additional shunt reactors (a device that absorbs reactive power and stabilises voltage) are proposed to be installed at the Bannaby 500 kV substation, but the additional equipment is expected to be substantially quieter than the existing transformers.

The closest sensitive receivers to the Bannaby 500 kV substation are around one kilometre away. Therefore, operational noise assessments for the Wagga 330 kV, Bannaby 500 kV and future Maragle 500 kV substations were not carried out as the project would result in a negligible change to operational noise emissions at these locations.

An operational noise assessment was undertaken for the proposed Gugaa 500 kV substation as it is proposed to contain noise-producing equipment such as transformers, auxiliary transformers and shunt reactors.

The potential operational noise levels from the proposed Gugaa 500 kV substation have been predicted using the CONCAWE industrial noise algorithm in SoundPLAN. The assessment assumed that all equipment within the substation would operate continuously in a steady state nature. Potential impacts were modelled with and without transformer barriers that were assumed to have a height of four metres to identify the potential influence of barriers on the noise levels likely to be experienced surrounding the substation.

The substation equipment would not generate any vibration during operation, therefore this has not been assessed.

15.2.5.3. Project noise trigger levels

Table 15-7 outlines the project noise trigger levels (PNTLs) determined for the operation of the project. These levels have been determined in accordance with the NPfI and using the results from ambient noise monitoring (refer to Section 15.3.1).

Table 15-7 Project noise trigger levels

Period	Recommended Amenity Noise Level LA_{eq} (dBA)	Measured Noise Level (dBA)		Project Noise Trigger Levels $LA_{eq\ (15\ minute)}$ (dBA)	
		RBL[1]	$LA_{eq\ (period)}$	Intrusiveness	Amenity[2, 3]
Day-time	50	35[4]	44-52	40	48
Evening	45	30[4]	39-48	35	43
Night-time	40	30[4]	36-46	35	38

Notes:
1 RBL = Rating Background Level.
2 The recommended amenity noise levels have been reduced by 5 dB, where appropriate, to give the project amenity noise levels due to other sources of industrial noise being present in the area, as outlined in the NPfI.
3 The project amenity noise levels have been converted to a 15-minute level by adding 3 dB, as outlined in the NPfI.
4 RBL increased to the minimum RBL specified in the NPfI.

15.3. Existing environment

15.3.1. Existing noise levels

Existing noise levels within the noise and vibration study area are typical of rural areas and dominated by natural sources such as wildlife and weather. However urban noise sources were noted to influence the background environment at some locations including:

- road traffic noise at Gilmore, Yass and Batlow
- industrial noise at Gilmore
- occasional aircraft noise at Tumut, Adjungbilly and Bannaby.

Existing substations, including Wagga 330 kV substation, Yass substation and Bannaby 500 kV substation, also generate noise from their operation.

The ambient noise monitoring results are summarised in Table 15-8.

Table 15-8 Summary of noise monitoring results

Location ID	Address	Noise level (dBA) [1, 2]					
		Background noise (RBL)			Average noise level (LA_{eq})		
		Day-time	Evening	Night-time	Day-time	Evening	Night-time
L01[3]	83 Ashfords Road, Wagga Wagga	31	29	26	43	43	38
L02	1070 Livingstone Gully Road, Gregadoo	29	<25	<25	52	41	42
L03[4]	Snowy Mountains Highway, Gilmore	45	43	41	58	56	55
L04	1428 Adjungbilly Road, Adjungbilly	39	39[5] (47)	38	53	57	51
L05	Hanworth Road, Bannaby	26	26[5] (27)	<25	44	39	46
L06	14 Memorial Avenue, Batlow	35	35	32	60	53	49
L07	Bowmans Lane, Batlow	29	29[5] (30)	29[5] (30)	46	43	43

Location ID	Address	Noise level (dBA) [1, 2]					
		Background noise (RBL)			Average noise level (LA_{eq})		
		Day-time	Evening	Night-time	Day-time	Evening	Night-time
L08	Perry Street, Yass	38	38[5] (42)	34	56	58	52
L09	38 Alfred Street, Tumbarumba	30	30[5] (53)	30[5] (39)	54	58	53

Notes:
1 The RBL and LAeq noise levels have been determined with reference to the procedures in the NPfI.
2 Day-time is 7am to 6pm, evening is 6pm to 10pm and night-time is 10pm to 7am.
3 Data taken from EnergyConnect (NSW – Eastern Section) Environmental Impact Statement, conducted in 2020.
4 The ambient noise environment at this location was found to be influenced by extraneous noise (likely mechanical plant/equipment in the vicinity of the monitor) and is not considered representative of the surrounding area.
5 The monitored evening level was found to be higher than the day-time. In this situation the NPfI requires that the evening level be reduced to match the day-time. The monitored level is shown in brackets.

15.3.2. Sensitive receivers

Sensitive receivers within the noise and vibration study area have been categorised as residential buildings, commercial/industrial buildings or 'other sensitive' land uses (eg places of worship, active recreation areas, etc). Most sensitive receivers surrounding the project are residential. The 'other sensitive' receivers in the noise and vibration study area are mainly grouped in the towns of Batlow, Tumbarumba and Yass. However, four individual places of worship have also been identified in rural areas between Yass and Bannaby. Figure 15-2 shows the location of sensitive receivers.

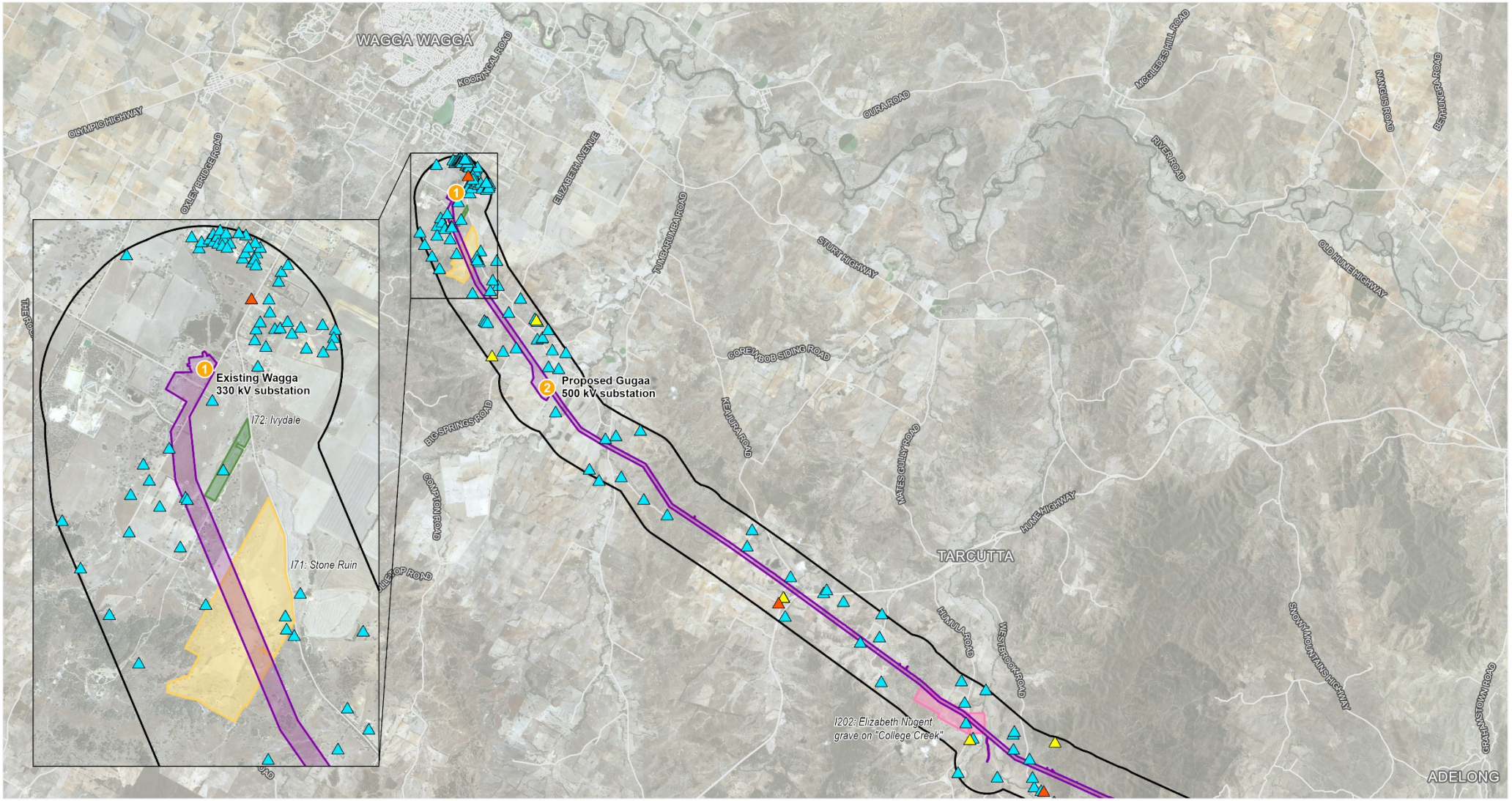
A conservative approach was taken to identify heritage listed buildings and structures within and near the project footprint that are potentially sensitive to vibration (refer to Table 15-9).

Table 15-9 Non-Aboriginal heritage listed items

Item name	Address	Significance	Heritage listing	Distance to nearest heritage structure[1]
Ivydale	9 Ivydale Road Gregadoo	Local	Wagga Wagga Local Environment Plan 2010 (Wagga Wagga Local Environmental Plan (LEP)) – ID I72	700 m
Stone ruin	1149 Gregadoo East Road, Gregadoo	Local	Wagga Wagga LEP – ID I71	500 m
Elizabeth Nugent grave on 'College Creek'	1615 Humula Road, Tarcutta	Local	Wagga Wagga LEP – ID I202	430 m
Kiley's Run	Red Hill State Forest	Indicative on Register of National Estate (RNE)	RNE – ID 16005	240 m

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

Further detail on the non-Aboriginal heritage listed items is provided in Chapter 10 (Non-Aboriginal heritage).



Project footprint

Noise and vibration study area

Waterway

Heritage listed item

I71: Stone Ruin

I72: Ivydale

I202: Elizabeth Nugent grave on "College Creek"

Sensitive receiver within 2km buffer

Residential

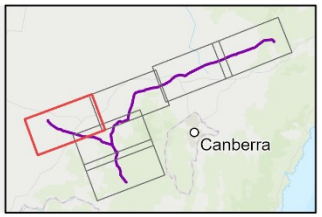
Possible residence

Firestation - Bush

Construction ancillary facilities

1 Wagga 330 kV substation compound (C01)

2 Gregadoo Road compound (C06)



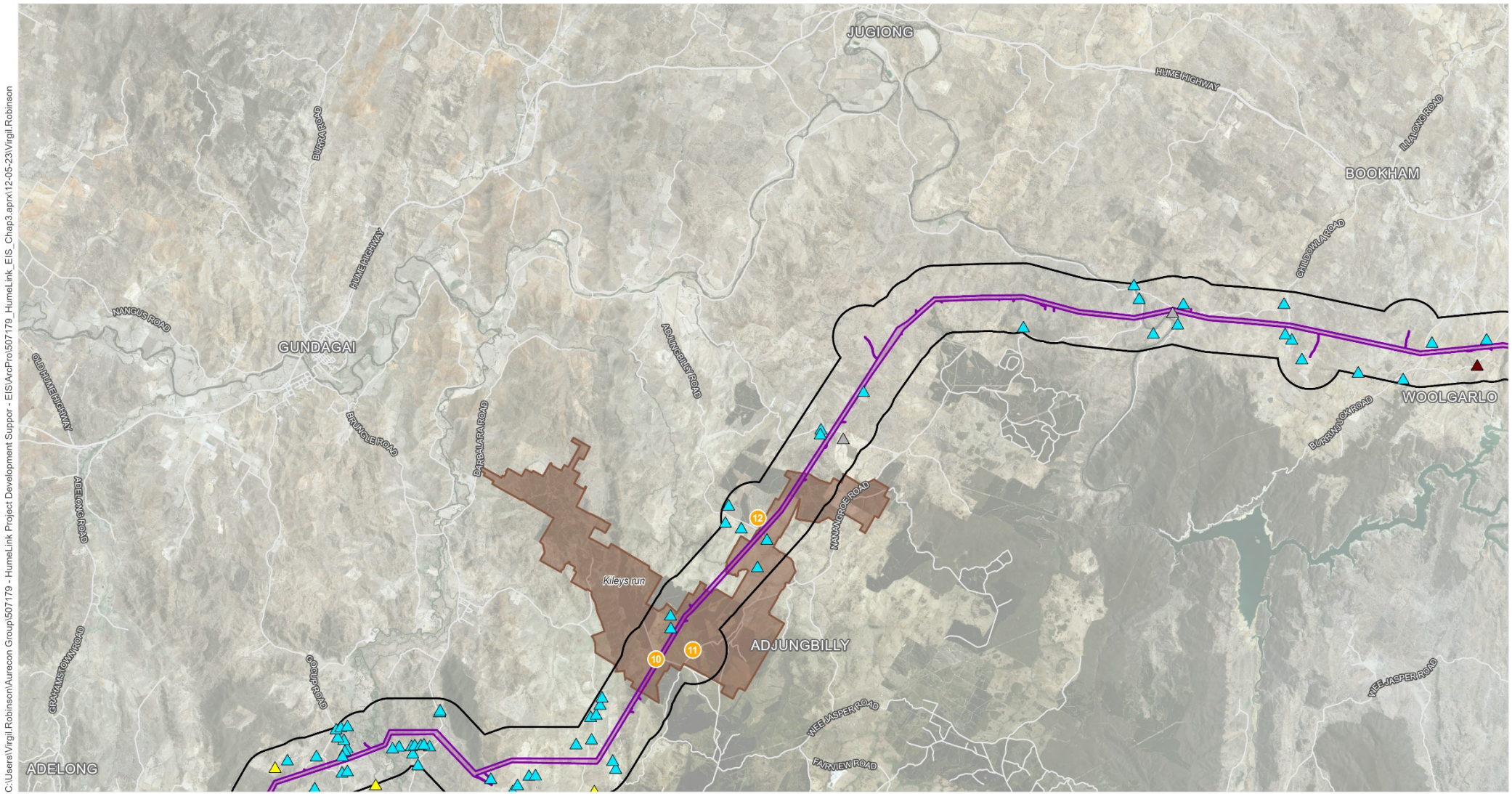
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0 5 10 km

Projection: GDA 1994 MGA Zone 55

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Figure 15-2a: Noise and vibration sensitive receivers



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Project footprint

Noise and vibration study area

Waterway

Heritage listed item

Kileys Run

Sensitive receiver within 2km buffer

Camping Ground

Dilapidated dwelling

Residential

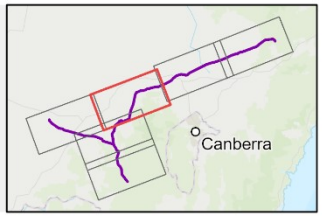
Possible residence

Construction ancillary facilities

10 Honeysuckle Road compound (C07)

11 Red Hill Road compound (C08)

12 Adjungbilly Road compound (C09)



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

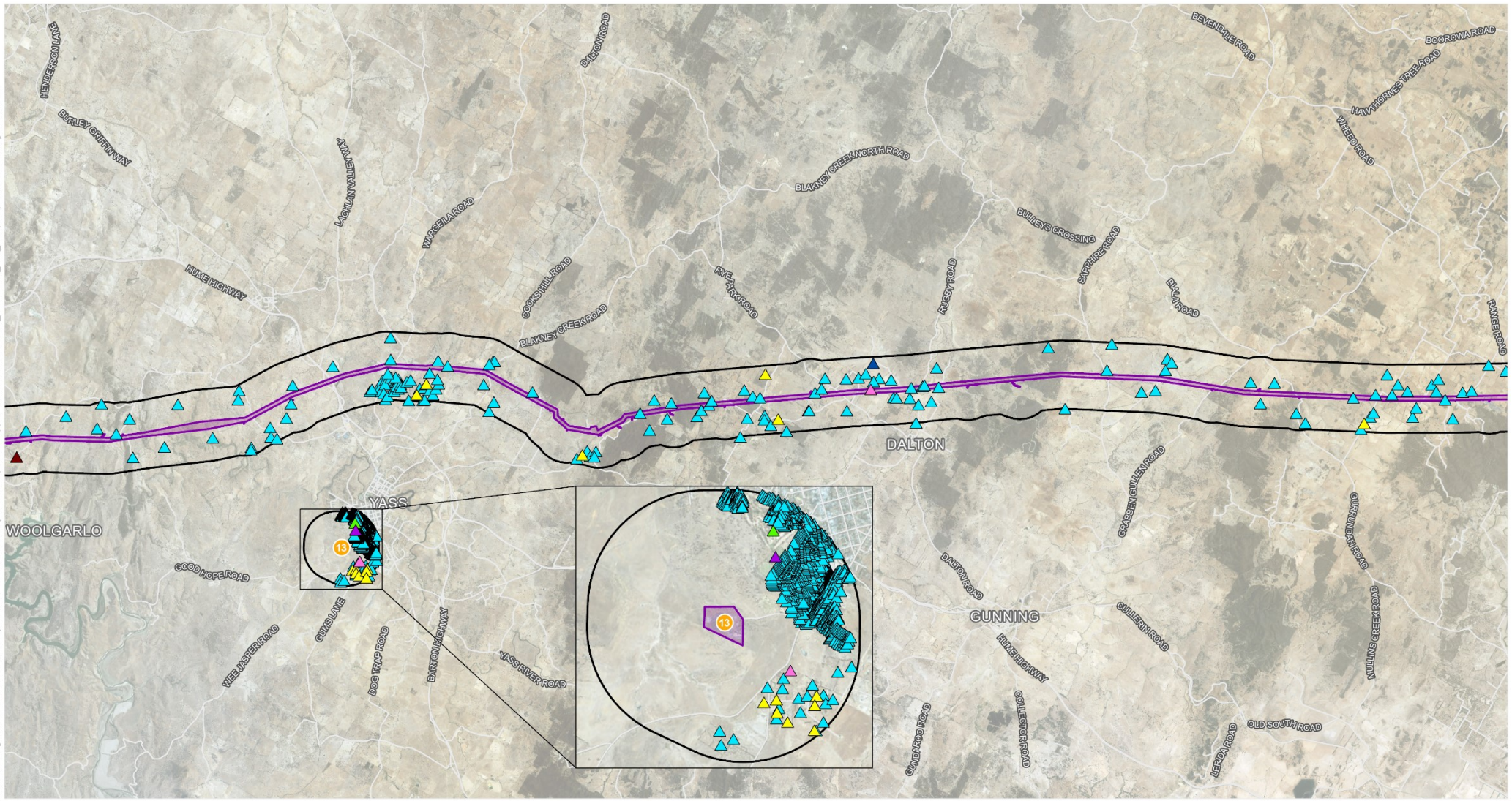
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Projection: GDA 1994 MGA Zone 55

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Figure 15-2b: Noise and vibration sensitive receivers



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Project footprint

Noise and vibration study area

Waterway

Sensitive receiver within 2km buffer

Camping Ground

Club

Residential

Possible residence

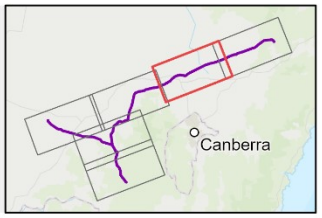
Gas Facility

Golf Course

Place of Worship

Construction ancillary facilities

13 Yass substation compound (C10)



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

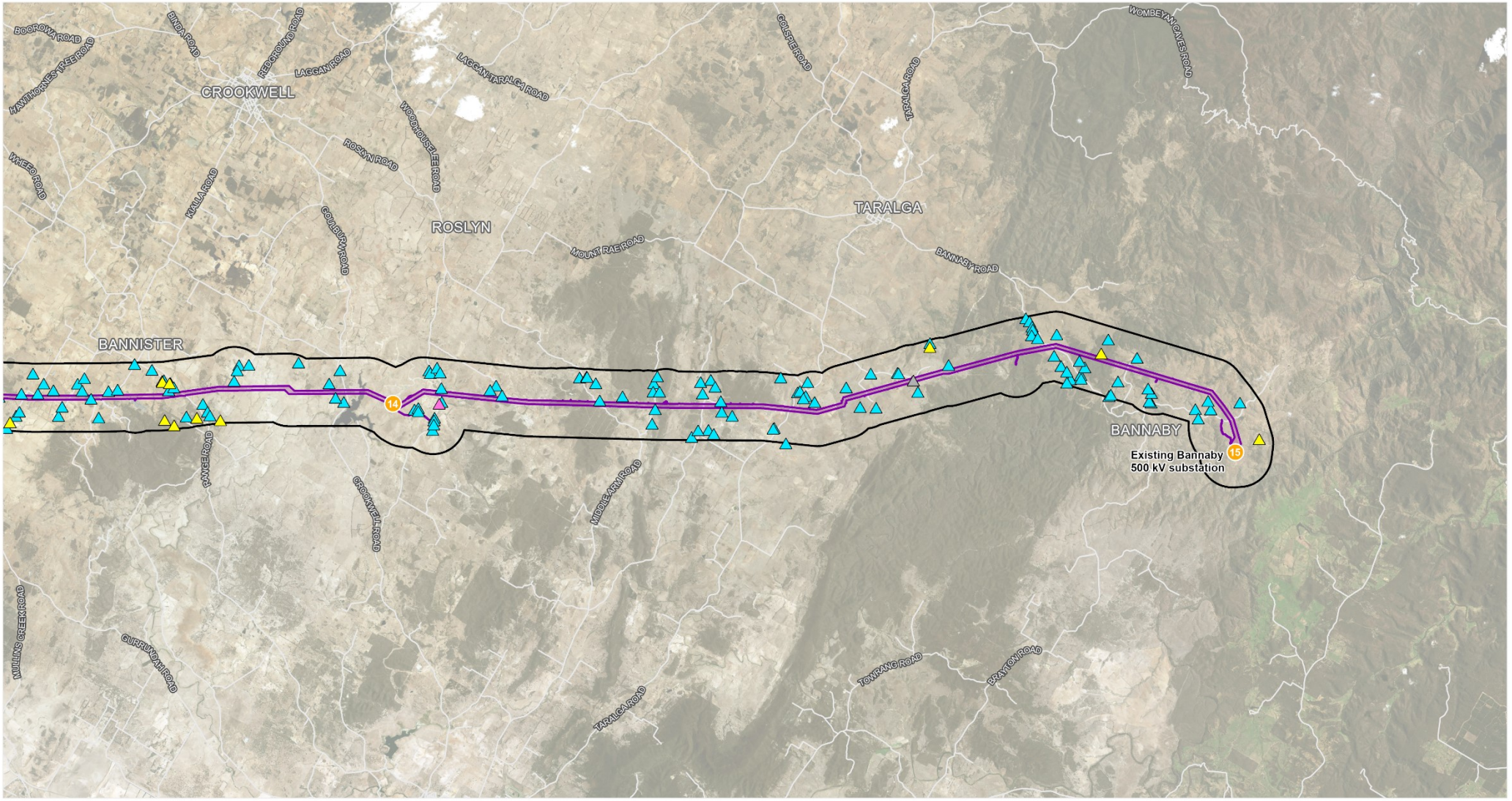
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0 5 10 km

Projection: GDA 1994 MGA Zone 55

HumeLink

Figure 15-2c: Noise and vibration sensitive receivers



Project footprint

Noise and vibration study area

Waterway

Sensitive receiver within 2km buffer

Dilapidated dwelling

Residential

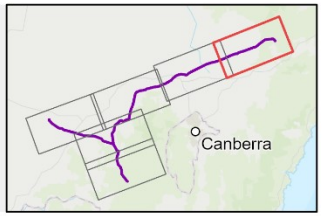
Possible residence

Place of Worship

Construction ancillary facilities

14 Woodhouselee Road compound (C11)

15 Bannaby 500 kV substation compound (C12)



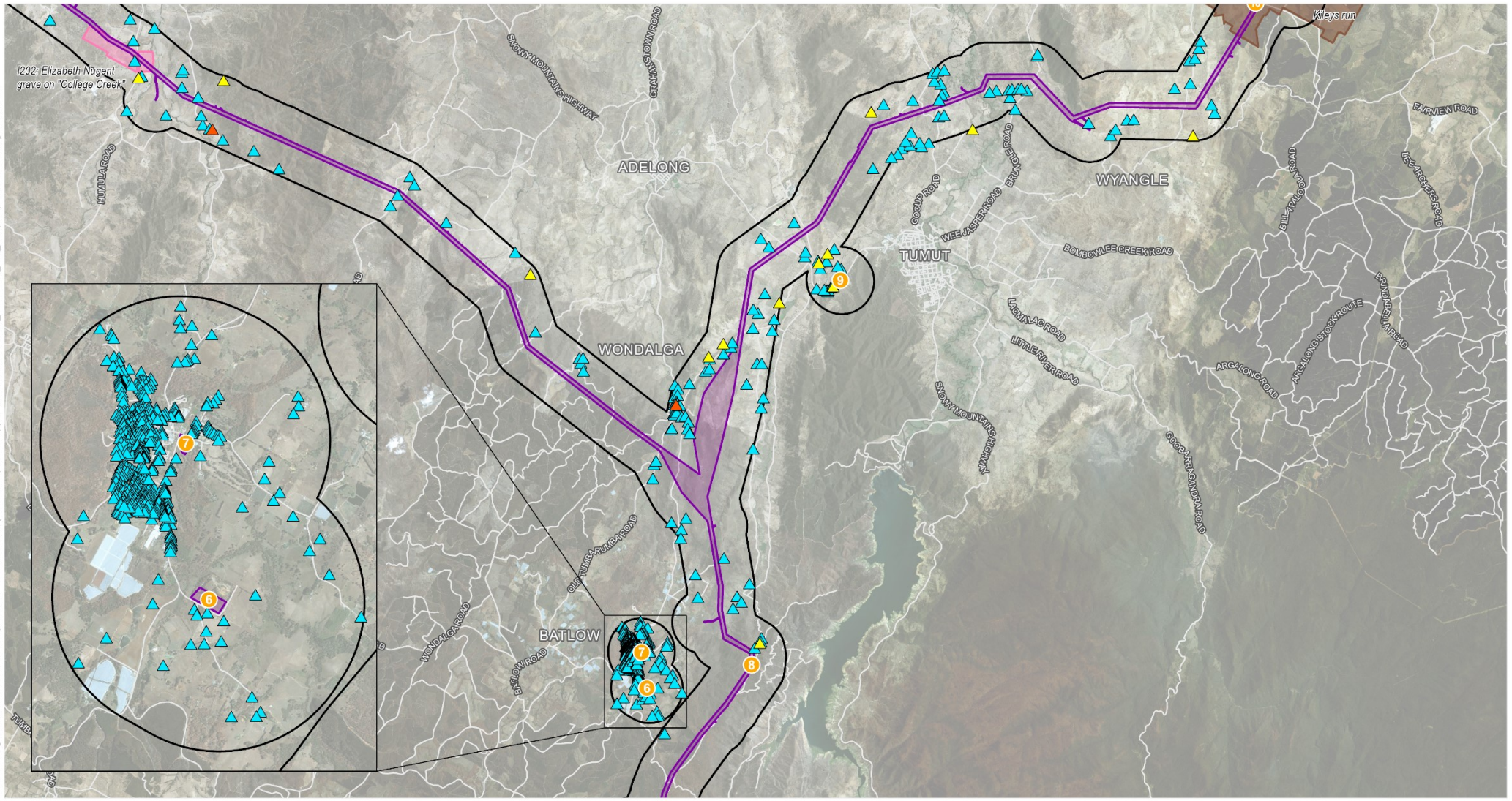
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0 5 10 km

Projection: GDA 1994 MGA Zone 55

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Figure 15-2d: Noise and vibration sensitive receivers



Project footprint

Noise and vibration study area

Waterway

Heritage listed item

I202: Elizabeth Nugent grave on "College Creek"

Heritage listed item

Kileys Run

Sensitive receiver within 2km buffer

Residential

Possible residence

Firestation - Bush

Construction ancillary facilities

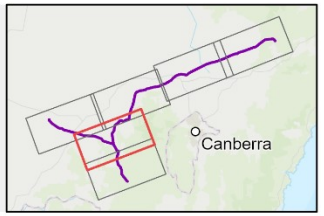
6 Bowmans Lane compound (C15)

7 Memorial Avenue compound (C14)

8 Snubba Road compound (C03)

9 Snowy Mountains Highway compound (C02)

10 Honeysuckle Road compound (C07)



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

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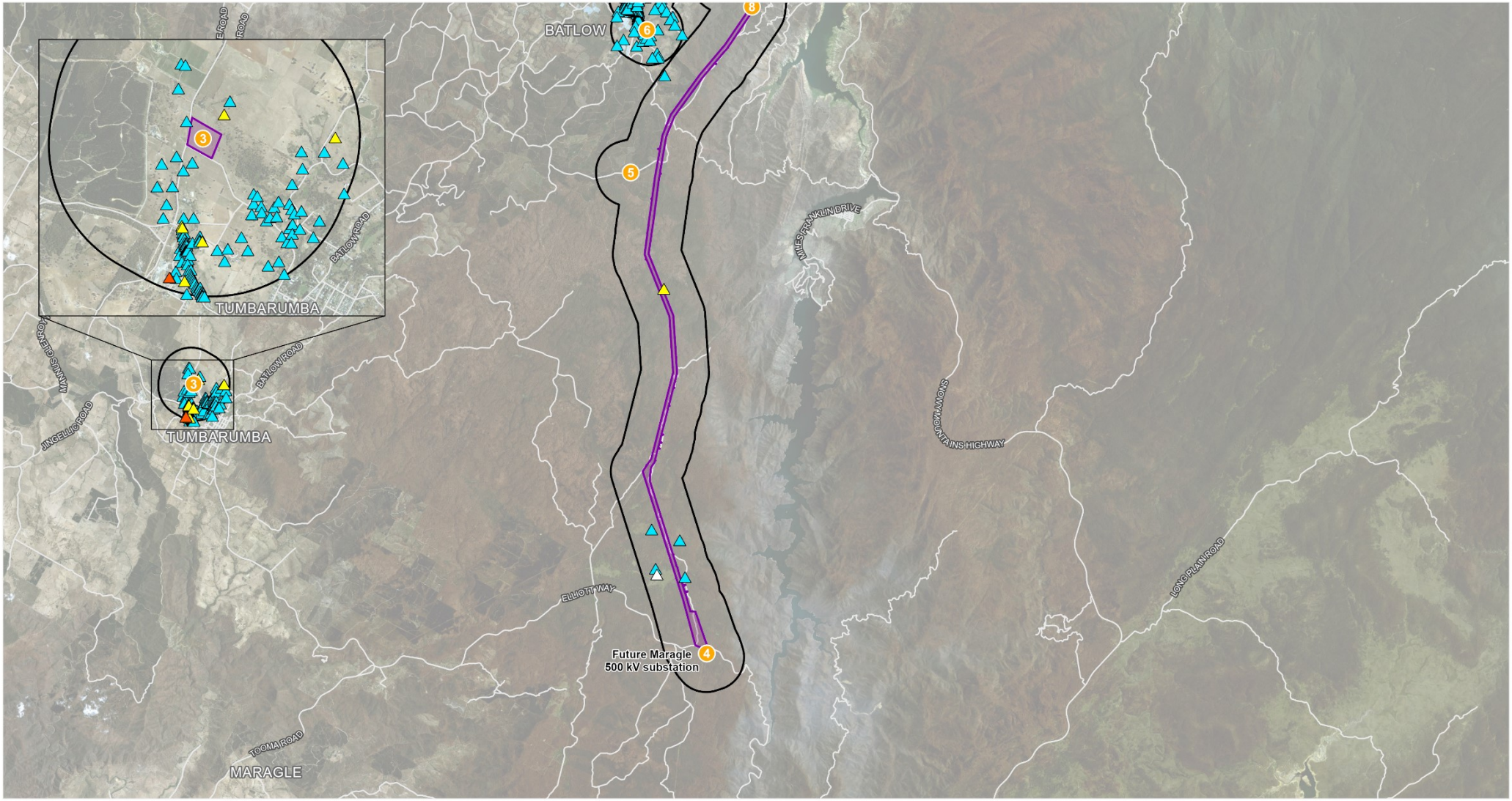
0 5 10 km

Projection: GDA 1994 MGA Zone 55

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Figure 15-2e: Noise and vibration sensitive receivers

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BATLOW
TUMBARUMBA
TUMBARUMBA
BATLOW ROAD
BATLOW ROAD
WILES FRANKLIN DRIVE
SNOWY MOUNTAINS HIGHWAY
LONG PLAIN ROAD
ELLIOTT WAY
Future Maragle
500 kV substation
TOOMA ROAD
MARAGLE
JINDELLI ROAD
Project footprint
Noise and vibration study area
Waterway
Sensitive receiver within 2km buffer
Residential
Possible residence
Firestation - Bush
SES Facility
Tourist Park / Home Village
Construction ancillary facilities
Tumbarumba accommodation facility (AC1)
Maragle 500 kV substation compound (C05)
Snubba Road compound (C16)
Bowmans Lane compound (C15)
Snubba Road compound (C03)
Canberra
1:200,000
0
5
10km
Projection: GDA 1994 MGA Zone 55
HumeLink
Figure 15-2f: Noise and vibration sensitive receivers

15.4. Potential impacts – construction

15.4.1. Construction noise

15.4.1.1. Construction noise impacts from transmission line construction

Construction work for the new transmission lines would typically include the following components of work:

- site establishment work for the access tracks, construction compounds and worker accommodation facility, utility service relocation and vegetation clearing
- civil work including earthwork, construction pads, construction of footings, steel fabrication, concrete pours, erection of transmission line structures and line stringing.

Table 15-10 provides a summary of the number of residential receivers during day-time work for construction scenarios where NML exceedances are predicted for transmission line construction. Table 15-11 provides predicted NML exceedances for out-of-hours work associated with transmission line construction. The number of receivers that are predicted to be HNA based on the ICNG definition of noise levels greater than 75 dBA is also provided.

The construction scenarios are relatively short in duration (about 3 weeks) for each transmission line structure and the impacts for each receiver are only expected when work is occurring at the closest transmission line structure site.

Table 15-10 Residential day-time NML exceedances – transmission line construction

Scenario	Duration	Number of receivers			
		HNA	With NML exceedance		
			1-10 dB	11-20 dB	>20 dB
Site establishment and deliveries	1-3 weeks per structure	13	226	56	21
Earthwork and clearing	1-5 days per structure	14	274	95	29
Construction of structures	2 weeks per structure	11	134	22	14
Overhead stringing of conductors and earth wires	3 weeks per structure	11	47	8	11
Site clean-up and rehabilitation	2-3 days per structure	11	157	25	16
Telecommunications hut construction	1-2 months	-	1	-	-

Table 15-11 Residential out-of-hours NML exceedances – transmission line construction

Scenario	Duration	Number of receivers											
		HNA	With NML exceedance										
			Day-time				Evening/night-time				Sleep disturbance			
			1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Overhead stringing of conductors and earth wires	3 weeks per structure	-	5	2	-	-	17	7	-	-	3	-	-	-

Overall, the construction scenarios are relatively short in duration for each transmission line structure and the impacts for each receiver are only expected when work is occurring at the closest transmission line structure site.

Table 15-10 shows that earthwork and clearing activities are predicted to have the greatest noise impact during standard construction hours for transmission line construction. Up to 29 residential receivers within 150 metres of the project footprint are predicted to experience highly intrusive worst-case noise impacts (over 20 decibels exceedance) and up to 14 of the nearest residential receivers are predicted to be HNA during earthwork and clearing activities. However, impacts are likely to be short term with a duration of one to five days per transmission line structure.

Two places of worship were identified as potentially impacted during day-time transmission line construction, resulting in:

- highly intrusive noise impacts (over 20 decibels exceedance) at Greendale Uniting Church, located 25 metres north of the project footprint in Broadway, NSW
- clearly audible noise impacts (exceedances between six and 15 decibels) at Saint James Anglican Church (former), located 390 metres south of the project footprint in Woodhouselee, NSW.

During out-of-hours work for transmission line construction (refer to Table 15-11), up to seven residential receivers are predicted to experience clearly audible worst-case noise impacts (exceedances between six and 15 decibels) during evening and night-time periods. However, impacts are only expected to be short term, with a duration of three weeks per structure. There is potential for three residential receivers closest to the transmission line construction to experience sleep disturbance impacts during this period. The number of potential night-time awakenings would depend on several factors, including the type of equipment being used and the duration of the noisy work.

The locations of access tracks and brake and winch sites would be spread across the project footprint, but final locations are not known at this stage. Table 15-12 provides the distances offset from these locations at which residential receivers are expected to experience noise levels that exceed the day-time NMLs.

Table 15-12 Approximate distance at which residential day-time NML exceedances are expected – access tracks and brake and winch sites

Scenario	Duration	Distance from work where exceedances occur			
		HNA	1-10 dB	11-20 dB	>20 dB
Access tracks	1-2 days per track	55 m	1,190 m	440 m	160 m
Brake and winch sites	1-3 weeks per site	30 m	600 m	210 m	70 m

Residential receivers are predicted to be impacted by the construction of access tracks and use of brake and winch sites if they are located within around 1,190 metres and 600 metres of the final access track and brake and winch site locations, respectively. There are 1,382 sensitive receivers within 1,190 metres and 433 sensitive receivers within 600 metres of the project footprint.

The assessment conservatively assumed that all components of transmission line construction could occur at any location within the project footprint, that several items of construction equipment would be in use at the same time and there is a flat topography between the noise source and receivers. In reality, it is expected that construction activities would move along the project footprint and there would frequently be periods where construction noise levels are much lower than the worst-case levels predicted as well as times when no equipment is in use and no noise impacts occur.

Where predicted impacts do occur, it is anticipated that the mitigation measures included in Section 15.6.3 would minimise and/or manage impacts on receivers.

15.4.1.2. Construction noise impacts from substation construction

Table 15-13 provides a summary of predicted NML exceedances for substation construction during standard construction hours. Table 15-14 provides predicted NML exceedances for out-of-hours work associated with substation construction.

No exceedances of the NMLs are predicted at the existing Bannaby 500 kV substation or connection to the future Maragle 500 kV substation due to the distance to the closest residential receiver and therefore these substations are not presented in these tables. Refer to *Technical Report 9 – Noise and Vibration Impact Assessment* for the full assessment results.

Table 15-13 Standard construction hours NML exceedances – substation construction

Scenario	Duration	Number of receivers			
		HNA	With NML exceedance		
			1-10 dB	11-20 dB	>20 dB
Wagga 330 kV substation					
Earthwork and vegetation clearance	2-4 months	-	9	1	-
Civil and building work	12-14 months	-	1	-	-
Installation of high voltage equipment and associated structures	11-12 months	-	1	-	-
Decommissioning and rehabilitation	3 months	-	1	-	-
Proposed Gugaa 500 kV substation					
Earthwork and vegetation clearance	2-4 months	-	2	-	-

Table 15-14 Out-of-hours NML exceedance – Substation construction

Scenario	Duration	Number of receivers												
		HNA	With NML exceedance											
			Day-time				Evening/night-time				Sleep disturbance			
			1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Gugaa 500 kV substation														
Installation of high voltage equipment and associated structures	1 month	-	1	-	-	-	1	1	-	-	-	-	-	-
Wagga 330 kV substation														
Installation of high voltage equipment and associated structures	1 month	-	4	1	-	-	9	5	-	-	1	-	-	-

The main noise-generating activity associated with construction or modification of substations during standard construction hours would be associated with earthwork and vegetation clearance, which would have an indicative duration of two to four months. The day-time impacts associated with earthwork and vegetation clearance activities include:

- moderately intrusive (exceedances between 11 and 20 decibels) noise impacts predicted at the closest residential receiver to the Wagga 330 kV substation
- clearly audible (exceedances between one and 10 decibels) noise impacts predicted at an additional nine residential receivers at Wagga 330 kV substation
- clearly audible (exceedances between one and 10 decibels) noise impacts predicted at the two closest residential receivers to the proposed Gugaa 500 kV substation.

During all other day-time work activities, impacts are predicted to be clearly audible at only the closest receiver or would be compliant with the NMLs.

Clearly audible (exceedances between six and 15 decibels) worst-case noise impacts are predicted during out-of-hours work for the construction or modification of substations. The residential receiver closest to the proposed Gugaa 500 kV substation and five residential receivers closest to the existing Wagga 330 kV substation are predicted to experience these impacts during the evening and night-time periods. However, as the work would have a duration of one month the impacts are considered short term.

Sleep disturbance impacts are also predicted at the residential receiver closest to the Wagga 330 kV substation during out-of-hours work. Sleep disturbance impacts would generally be caused by heavy vehicle movements and more noise-intensive equipment such as vacuums and oil pumps required for installing high voltage equipment.

No receivers are predicted to be HNA during standard construction hours or out-of-hours work associated with construction or modification of substations. Also, no ‘other sensitive’ land uses are predicted to be impacted by the substation activities. Where predicted impacts do occur, it is anticipated that the mitigation measures included in Section 15.6.3 would minimise and/or manage impacts on receivers.

15.4.1.3. Construction noise impacts from construction compounds and accommodation facility

Construction compounds would be required during construction to support staging and equipment laydown; concrete batching; temporary storage of materials, plant and equipment; and worker parking.

The construction compounds that are expected to have predicted NML exceedances during day-time construction hours along with the proposed Tumbarumba accommodation facility (AC1) are detailed in Table 15-15, and Table 15-16. The table only shows the scenarios where exceedances are predicted.

Table 15-15 Residential day-time NML exceedances – construction compounds and worker accommodation facility

Scenario	Duration	Number of receivers			
		HNA	With NML exceedance		
			1-10 dB	11-20 dB	>20 dB
Wagga 330 kV substation compound (C01)					
Site establishment	3-4 weeks	-	9	1	-
Compound operation	Construction duration	-	5	-	-
Snowy Mountains Highway compound (C02)					
Site establishment	3-4 weeks	-	1	-	-
Snubba Road compound (C03)					
Site establishment	3-4 weeks	-	1	-	-
Gregadoo Road compound (C06)					
Site establishment	3-4 weeks	-	4	-	-
Adjungbilly Road compound (C09)					
Site establishment	3-4 weeks	-	2	-	-
Yass substation compound (C10)					
Site establishment	3-4 weeks	-	48	-	-
Memorial Avenue compound (C14)					
Site establishment	3-4 weeks	1	446	81	6
Compound operation	Construction duration	1	338	21	3
Bowmans Lane compound (C15)					
Site establishment	3-4 weeks	-	64	5	3
Compound operation	Construction duration	-	13	3	1
Tumbarumba accommodation facility (AC1)					
Site establishment	3-4 weeks		41	6	1
Accommodation facility operation	Construction duration		2	1	-

Table 15-16 Out-of-hours NML exceedance – Tumbarumba accommodation facility (AC1)

Scenario	Duration	Number of receivers											
		HNA	With NML exceedance										
			Day-time OOH[1]				Evening/ night-time				Sleep disturbance			
			1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB	1-5 dB	6-15 dB	16-25 dB	>25 dB
Accommodation facility operation	Project duration	-	4	2	1	-	5	6	1	-	2	2	1	-

Note: Day-time OOH refers to the period on Saturday between 7am – 8am, and 1pm – 6, Sunday and public holidays 8am – 6pm

The establishment and operation of several construction compounds are not predicted to result exceedances of NMLs at any sensitive receivers due to the distance to the nearest sensitive receiver (refer to Table 15-17).

Table 15-17 Construction compounds not predicted to result in noise impacts

Construction compound	Nearest town	Approximate distance to nearest receiver
Maragle 500 kV substation compound (C05)	Nurenmerenmong	3,750 m
Honeysuckle Road compound (C07)	Adjungbilly	1,680 m
Red Hill Road compound (C08)	Adjungbilly	1,560 m
Woodhouselee Road compound (C11)	Woodhouselee	950 m
Bannaby 500 kV substation compound (C12)	Bannaby	1,000 m
Snubba Road compound (C16)	Laurel Hill / Batlow	5,200 m

Table 15-15 identifies that site establishment is the main noise-generating activity associated with construction compounds and the Tumbarumba accommodation facility (AC1). Site establishment impacts would be short term and are expected to be generally limited to between three to four weeks at each site. The site establishment of Memorial Avenue compound (C14) is predicted to result in day-time noise impacts on 'other sensitive' receivers, which include:

- moderately intrusive (exceedances between 11 and 20 decibels) worst-case noise impacts at Batlow-Adelong Multipurpose Service (health care facility) located about 150 metres south-west of the construction compound
- clearly audible (exceedances between one and 10 decibels) worst-case noise impacts at Batlow Technology School, St Mary's Primary School, St Mary's Church and St John's Anglican Church which range between 210 and 290 metres west of the construction compound.

As shown in Table 15-15, highly intrusive (exceedances greater than 20 decibels) worst-case day-time noise impacts are predicted for up to 10 receivers closest to the Memorial Avenue (C14) and Bowmans Lane (C15) compounds and Tumbarumba accommodation facility (AC1). This would occur during site establishment and operation of the construction compounds, and site establishment of the worker accommodation facility due to the proximity of the sites to the receivers and the low existing background noise levels. The closest residential receiver to Memorial Avenue compound (C14) is also predicted to be HNA during site establishment and operation of the construction compound (refer to Table 15-15).

However, as noted in Section 15.2.4.1, it is expected that the construction noise levels would frequently be lower than predicted, as the noise levels predicted are conservatively based on each construction compound scenario occurring at the project footprint boundary, which is the closest point to each receiver. The assessment is further considered to be conservative as it assumed that several items of construction equipment would be in use at the same time within individual scenarios. Furthermore, the proposed boundaries for the construction compounds would be refined as the project develops and the construction contractors may not elect to use all nominated potential locations.

Moderately intrusive (exceedances between 16 to 25 decibels) worst-case night-time noise impacts are also predicted during operation of the Tumbarumba accommodation facility (AC1) at one residential receiver. Sleep disturbance impacts are also predicted at up to five residential receivers during operation of the Tumbarumba accommodation facility (AC1). These impacts are due to the proximity of the receivers and the potential for heavy vehicle movements at the facility.

Where predicted impacts do occur, it is anticipated that the mitigation measures included in Section 15.6.3 would minimise and/or manage impacts on receivers.

15.4.2. Construction road traffic noise

The construction access routes for the project are discussed Chapter 20 (Traffic, transport and access) and include national, state, regional and local roads. These access routes would provide access to/from the project footprint, including transmission line work sites, substations, construction compounds and the worker accommodation facility. Construction is expected to generate light and heavy vehicle movements along these roads with up to 210 daily heavy vehicle movements on some local roads (associated with the construction of the proposed Gugaa 500 kV substation) during the peak construction period. The light and heavy vehicle movements have the potential to result in road traffic noise impacts at the nearest residential sensitive receivers.

Based on the initial RNP screening assessment of the access routes, there are likely to be noticeable increases in noise levels (greater than two decibels) on all local roads and around 40 per cent of the arterial/sub-arterial roads (ie national, state and regional roads) due to low existing traffic volumes on these routes. The highest worst-case road traffic noise increase is predicted for Grabben Gullen Road (north of Cullerin Road) at 6.3 decibels.

Exceedances of the RNP criteria (refer to Section 15.2.4.3 for more information on the criteria) are predicted for:

- local unsealed roads
  - all roads (all of the provided construction access routes) if receivers are 100 metres from the road edge
  - around half of the roads if receivers are 250 metres from the road edge
  - no roads if receivers are 500 metres from the road edge
- local sealed roads
  - all roads if receivers are 100 metres from the road edge
  - 10 roads if receivers are 250 metres from the road edge
  - one road (Clinton Street in the Goulburn-Mulwaree LGA) if receivers are 500 metres from the road edge.

Exceedances of the RNP criteria are not predicted for arterial/sub-arterial roads (ie national, state and regional roads) used for construction access, where receivers are at least 50 metres from the road edge, which is generally expected to be the case for this class of road.

The above assessment is based on the worst-case scenario, which assumes the peak construction workforce is traveling in the night-time period. However, it is likely that there would be times during construction when fewer vehicle movements are required and/or the maximum vehicle movements occur during the daytime period, resulting in lower road traffic noise impacts than those predicted in the worst-case scenario. In addition, it is anticipated that most access routes would not be used for the full duration of construction. Where predicted impacts do occur, it is anticipated that the mitigation measures included in Section 15.6.3 would minimise and/or manage impacts on receivers.

Chapter 20 (Traffic, transport and access) provides more detail on expected traffic movements.

15.4.3. Construction vibration impacts

As the construction activities could occur anywhere within the project footprint, there is the potential that vibration-intensive equipment could be used within the minimum working distances for cosmetic damage and human response as outlined in Table 15-6. As such, worst-case vibration impacts for the construction of the project have been determined based on the minimum working distances and use of a large vibratory roller at the boundary of the project footprint. The assessment of the worst-case impacts found:

- 13 receivers closest to transmission line construction are likely to be within the minimum working distance for cosmetic damage (ie 20 metres for a large vibratory roller). Of these receivers, 11 are within the project footprint.
- 20 receivers closest to transmission line construction are likely to be within the human comfort minimum working distance (ie 100 metres for a large vibratory roller).
- One of the receivers within the human comfort minimum working distance is Greendale Uniting Church. Two receivers within the cosmetic damage minimum working distance are dilapidated dwellings. All other receivers identified within the vibration minimum working distances are residential.
- No receivers are within the cosmetic damage or human comfort minimum working distance relative to the construction compounds and Tumbarumba accommodation facility (AC1).
- All identified vibration-sensitive heritage structures are beyond the recommended minimum working distances for vibration intensive equipment (refer to Table 15-6) likely to be required for project construction.

The potential for vibration impacts at these receivers would be minimised through refinement of the construction methodology, such as the selection of alternative equipment if work needs to occur within minimum working distances.

15.4.4. Blasting

As discussed in Chapter 4 (Project description – construction), blasting may be required as part of the project, depending on geotechnical conditions. However, sites where blasting may be required have not yet been determined. Blasting may be required as a preferred excavation methodology in particular situations such as:

- difficult foundations work
- steep terrain where access tracks are required and blasting in a small area of the track could be the most appropriate approach for construction.

The need and locations for blasting would be confirmed during detailed design. The potential noise and vibration impacts from blasting would be managed through implementation of a Blast Management Plan.

15.5. Potential impacts – operation

15.5.1. Operational impacts from transmission lines

The new double circuit 500 kV transmission lines between Wagga Wagga, Bannaby and Maragle may generate audible noise during operation. The majority of sensitive receivers who are potentially impacted are scattered rural residences surrounding the transmission line route.

The section of transmission line between the proposed Gugaa 500 kV substation to Wagga 330 kV substation would operate at 330 kV. When operating at 330 kV, this transmission line is predicted to emit noise levels less than 20 dBA at the edge of the easement during worst-case L50 (light rain or mist)

conditions. Therefore, this section of transmission line is predicted to have noise levels below the relevant PNTLs when in operation.

The operational noise emissions of the transmission lines is assessed based on the offset distance at which the night-time PNTL of LA_{eq},15min 35 dBA is expected to be reached. The assessment found the following:

- During fair weather conditions when noise emissions are lower, 11 residential receivers are expected to potentially experience noise levels above the most stringent night-time PNTL (refer to Section 15.2.5.3). Table 15-18 provides a summary of predicted night-time noise trigger level exceedances (ie greater than 35 dBA) for the new transmission line based on the light rain scenario detailed in Section 15.2.5.1. The summary also includes consideration of existing 132 kV to 500 kV transmission lines that run parallel to parts of the project footprint.
- During the light rain scenario, which is expected to be the worst-case condition for audible noise generation, the noise level at 62 of the receivers closest to the project footprint is predicted to potentially exceed the most stringent night-time PNTL (refer to Section 15.2.5.3).
- In sections where existing high voltage lines run parallel to the project, cumulative noise levels are expected to be marginally greater, with the noise level at 65 receivers (majority located along the Wondalga to Bannaby 500 kV substation section) predicted to potentially exceed the night-time noise trigger level.
- Worst-case project transmission line noise levels at the edge of the easement are predicted to be up to around 50 dBA during L50 conditions (light rain or mist), which exceeds the night-time PNTL by 15 decibels. During fair weather, project transmission line noise levels at the edge of the easement are predicted to be up to around 39 dBA, which exceeds the night-time PNTL by 4 decibels.
- The average distance between the identified potentially impacted receivers and the assumed easement (35 metres within the project footprint) is around 200 metres. At this distance, project transmission line noise levels are predicted to be around 37 decibels to 39 decibels during L50 conditions (light rain or mist), which marginally exceed the night-time PNTL by around 2 decibels to 4 decibels.

Table 15-18 Transmission line operational worst-case noise impacts (light rain scenario)

Transmission line section	Number of receivers with worst-case night-time exceedance		Maximum distance from transmission line where night-time impacts (noise levels >35 dBA) are expected	
	Project only	Cumulative (project plus existing)	Project only	Cumulative (project plus existing)
Future Maragle 500 kV substation to Wondalga	4	4	366	442
Wondalga to proposed Gugaa 500 kV substation	6	6	326	348
Wondalga to Bannaby 500 kV substation	52	55	348	470

The above findings are for a worst-case scenario, with the assessment conservatively assuming the transmission line may be anywhere within the project footprint, with consideration of a 70 metre minimum easement. As such, the number of impacted receivers may further decrease when the final transmission line route and easement are defined within the project footprint.

The proposed mitigation measures to minimise and manage operational impacts are provided in Section 15.6.3.

15.5.2. Operational noise impacts from proposed Gugaa 500 kV substation

The proposed Gugaa 500 kV substation would include a number of noise-generating plant and equipment including the new single-phase 500/330 kV transformers and three-phase 500 kV reactors. The three closest residential receivers are predicted to have noise contributions from the operation of the proposed Gugaa 500 kV substation. Therefore, the potential change in noise levels from the project was assessed for these three residential receivers. The assessment included consideration of noise-enhancing weather in accordance with the NPfI. The assessment identified the following:

- With the inclusion of four-metre-high transformer walls, noise emissions would be compliant with the project noise trigger levels at all but the closest residential receiver, where an exceedance of up to three decibels is predicted when noise enhancing weather conditions are present during the night-time period.
- Without transformer walls, noise emissions from the proposed Gugaa 500 kV substation are predicted to potentially exceed the PNTLs at the two closest residential receivers to the substation during the night-time period.
- Without transformer walls, noise emissions are predicted to exceed the PTNLs by up to six decibels and two decibels during the night-time with and without noise enhancing weather at the closest impacted residential receiver to the substation.

The findings of the assessment showed potential exceedances of the intrusiveness PNTLs (from Table 15-7) for the two closest residential sensitive receivers to the substation. Exceedances are predominantly predicted for the evening and night-time periods with no exceedances predicted during day-time.

It is anticipated that the mitigation measures included in Section 15.6.3 would minimise and/or manage operational impacts from the proposed Gugaa 500 kV substation to nearby receivers.

15.5.3. Noise and vibration from maintenance

Once operational, the project substations and transmission lines would be inspected on a regular basis (refer to Chapter 3 (Project description – infrastructure and operation) for more details on the maintenance activities). These activities would be intermittent, minor in nature and unlikely to generate substantial noise or vibration at surrounding sensitive receivers.

Operation and maintenance vehicle movements on public roads are not expected to exceed the RNP screening criteria of a greater than two decibel increase for road traffic noise impacts, noting that this level of increase generally requires a 60 per cent increase in traffic. Therefore, the risk of noise and vibration impacts from operational and maintenance vehicle traffic at sensitive receivers was considered minimal and was not assessed.

15.6. Management of impacts

15.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental Management).

A NVMP will be prepared to provide the framework and mechanisms for the management and mitigation of all potential noise and vibration impacts from construction of the project. The NVMP would include procedures for dealing with potential impacts during out-of-hours work. If blasting is required, a Blast Management Plan would be developed to minimise the potential impacts. The Blast Management Plan would provide the process that would be used to design blasting (if required) to comply with relevant noise and vibration criteria at any nearby sensitive receivers. The Blast Management Plan would be based on the methodologies and requirements set out in AS 2187.2-2006 and the ANZECC guideline. The Blast Management Plan would:

- identify blast-sensitive receivers
- set blast overpressure limits, vibration limits and blast monitoring requirements
- document the blast design process and management approach
- identify landowner notification requirements.

Where operational noise from the project is predicted to exceed the relevant noise criteria, feasible and reasonable operational noise mitigation measures will be considered. Mitigation measures will be generally in accordance with the typical hierarchy for mitigating and managing industrial noise sources as follows:

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

15.6.2. Avoidance and minimisation of impacts

The following approaches to avoid and minimise noise and vibration impacts were considered in developing the project footprint and approach to construction:

- locating the project footprint to increase the distance between the new transmission line and associated infrastructure and sensitive receivers, where practicable, to reduce potential operational noise impacts
- locating the construction compounds and worker accommodation facility at an appropriate distance from sensitive receivers, where practicable, to reduce potential construction noise and vibration impacts.

15.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

Table 15-19 summarises the mitigation measures that would be implemented to avoid or minimise potential noise and vibration impacts.

Table 15-19 Summary of noise and vibration mitigation measures

Reference	Impact	Mitigation measure	Timing	Relevant locations
NV1	Construction noise	Where receivers are predicted to be noise affected and near construction compounds or fixed work areas with long durations (ie several months), path control, such as hoarding or earth bunds will be investigated. Practical measures will be implemented where required. Positioning of site structures will also be considered to act as barriers between noisy work and receivers where practical.	Detailed design and construction	• Wagga 330 kV substation compound (C01) • Memorial Avenue compound (C14) • Bowmans Lane compound (C15) • Tumbarumba accommodation facility (AC1).
NV2	Construction noise	An out-of-hours work protocol that details how the project will identify, assess and approve out of hours work outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers will be developed and implemented. The protocol will include provisions to: • carry out additional assessments for work proposed outside standard construction hours, to confirm noise levels at potentially affected sensitive receivers and determine suitable mitigation measures to minimise noise levels • notify and engage with potentially noise affected receivers about upcoming work outside standard construction hours and address any associated complaints • identify appropriate respite for noise affected receivers (where required). The out-of-hours work protocol will not apply to the operation of the worker accommodation facility.	Detailed design and construction	All locations
NV3	Construction noise and vibration	If blasting is required, a Blast Management Plan will be developed to minimise the potential for impacts. Maximum instantaneous charge calculations will be undertaken for specific sites where blasting is required. Individual blast designs will be based on meeting the criteria rather than restrictions on maximum instantaneous charge. All blasts, including initial trial blasts will be monitored to obtain data which can be used to confirm site constants and compliance with blasting criteria. Landowner notification and consultation requirements will be identified in the Blast Management Plan.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant locations
NV4	Construction noise	Where construction is likely to result in exceedances of NMLs at sensitive receivers, mitigation and management measures will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: • select quieter plant and equipment and use alternative construction methods to minimise noise levels • plan and schedule concurrent noisy activities to minimise the number of items of noisy plant operating at one time and cumulative noise levels • install screens or use barriers to mitigate noise from stationary noise sources • maximise the offset distance between noisy plant and sensitive receivers • orient noisy plant and equipment away from sensitive receivers • use noise source controls, such as residential class mufflers, to reduce noise from all regularly used plant including cranes, excavators and trucks • use non-tonal reversing alarms in place of traditional beeper reversing alarms during out-of-hours where noise impacts are predicted • turn off machinery when not in use • confirm equipment is maintained in accordance with manufacture's requirements to minimise generation of excessive noise • operate machinery in a manner which reduces occurrence of maximum noise level events, such as excavator bucket impacts, material drop heights, steel on steel impacts and dragging materials across hard surfaces • provide awareness training regarding noise mitigation measures to be implemented as part of regular toolbox meetings • notify and consult with potentially noise affected receivers about upcoming noisy activities • confirm that noise affected receivers outside standard construction hours and highly noise affected sensitive receivers are managed with consideration to the CNVG additional mitigation measures such as notifications, verification, and respite where appropriate.	Construction	All locations
NV5	Construction noise	Monitoring will be carried out for noise intensive activities that have the potential to cause noise exceedances at sensitive receivers, to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures have been implemented.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant locations
NV6	Construction noise	All construction vehicle movements will adhere to the following measures: • out-of-hours vehicle movements will be minimised where possible • construction delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible • use of engine compression brakes will be avoided at night and in residential areas • site access points and roads/flight paths will be located as far as possible away from sensitive receivers • traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements • construction inductions will include driver behaviour requirements to minimise vehicle noise emissions.	Construction	All locations
NV7	Construction vibration	Where vibration intensive work is required within the recommended minimum working distances and is considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels will be investigated and implemented, where feasible • vibration monitoring will be undertaken at the start of work to determine actual vibration levels at the receiver • work will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Construction	All locations
NV8	Operational substation noise	The design and layout of the proposed Gugaa 500 kV substation will comply with the NPfI criteria. The design will consider the following measures to mitigate potential noise impacts: • positioning of transformer barriers • selection of equipment with consideration of sound power levels • acoustic modelling of noise levels at surrounding receivers from all noise-generating substation equipment.	Detailed design and operation	Proposed Gugaa 500 kV substation

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

15.6.4. Managing residual impacts or uncertainties

The construction noise and vibration assessment presents worst-case noise impacts prior to the application of mitigation. It is expected that the impacts would be reduced by the mitigation measures detailed in Section 15.6.3. As the project progresses, the NVMP and further assessments would determine the requirement for potential additional mitigation measures to address residual construction noise and vibration impacts.

The operational noise assessment has carried out a conservative assessment to manage uncertainties associated with the noise impacts from the operation of the transmission lines. It is expected that noise impacts at most of the surrounding receivers would be less than the conservative (worst-case) scenario based on the project footprint that has been used for this assessment.

In addition, through the implementation of the mitigation measures detailed in Section 15.6.3, noise impacts resulting from the operation of the transmission line and proposed Gugaa 500 kV substation are anticipated to be appropriately managed without any unacceptable residual impacts.

Operational transmission line noise impacts will continue to be considered as the project progresses and confirmed with noise monitoring post-construction. Individual receiver agreements are expected to be the most feasible and reasonable mitigation option where operational noise impacts remain.

16. Soils, geology and contamination

This chapter provides a detailed summary of the assessment of potential soils, geology and contamination impacts of the project. The full contamination assessment is provided in *Technical Report 10 - Phase 1 Contamination Assessment* (Aurecon, 2023a).

16.1. Environmental assessment requirements

16.1.1. Secretary's Environmental Assessment Requirements

Table 16-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to soil, geology and contamination impacts of the project and where these requirements are addressed in this EIS.

Table 16-1 Secretary's Environmental Assessment Requirements – soils, geology and contamination

Reference	SEARs	Where principally addressed in the EIS
Water and soils		
Key issues	The EIS must address the following matters: • a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004a).	Section 16.6.1 provides an outline of erosion and sediment control measures that would be implemented to manage erosion risk. Chapter 8 (Biodiversity) and Chapter 17 (Surface water and groundwater quality) provides further erosion and sediment control measures that would be implemented.
Land		
Key issues	The EIS must address the following matters: • an assessment of impacts of the project on soils and land capability of the site and surrounds;	Section 16.4 and Section 16.5 provides an assessment of impacts on soils. Chapter 11 (Land use and property) discusses land capability of the site and surrounds.
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site);	Sections 16.4 and 16.4.2 contain an assessment of the risk of soil contamination and disturbance of land.
Waste		
Key issues	The EIS must address the following matters: • identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Section 16.4.2.3 identifies, quantifies, and classifies the likely waste streams to be generated in construction and operation. Section 16.6.3 describe measures to be implemented to manage, reuse, recycle, and safely dispose of this waste. Further information on waste management is described in Chapter 23 (Waste).

16.2. Assessment approach

16.2.1. Legislation and policies

Legislation relevant to the assessment of soils, geology and contamination includes:

- *Contaminated Land Management Act 1997* (CLM Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Environmentally Hazardous Chemicals Act 1985*
- Protection of the Environment Operations (General) Regulation 2021
- Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation)
- Work Health and Safety Regulation 2017
- State Environmental Planning Policy (Resilience and Hazards) 2021.

The assessment was completed with consideration of the relevant guidelines:

- *Sampling Design Guidelines for Contaminated Land* (NSW EPA, 2020a)
- *Guidelines for the Assessment and Management of Groundwater Contamination* (NSW EPA, 2007)
- *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020b)
- *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2020c)
- *Waste Classification Guidelines – Part 1 to Part 4* (NSW EPA, 2014) and Addendum (NSW EPA, 2016)
- *Guidelines on the Duty to Report Contamination* under the CLM Act (NSW EPA, 2015)
- *Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2017b)
- *National Environment Protection Assessment of Site Contamination Measure 1999* (as amended 2013) (NEPM, 2013)
- *Acid Sulfate Soils Manual* and *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soils Management Advisory Committee, 1998)
- *Acid Sulfate Soils Laboratory Methods Guidelines* (QLD Department of Natural Resources, Mines and Energy, 2004)
- *Managing Urban Stormwater: Soils and Construction Volume 1 (*Landcom, 2004*) and Volume 2C* (DECC, 2008a)
- *Australian Soil and Land Survey Handbook* (Commonwealth Scientific and Industrial Research Organisation (CSIRO), 2009)
- *Soil and Landscape Issues in Environmental Impact Assessment* (Department of Land and Water Conservation (DLWC), 2000a)
- *Site investigations for Urban Salinity* (DLWC, 2000b)
- other guidelines made or approved under Section 105 of the CLM Act.

16.2.2. Methodology

The Phase 1 Contamination Assessment involved:

- reviewing relevant legislation, policy and guidelines to address SEARs and agency requirements
- reviewing a desktop assessment comprising of existing information, aerial photography and previous ground investigation reports. The review helped to identify current environmental conditions of the project, including topography, regional geology, historical investigations, soil mapping and geological hazards
- completing searches of relevant public databases to identify registered sites or areas which may contain contamination
- reviewing previous investigations and reports containing information on soil conditions to determine areas of environmental concern (AECs)
- carrying out field surveys from 21 March 2022 to 24 March 2022 and from 2 August 2022 to 3 August 2022 to confirm the findings of the background desktop assessment (including the AECs); the surveys involved the observation and recording of terrain, surface condition, topography, vegetative cover, drainage pathways, contaminated land risk areas and surrounding land uses
- undertaking a qualitative risk ranking assessment in accordance with the risk rating framework outlined in *Technical Report 10 – Phase 1 Contamination Assessment*
- identifying potential construction, operational and cumulative impacts associated with soils, geology and contamination
- identifying mitigation measures to eliminate or minimise these potential impacts on soils, geology and contamination.

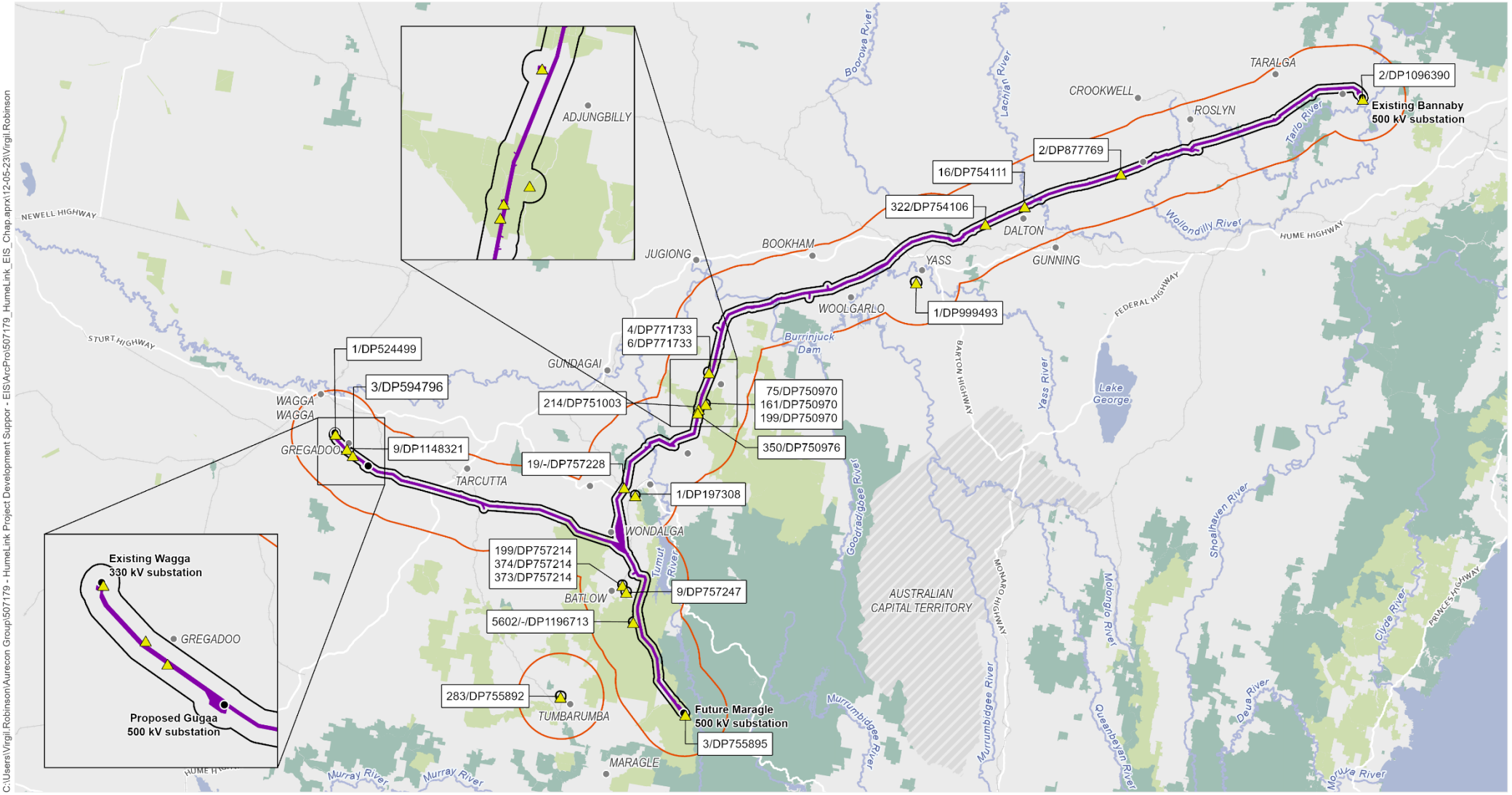
Further information regarding the methodology is provided in *Technical Report 10 - Phase 1 Contamination Assessment*.

The contamination study area covers the project footprint plus a one-kilometre buffer (refer to Figure 16-1). This buffer was included to capture potential contaminating activities immediately outside of the project footprint. In addition, a 10 kilometre buffer around the project footprint was used for the purpose of the NSW Government per-and poly-fluorinated alkyl substances (PFAS) Investigation Program and Department of Defence Unexploded Ordnance (UXO) desktop searches. The extended 10 kilometre buffer was due to the type of contaminants (which can be persistent and can travel long distances) and activities associated with PFAS and UXO residues.

Survey sites comprised a mix of private properties and publicly accessible roadside locations (refer to Figure 16-1). The survey sites were based on locations of potential areas of environmental concern identified through a desktop review as described in *Technical Report 10 - Phase 1 Contamination Assessment.*

Risk ratings for the AECs have been determined using the criteria outlined in *Technical Report 10 – Phase 1 Contamination Assessment* and are defined as follows:

- **Negligible** – The presence of the identified source does not give rise to the potential to cause major harm.
- **Low** – It is possible that harm could arise to a designated receptor from an identified source, though this is likely to be mild.
- **Moderate** – It is possible that harm could arise to a specific receptor, but it is unlikely that such harm would be major.
- **High** – A designated receptor is likely to experience major harm from an identified source without remedial action.
- **Very High** – There is a high probability that severe harm could arise to a designated receptor from an identified source without appropriate remedial action.



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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 16-1: Contamination study area and survey sites

16.3. Existing environment

16.3.1. Topography

The topography of the project footprint is widely variable, ranging from alpine regions near Maragle to alluvial valleys near the Murrumbidgee River. The elevations range from about 220 metres above the Australian height datum (mAHD) to 1,232 mAHD. The project footprint includes:

- a relatively flat area near Wagga Wagga, with elevations ranging from about 220 mAHD to 338 mAHD
- hilly areas between Tumut and Yass, with elevations ranging from about 261 mAHD to 768 mAHD, and between Yass and Bannaby (particularly between Dalton and Bannaby), with elevations ranging between 537 mAHD and 928 mAHD
- the highest elevations between Batlow and the Maragle State Forest, ranging between about 1,012 mAHD and 1,232 mAHD.

16.3.2. Soils and geology

16.3.2.1. Geology

Surface outcrops of geological units within the contamination study area have been determined from a review of the NSW Seamless Geology dataset (Department of Regional NSW, 2022). The contamination study area extends through and across highly variable landscapes and geological history given the scale of the project.

This is reflected in the geology underlying the contamination study area. Of the 97 formations underlying the contamination study area, Quaternary aged alluvial deposits make up the largest proportion at 7.6 per cent, with other Silurian, Ordovician, and Devonian aged formations making up the larger proportions. There are 83 formations underlying the contamination study area, each with a proportion less than two per cent.

16.3.2.2. Soil types

Due to the complex geology, varying topography and climate influences, there is a diverse range of soil types across the project footprint. The predominant soils underlying the study area according to the Australian Soil Classification (CSIRO, 2021) are either sand or clay based, or a mixture of the two. Specific features of soils relevant to the project footprint are described in further detail in *Technical Report 10 – Phase 1 Contamination Assessment*.

16.3.2.3. Saline soils

The Hydrogeological Landscapes of NSW and ACT dataset (DPE, 2022g) revealed the project footprint has a salinity hazard ranging from very low to very high.

Areas of high overall salinity hazard are located along the banks of O'Briens Creek and Brungle Creek and areas to the south of the Crookwell town centre, between Crookwell Road and Middle Arm Road.

The project footprint passes through areas of very high overall salinity hazard around the town centre of Yass, between Washpen Creek to Range Road.

16.3.2.4. Acid sulfate soils and rock

Acid sulfate soils and potential acid sulfate soils are naturally occurring soils containing iron sulfides. When exposed to air, iron sulfides oxidise and create sulfuric acid resulting in the mobilisation of aluminium, iron and manganese from the soils.

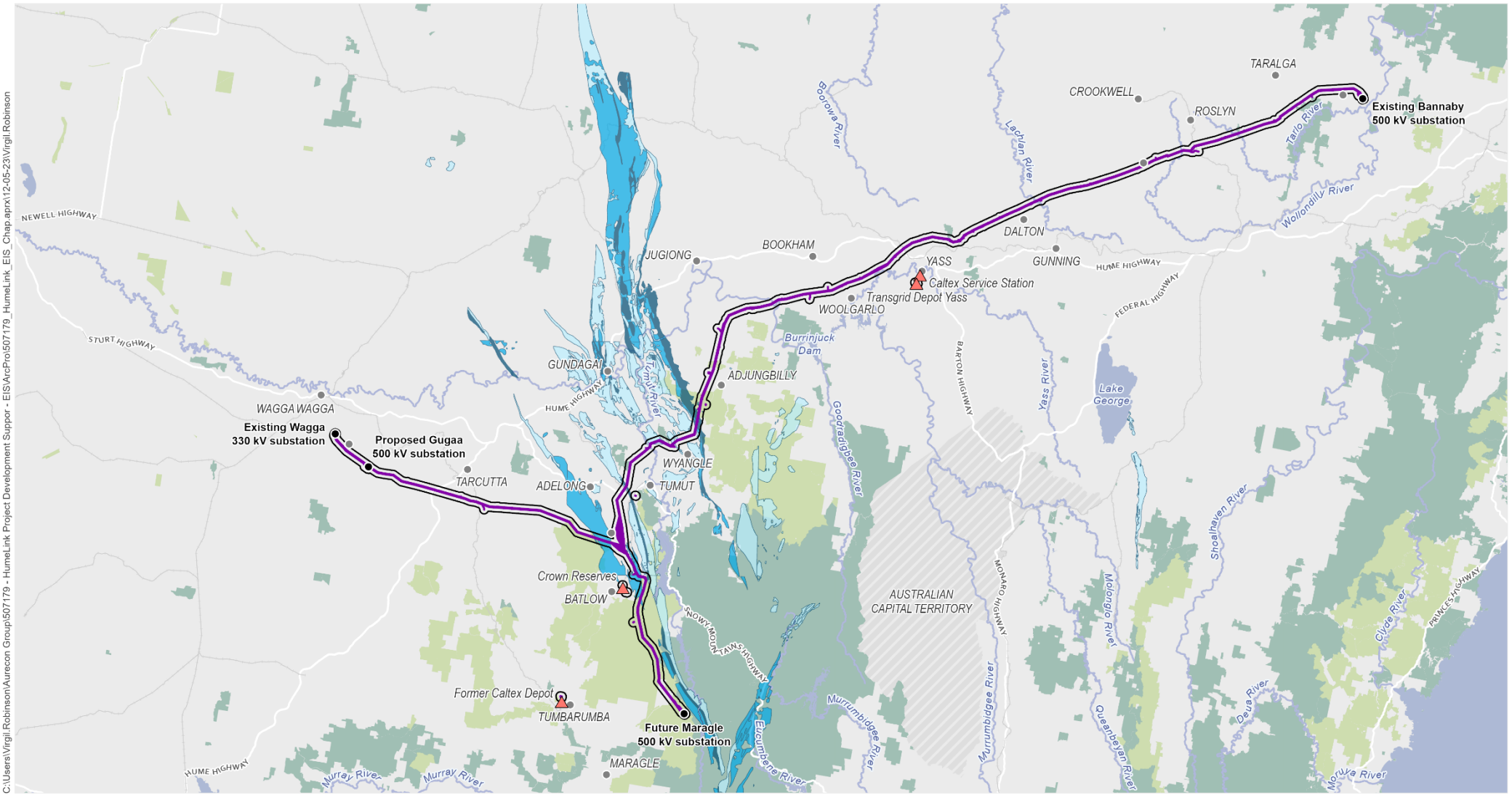
The Australian Soil Resource Information System (CSIRO, 2014) indicates that there is low or extremely low probability of acid sulfate soils within the project footprint.

The geological landscape of the contamination study area may contain naturally occurring pyrite veins and dykes which when disturbed may generate acidity when wet. Veins and dykes are common across the geological profile of the contamination study area, however have not been mapped in detail.

16.3.2.5. Naturally occurring asbestos

Naturally occurring asbestos (NOA) refers to the mineral component found in certain types of soils or rock formations, as opposed to asbestos present in commercial products, mining or processing operations. NOA minerals are associated with rock formations that are present within NSW in the Lachlan Fold Belt. The NSW Government's online environmental data portal has mapped the probability of NOA being present as low, medium or high potential regions (DRNSW, 2015). A review of the database indicates that NOA is not mapped in the majority of the project footprint. However, low, medium and high potential regions of NOA have been mapped (refer to Figure 16-2) in the following locations:

- low potential regions - from Red Hill to Gilmore
- medium potential regions - south of Red Hill and between Sharps Creek and Wondalga
- high potential regions - around Red Hill and Gadara.



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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 16-2: Contamination and other hazards

16.3.3. Contaminant sources

16.3.3.1. Database searches

Searches of the NSW EPA public register (notified sites and the contaminated land record) (NSW EPA, 2022) identified three sites within the contamination study area (refer to Figure 16-2):

- the Yass substation compound (C10) - a notified site currently under assessment
- a former Caltex Depot at 150 Albury Street, Tumbarumba, about 890 metres south of the Tumbarumba accommodation facility (AC1) – the site is categorised as 'Other Petroleum' and is not required to be regulated under the CLM Act
- Crown Reserves located on Mill Road, Batlow about 185 metres south of the Memorial Avenue compound (C14) – the site is categorised as 'Other Industry' and is not required to be regulated under the CLM Act.

A search of the database of unlicensed premises regulated by the EPA (NSW EPA, 2017b) identified two unlicensed premises within the contamination study area, as summarised in Table 16-2.

Table 16-2 Unlicensed premises regulated by the NSW EPA within the contamination study area

Site and location	Distance from project footprint	Scheduled activities
Yass 330 kV substation Perry Street, Yass, NSW, 2582	Within the project footprint. The Yass substation compound (C10) is on this site.	Hazardous, Industrial or Group A Waste Generation or Storage
Wagga 330 kV substation Corner Ashford Road and Boiling Down Road, Gregadoo, NSW, 2651	Within the project footprint.	Hazardous, Industrial or Group A Waste Generation or Storage

A review of the Environmental Protection Licences issued by the NSW EPA under the POEO Act (NSW EPA, 2022b) indicated a number of sites within the contamination study area, as summarised in Table 16-3.

Table 16-3 NSW EPA licensed activities

Site and location	Distance to project footprint	Scheduled activities
Rye Park Wind Farm Flakney Creek Road, Rye Park, NSW, 2586	The project footprint passes through this site and the project is proposed to connect to the Rye Park Wind Farm substation, which is under construction.	Crushing, grinding or separating electricity works (wind farms)
Crookwell 3 Wind Farm 794 Woodhouselee Road, Woodhouselee, NSW, 2580	The project footprint is directly south. This project is still under development.	Crushing, grinding or separating electricity works (wind farms)
Halfway Hill and Doctors Hill Gocup Road, Tumut, NSW, 2720	The project footprint passes through this site.	Land-based extractive activity (Including road construction)
Bellette Landfill Gilmore Snowy Mountains Highway, Gilmore, NSW, 2720	The project footprint is directly adjacent to the Snowy Mountains Highway compound (C02).	Waste disposal by application to land
Visy Pulp & Paper Pty Ltd 436 Gadara Road, Tumut, NSW, 2720	The project footprint is located about 400 m east of the land used for irrigation by Visy and 1.6 km east of the pulp and paper mill.	Paper or pulp production
Zones 1 To 4 Hume Highway Duplication Hume Highway, Tarcutta, NSW, 2652	The project footprint is presumed to either run through or be in close proximity to these upgraded sections of Hume Highway in construction zones 1 to 4.	Road construction

Site and location	Distance to project footprint	Scheduled activities
Carbon Mate Organic Recycling 132 Ashford Road, Wagga Wagga, NSW, 2650	The project footprint passes through this site, but composting activities are undertaken about 500 m to the west.	Composting
Wagga 330 kV Substation Corner Ashford Road and Boiling Down Road, Gregadoo, NSW, 2650	This site is located within the project footprint.	Hazardous, Industrial or Group A Waste Generation or Storage
Gregadoo Waste Management Centre 132 Ashford Road, Wagga Wagga, NSW, 2650	The project footprint passes through this site but waste activities are undertaken about 700 m to the west.	Waste storage –waste tyres Waste disposal by application to land
Batlow Sewage Treatment Plant Boggamilla Road, Batlow, NSW 2730	The lot is located about 100 m south-east of the Memorial Avenue compound (C14). The operating plant is about 215 m south-east of the construction compound.	Sewage treatment processing by small plants

In addition, a search of the Waste Management Facilities Database (Orr and Gordon, 2017) identified four waste sites within the contamination study area. These are summarised in Table 16-4. The sites identified in Table 16-3 and Table 16-4 involve activities that may have potential to cause contamination if not managed in accordance with the relevant operational management conditions.

Table 16-4 National Waste Management sites near the project footprint

Site and location	Distance to project footprint	Class
Bellette Landfill 10 Killarney Road, Tumut, NSW, 2720	The Snowy Mountains Highway compound (C02) is located directly adjacent to this site.	Landfill – Operational
Tumut Resource Recovery Centre Killarney Road, Gilmore, NSW, 2720	The Snowy Mountains Highway compound (C02) is located directly adjacent to this site.	Transfer Station – Operational
Gregadoo Waste Management Centre 102 Ashfords Road, Lake Albert, NSW, 2650	The project footprint crosses into the site. However, waste activities are undertaken about 700 m to the west of the project footprint.	Landfill – Operational
Batlow Landfill 496 Keenans Road, Batlow, NSW, 2730	Directly to the north of the Bowmans Lane compound (C15).	Landfill – Operational

A search of the *Where is Unexplained Ordinance* database (Department of Defence, 2022) indicated that the Defence Controlled Area Royal Australian Air Force (RAAF) Base Wagga Wagga is located 6.3 kilometres north-east of the project footprint while the Defence Controlled Area Blamey Barracks (NSW) is located 9.5 kilometres north-west of the project footprint. No other unexplained ordnance sites were identified within a 10 kilometre radius of the project footprint.

A search of the NSW Government PFAS investigation program identified two PFAS investigation sites within a 10 kilometre radius of the project footprint. These sites are the Wagga Wagga RAAF Base at Sturt Highway, Wagga Wagga and the Kapooka, Blamey Barracks at Kapooka Drive, Kapooka.

Cattle dips are also potential contamination sites due to past use of arsenic and dichloro-diphenyl-trichloroethane. The publicly available cattle dip site locator database (DPI, 2022) contains historical information regarding cattle dip sites only in the Northern Rivers region. As the database only covers the Northern Rivers region, the contamination study area (which is located in southern and central NSW) is not

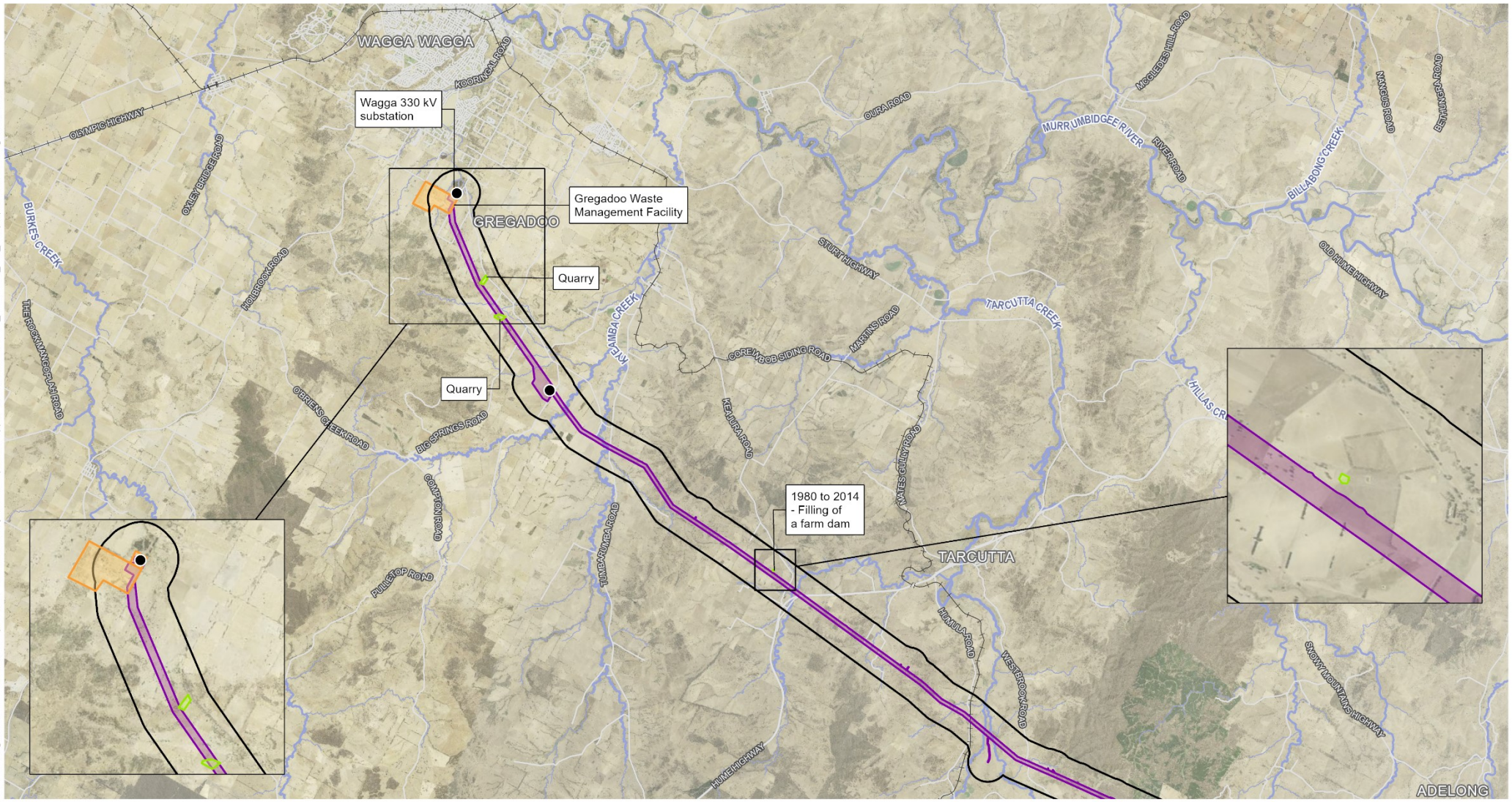
captured in this database. Given the historical land uses across the contamination study area, cattle dips and livestock dips are likely to be present even though no mapping data exists.

16.3.3.2. Areas of environmental concern

The AECs within the contamination study area are shown in Table 16-5 and Figure 16-3. These were identified through a combination of the desktop search results (refer to Section 16.3.3.1), a review of historical aerial photography and existing reports, and field survey observations. These AECs related to activities/observations such as existing infrastructure, potentially dumped wastes (including potential asbestos containing material), stored materials, landfill, stockpiled material, NOAs, and areas with potential historical uncontrolled filling or ground disturbance. The AECs were identified as having the potential to cause harm to human health or ecological receptors during construction (land disturbance) and operation of the project without mitigation measures in place. Section 16.2.2 provides further explanation of the risk rating criteria.

Table 16-5 Summary of areas of environmental concern

AECs	Rationale for concern	Risk rating
Bannaby 500 kV substation, Wagga 330 kV substation, Yass 330 kV substation, Gullen Range Wind Farm substation	On-site spills and leaks from maintenance activities, asbestos, lead paints and/or PCBs on existing substation structures.	Moderate
Existing transmission line infrastructure	On-site spills and leaks from maintenance activities, asbestos and/or lead paints on transmission line structures.	Low
Farm dams (open or infilled)	Areas of potential contaminant sediment build-up (sink).	Low
Cleared improved agricultural land (including cropping and irrigated land)	Historical use of pesticides, herbicides and fertilisers, large scale land clearance and heavy machinery use.	Low
Areas with pesticide use, including Hume Forest and Forestry owned land	Ongoing use of pesticides, including for pine forests.	Low
Designated hunting grounds	Lead bullets used within hunting grounds.	Low
Areas of disturbed land, fill, stockpiling and dumping	Areas with historical and existing stockpiles, filling and dumping, including dumped cars and the presence of potential asbestos containing materials.	Moderate
Built-up areas, including rural residences	Historical uncontrolled earthworks and building structures previously demolished/ degraded. The building structure may contain asbestos and/or lead paints.	Low
Tumut Resource Recovery Centre and Bellette Landfill	Operating as a waste transfer station. Tumut Community Recycling Centre is located adjacent to the Bellette Landfill.	Moderate
Gregadoo Waste Management Centre and Batlow Landfill	Operating as a landfill at the Gregadoo site. Composting activities also operating on the site. Historical landfill activities at the Batlow site.	Moderate
Quarries	Historical spills and leaks from the use of machinery at historical and existing quarries.	Low
Areas with potential for NOA	Mapped with potential for NOA.	Moderate
Biosolids applied to land for farming and crops, often tilled into the surface soils	Historical application of resource recovery and biosolids from wastewater treatment systems.	Low
Areas with potential for soil and groundwater salinity	Mapped with potential for soil salinity.	Low
Visy Pulp and Paper	Operating as a paper mill.	Low



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Project footprint

Contamination study area

Waterway

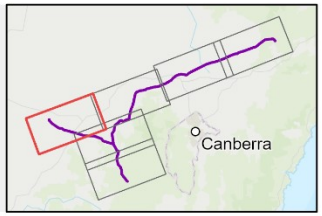
Substation

Areas of Environmental Concern

Risk Rating

Low

Moderate



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

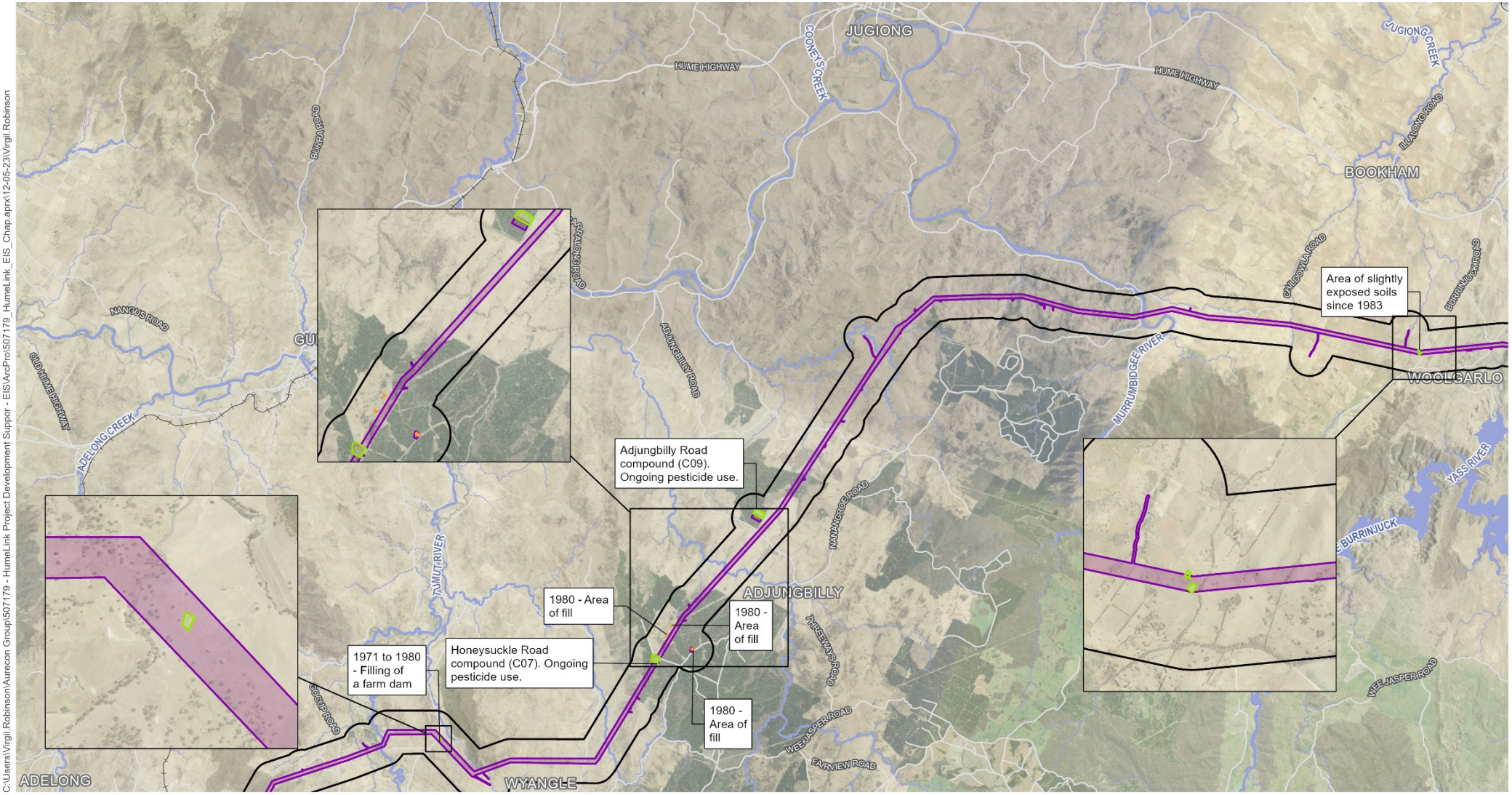
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Projection: GDA 1994 MGA Zone 55

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Figure 16-3a: Potential areas of environmental concern for contamination



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Project footprint

Contamination study area

Waterway

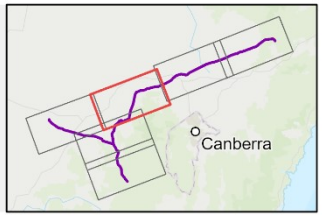
Substation

Areas of Environmental Concern

Risk Rating

Low

Moderate



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

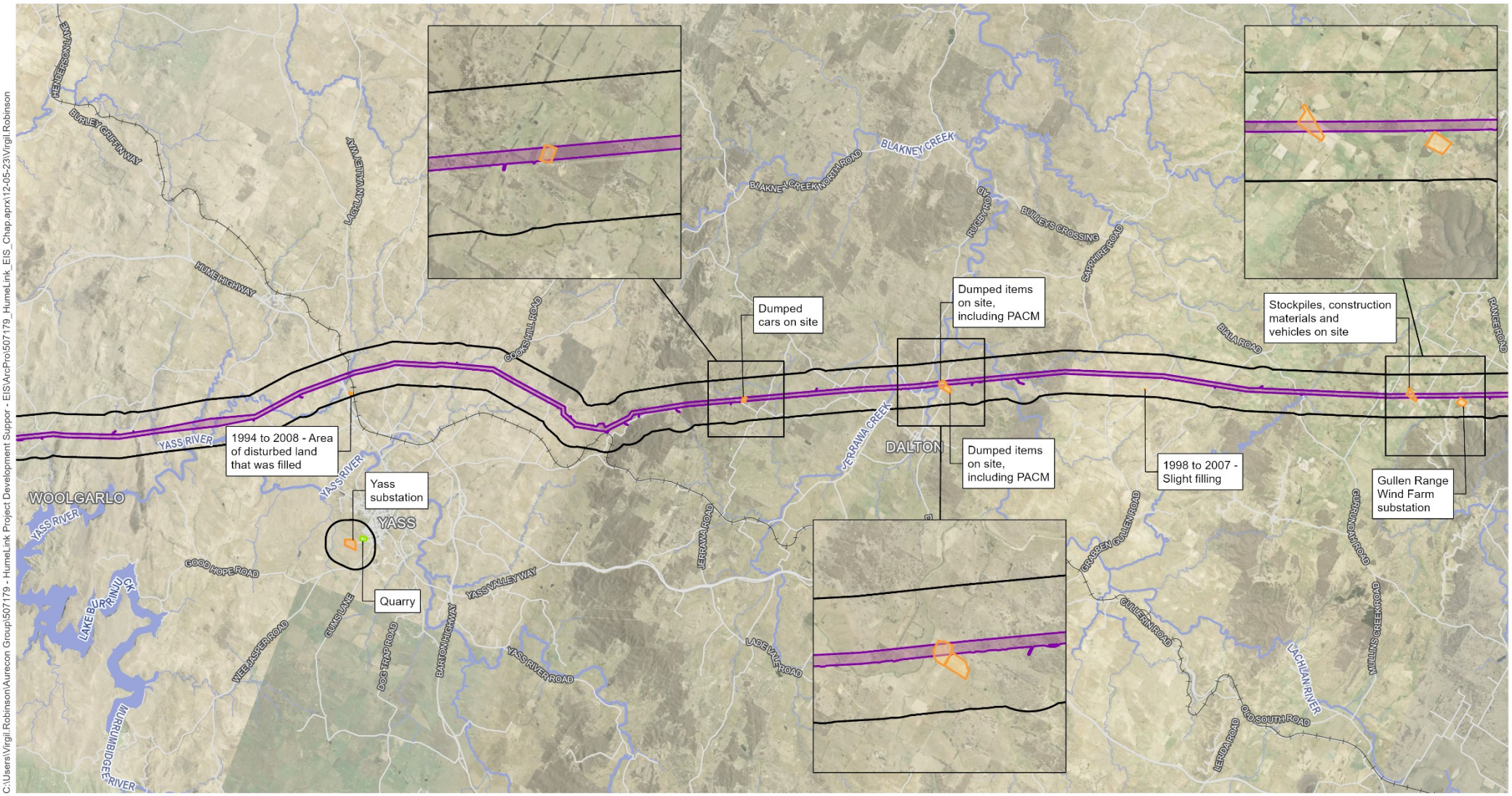
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Figure 16-3b: Potential areas of environmental concern for contamination



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

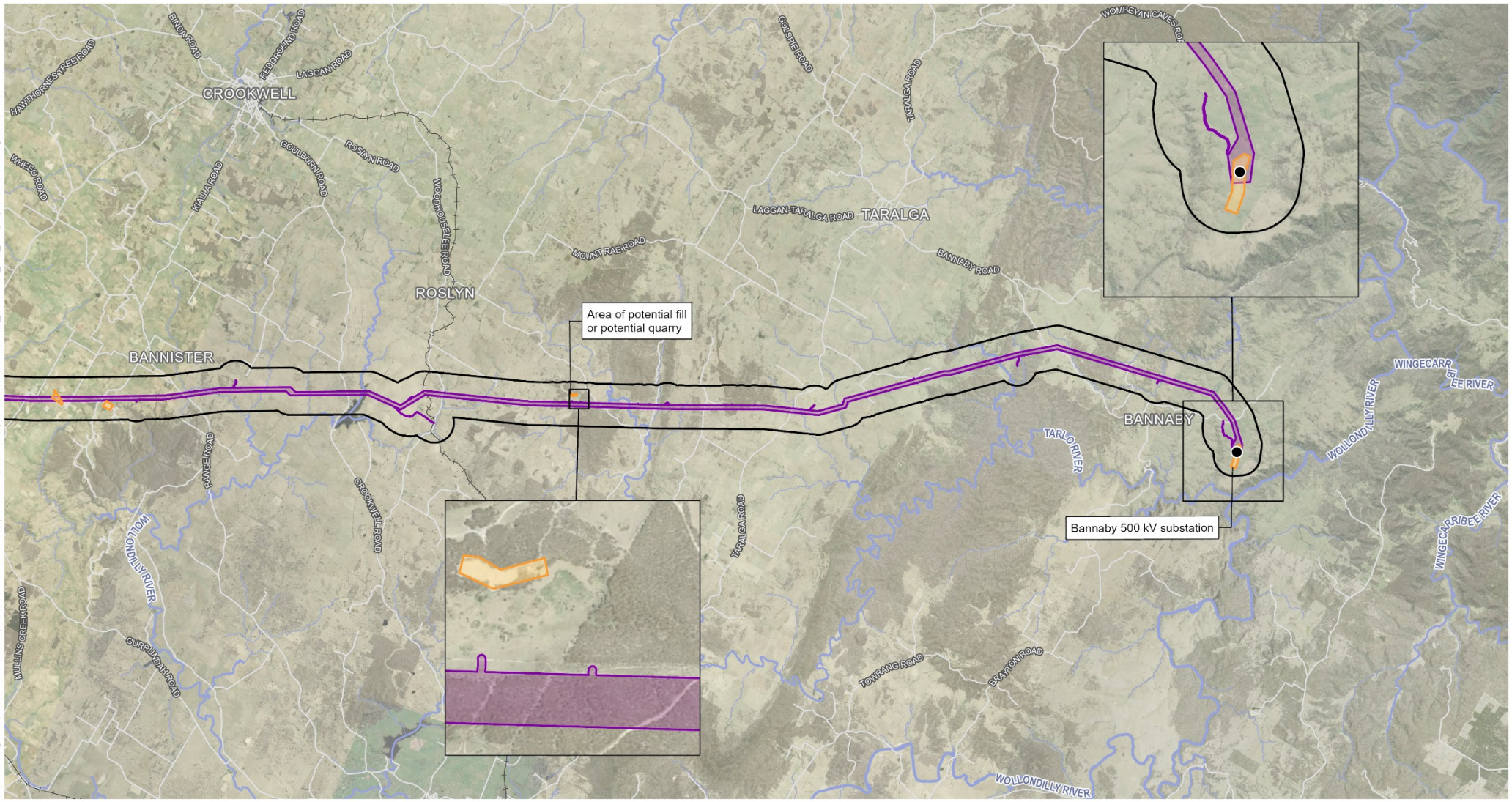
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Projection: GDA 1994 MGA Zone 55

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Figure 16-3c: Potential areas of environmental concern for contamination



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Project footprint

Contamination study area

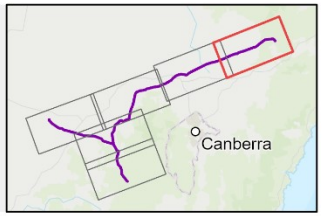
Waterway

Substation

Areas of Environmental Concern

Risk Rating

Moderate



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

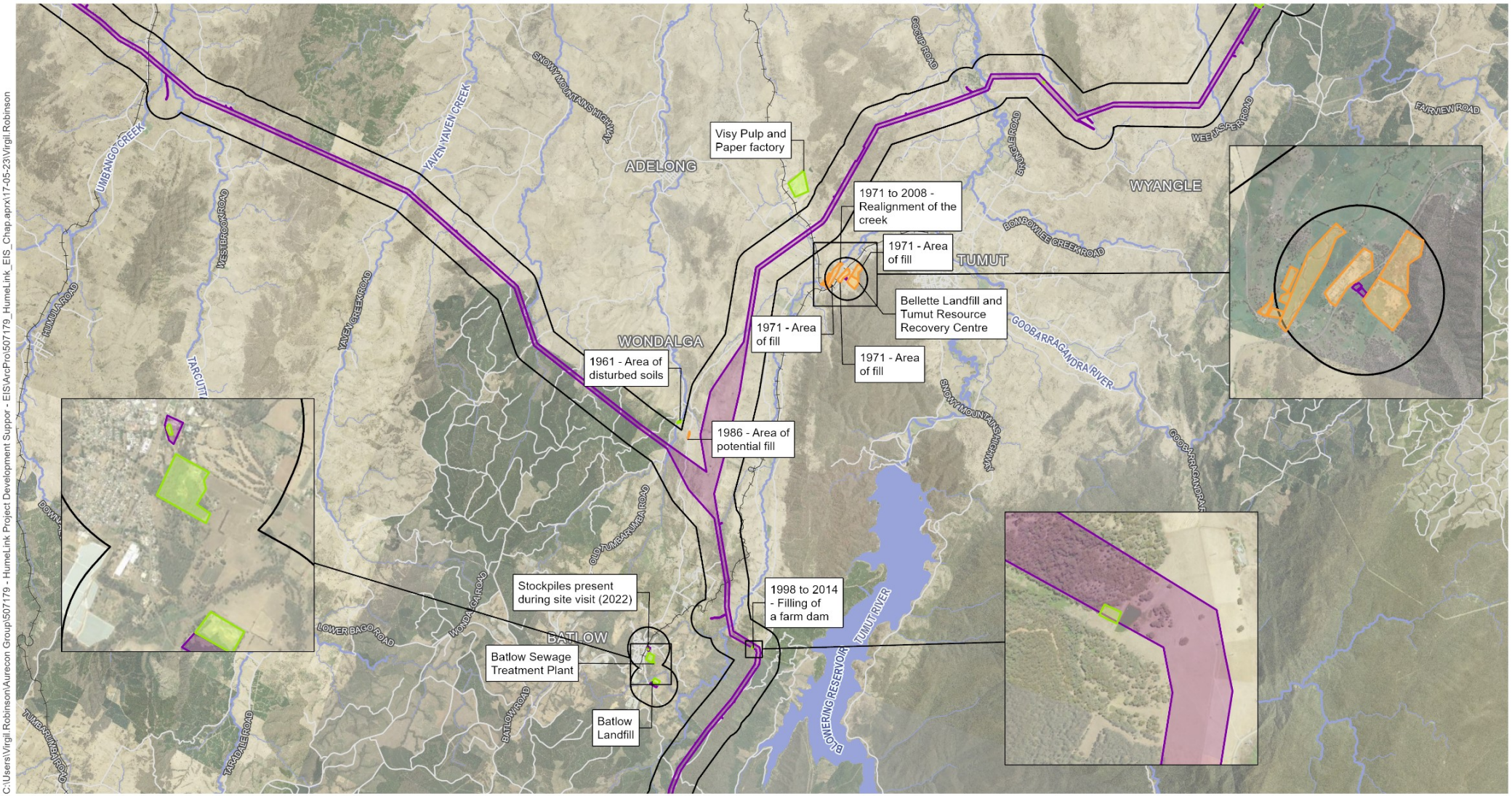
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Projection: GDA 1994 MGA Zone 55

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Figure 16-3d: Potential areas of environmental concern for contamination



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

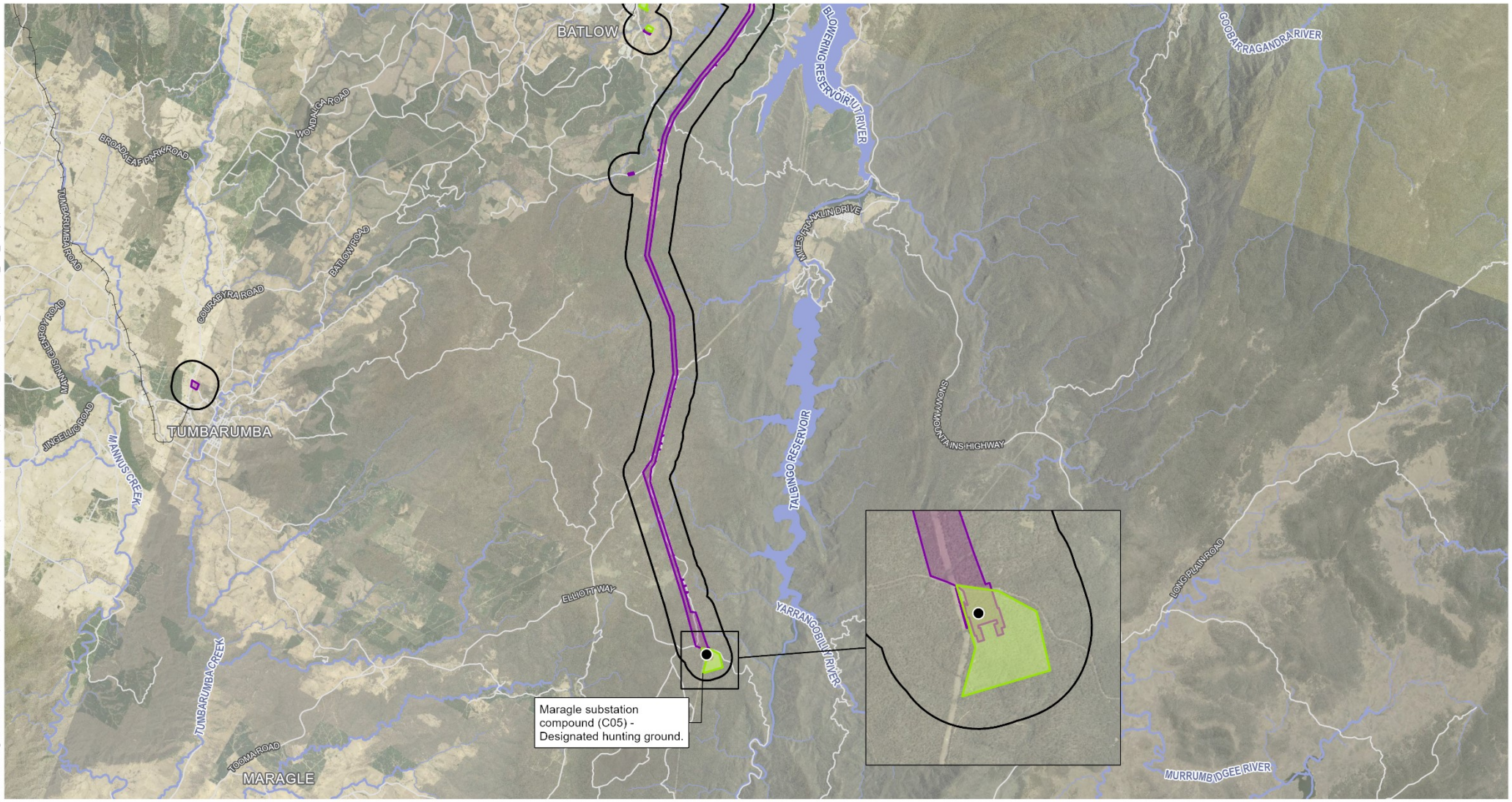
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Figure 16-3e: Potential areas of environmental concern for contamination



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Project footprint

Contamination study area

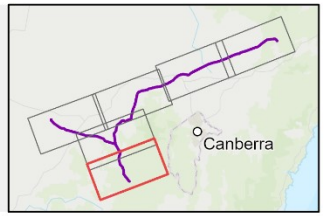
Waterway

Substation

Areas of Environmental Concern

Risk Rating

Low



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

1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

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Figure 16-3f: Potential areas of environmental concern for contamination

16.4. Potential impacts – construction

16.4.1. Soil and geological risks

16.4.1.1. Soil erosion and sediment transport

During construction of the project, there is potential for soil erosion and sediment transport to occur as a result of excavation, vegetation removal, stockpiling, vehicle, plant and equipment movements and landscaping. It is expected that a total of 382,434 m^3 of cut and 302,575 m^3 of fill would be required across the substation sites. Slopes are present across the contamination study area, with topography ranging from about 220 mAHD to 1,232 mAHD across the project footprint. In addition, parts of the project footprint are underlain by sodic and/or sand-based soils including sodosols, kurosols and rudosols, which are susceptible to erosion.

If not managed correctly, the movement of eroded soil has potential to result in sedimentation of surrounding waterways, including the Tumut River, the Goodradigbee River, the Yass River, the Lachlan River, the Wollondilly River and the Tarlo River. Potential adverse impacts on waterways would be adequately managed with the implementation of appropriate erosion and sediment controls including those outlined in Chapter 17 (Surface water and groundwater quality).

Soil disposal requirements are outlined in Section 16.4.2.3.

16.4.1.2. Saline soils

As described in Section 16.3.2.3, moderate to very high saline soil risk areas are present within the project footprint.

During earthworks, exposure of saline soils could adversely impact surface water and/or groundwater, soil erosion, and soil structure. Impacts can include localised degradation in soil structure, salt scolding at the surface, distressed vegetation and increased salt mobilisation through runoff or groundwater. The main impact from construction would be from the excavation of saline subsoils for access tracks, easements, and infrastructure. Construction activities could also generate secondary salinisation, which involves changes in landscape salt movement over time through processes such as the removal of vegetation, altering hydrology, general land use changes, increased hardstand and disturbance of groundwater. As such, construction activities have the potential to result in localised secondary salinisation near creeks, floodplains and drainage lines.

The project impacts would be very localised to the area of disturbance and limited in nature due to the level of ground disturbance proposed. Mitigation measures would ensure adequate management and control as outlined in Section 16.6.3.

16.4.1.3. Acid sulfate soils and rock

As discussed in Section 16.3.2.4, the vast majority of the soils in the project footprint are mapped as low probability of encountering acid sulfate soils due to the project's elevation and surface geology. Therefore, it is unlikely that acid sulfate soils would be encountered during construction.

The probability of encountering acid sulfate rock within localised veins and dykes of certain geological formations is low throughout the contamination study area, with limited potential for disturbance from deeper excavations and piling.

In the unlikely event unexpected acid sulfate soils are found, the Unexpected Contaminants Finds Protocol would be followed.

16.4.1.4. Naturally occurring asbestos

As previously outlined in Section 16.3.2.5, there are low, medium and high potential regions of NOA. There is a low overall risk of exposure to NOA during construction as the majority of the project footprint is classified as low to no probability. However, there are localised regions with medium risk (to the south of Red Hill and between Sharps Creek and Wondalga) and high risk (around Red Hill and Gadara).

In the medium and high potential regions of NOA, excavation could result in the mobilisation of asbestos fibres if NOA is disturbed, improperly stockpiled or not managed appropriately, which may present a risk to human health during construction. However, any NOA that is encountered during construction would be managed in accordance with the implementation of an Asbestos Management Plan (refer to Section 16.6).

16.4.2. Contamination risks

16.4.2.1. Soil contamination

As discussed in Section 16.3.3.2, some areas within the project footprint were identified as AECs having a moderate risk ranking (based on potential impacts associated with encountering contamination) due to historical and present day land use and activities in those areas (refer to *Technical Report 10 – Phase 1 Contamination Assessment*). These areas are associated with waste facilities, electrical substations and areas of disturbed land, uncontrolled fill, stockpiling and dumping.

Disturbance of contaminated soil within these AECs has the potential to expose human receptors, the environment and flora and fauna to potentially contaminated soil material in the absence of appropriate controls. In addition, unexpected contamination may potentially be encountered due to previously unknown diversity in the subsurface, soil contamination not previously identified or through existing contamination spreading to previously uncontaminated areas. These risks would be managed in accordance with an unexpected contamination finds protocol during construction and additional contaminated land investigations within AECs identified as moderate or high risk (refer to Section 16.6).

Construction activities also have the potential to introduce contamination to the environment within the project footprint, including through spills and leaks of hazardous and dangerous goods or inappropriate management of stockpiled contaminated soils and materials.

The risk to the project of potentially encountering contaminated soil and the risk of contamination being introduced or spread from construction of the project would be minimised through the implementation of mitigation measures detailed in Section 16.6.3.

16.4.2.2. Groundwater contamination

There would be a low risk of groundwater contamination during construction due to the minimal and very localised interaction with groundwater. Environmental management of groundwater would be carried out in accordance with the approach detailed in Chapter 17 (Surface water and groundwater quality).

16.4.2.3. Waste management

Waste materials, including potentially contaminated soil, would be produced during construction (refer to Chapter 23 (Waste) for more information on the waste generated). Waste would be sampled and classified prior to reuse onsite or off site in accordance with the *NSW Waste Classification Guidelines* (NSW EPA,

2014) and any applicable Resource Recovery Orders and Exemptions under the POEO Act. Waste that cannot be reused or recycled would be disposed of at a suitably licensed landfill or waste management facility.

Management of contaminated soil is generally expected to pose a low risk to the surrounding environment. However, spoil wastes produced in the AECs (refer to Section 16.3.3.2) have the potential to present a moderate risk to the surrounding environment. Measures to manage waste are outlined in Section 16.6.3.

16.5. Potential impacts – operation

16.5.1. Soil and geological risks

16.5.1.1. Soil erosion and sediment transport

During operation, there would be minimal exposed topsoil close to waterways and therefore generally little or no risk of soil erosion and subsequent transport of sediment into nearby receiving waterways. Soil erosion and associated sediment transport near waterways may occur as a result of vehicle use on unsealed access tracks for general maintenance of the transmission lines. Any potential impacts from soil erosion and sediment transport would be managed through mitigation measures outlined in Section 16.6.3 in addition to management plans outlined in Section 16.6.1.

16.5.1.2. Saline soils

During operation, changes to the soil profile, increased hardstand areas and ongoing vegetation removal within the transmission line easement could impact long term salinity compared to pre-development conditions. However, the impact would reach an equilibrium over time based on the final landform and therefore any impacts associated with salinity would be minor.

16.5.2. Contamination risks

16.5.2.1. Soil and groundwater contamination

If not managed appropriately, the storage and use of chemicals during operation and maintenance of the project have the potential to cause localised soil and/or groundwater contamination arising from vehicle accidents, leaks and spills, which may migrate through runoff. The risk of soil and groundwater contamination resulting in environmental impacts would be increased in areas close to sensitive receptors, such as national parks, nature reserves, waterways and other environmental management areas. With the implementation of mitigation measures outlined in Section 16.6.3, potential soil and groundwater contamination impacts would be minor and temporary.

16.6. Management of impacts

16.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach as detailed in Chapter 26 (Environmental management).

The construction phase of the project has the potential to impact the surrounding environment. As such, a Construction Environmental Management Plan (CEMP) would be prepared prior to construction commencing and would identify all reasonably foreseeable risks associated with earthworks and ground disturbance.

A project specific Soil and Water Management Plan (SWMP) would be a sub-plan to the CEMP and provide mitigation measures to minimise impacts on soils and surface water due to sediment migration, saline soils and incidental spills. The SWMP would include Erosion and Sediment Control Plan (ESCPs), which would be prepared by the construction contractors and focus on managing potential erosion and sedimentation impacts. The SWMP and ESCPs would be prepared in accordance with *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), other relevant volumes and other relevant guidelines.

During operation of the project, environmental management would be carried out in accordance with Transgrid's environmental policies and internal environmental management system (EMS). This would include management of waste, soil erosion, spills and leaks and other associated operational aspects.

16.6.2. Avoidance and minimisation of impacts

The project impact on soil and contamination would be avoided or minimised through the implementation of mitigation measures provided in Section 16.6.3. Additional contaminated land investigations following detailed design would be undertaken to target proposed ground disturbance within AECs with moderate or high risk as outlined in the mitigation and management measures in Table 16-6.

16.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts to soils, geology and contamination are listed in Table 16-6.

Table 16-6 Mitigation measures – soils, geology and contamination

ID	Impact	Mitigation measures	Timing	Relevant location
SC1	Salinity	Prior to ground disturbance within areas mapped as moderate to high risk saline soils, an inspection will be undertaken for the presence of saline soils. Areas of known or suspected salinity will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW DECC, 2008c) and the *Salinity Training Manual* (DPI, 2014) to manage salinity impacts. Erosion controls will be implemented in accordance with The *Blue Book* (Landcom 2004). Prior to construction, materials will be selected to withstand acidic or high saline soil and groundwater environment (where applicable). During construction, existing areas of waterlogging and poor drainage will be avoided, where possible, when building access tracks and permanent structures.	Detailed design and construction	All locations
SC2	Soil contamination	Disturbance to AECs identified as having a moderate risk or greater will be avoided or minimised where practicable during construction. Where disturbance cannot be avoided, potential impacts will be minimised during finalisation of the design and construction methodology, where practicable. AECs identified as having a moderate risk that will be disturbed will be further assessed prior to construction. The investigations will be undertaken in accordance with the assessment of site contamination NEPM 2013. Any remediation required for the project will be undertaken based on a site-specific Remedial Action Plan. The Remedial Action Plan will define remedial goals and objectives, performance criteria for remedial effort and remediation methodology. A validation report will be prepared after remedial effort and be in accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020b).	Detailed design and construction	All locations
SC3	Acid sulfate soils and rocks	Prior to ground disturbance in areas of potential acid sulfate soil or rock occurrence, testing will be carried out to determine the presence of actual and/or potential acid sulfate soils or rocks. If acid sulfate soils or rocks are encountered, they will be managed in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998).	Detailed design and construction	All locations
SC4	Soil contamination – chemical spills and runoffs	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. Environmental spill kits containing spill response materials suitable for the work being undertaken will be available with extras available to be carried in vehicles. A spill response procedure will be developed and implemented. All staff will be trained in emergency spill procedures.	Construction and operation	All locations

ID	Impact	Mitigation measures	Timing	Relevant location
SC5	Naturally Occurring Asbestos	An Asbestos Management Plan will be prepared in accordance with the NSW Government Code of Practice *How to Manage and Control Asbestos in the Workplace* (SafeWork, 2020). The Asbestos Management Plan will include the following measures: • management or isolation of areas mapped as medium to high risk of NOA, where direct disturbance of NOA is confirmed to be required for project construction works • placement of suitable signage around the work areas • list of appropriate personal protective equipment, including Respiratory Protective Equipment • implementation of dust suppression controls including wetting surfaces, covering disturbed surfaces and the use of sealed air-conditioned vehicles to minimise potential asbestos impacts to workers • decontamination of the workers' coveralls, personal protective equipment, equipment and work site • procedures for the disposal of NOA material or waste, if required • implementation of air monitoring using pumps and sample filter grid cowls for asbestos fibres and dusts if it is suspected that exposure to NOA dust during work might exceed safe levels of airborne asbestos. The air monitoring pumps, and reporting, must be undertaken by a licensed asbestos assessor.	Detailed design and construction	All locations
SC6	Soil contamination	The contractor will undertake compliance monitoring, keep a record of waste volumes and waste types and keep a stockpiles register where excavations and stripping of surface soil contamination occurs. The contractor will keep all records during construction for waste disposal and for the importation of materials such as engineering fill and excavated natural materials (ENM) or virgin excavated natural materials (VENM) soils. Engineering fill materials for use on site will be validated to confirm they meet the classification of VENM or ENM prior to being transported to site.	Construction	All locations
SC7	Unexpected contamination	The discovery of any unexpected contamination during construction will be managed in accordance with an Unexpected Contaminants Finds Protocol, which will be prepared prior to construction.	Construction	All locations

16.6.4. Managing residual impacts or uncertainties

With the implementation of the mitigation measures detailed in Section 16.6.3, the residual impacts of the project related to contamination are considered to be low.

Uncertainties regarding soil and geological conditions within the project footprint will continue to be resolved through additional geotechnical investigations during detailed design.

17. Surface water and groundwater quality

This chapter provides a detailed summary of the assessment of potential surface water and groundwater impacts of the project. The full assessment is provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment* (Aurecon, 2023b).

17.1. Environmental Assessment Requirements

17.1.1. Secretary's Environmental Assessment Requirements

Table 17-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to surface water and groundwater quality impacts of the project and where these requirements are addressed in this EIS.

Table 17-1 Secretary's Environmental Assessment Requirements – surface water and groundwater quality

Reference	SEARs	Where principally addressed in the EIS
Water and soils		
Key issues	The EIS must address the following matters: • an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Goobarragandra River, Lachlan River, Murrumbidgee River, Tarlo River, Tumut River, Wollondilly River, Yass River and Blowering Dam, Burrinjuck Dam and Wyangala Water Catchment Areas, having regard to *NSW Water Quality Objectives*;	Sections 17.4.2 and 17.5.2 provide an assessment of the impacts of the project on the quantity and quality of the region's surface water resources.
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Sections 17.4.1 and 17.5.1 provide details of water requirements, supply arrangements and wastewater disposal arrangements. Chapter 23 (Waste) provides further information on wastewater disposal arrangements.
	• an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the *NSW Aquifer Interference Policy* and relevant *Water Sharing Plans*;	Sections 17.4.3 and 17.5.3 provide an assessment of the impacts of the project on groundwater. Chapter 8 (Biodiversity) provides consideration of impacts on groundwater dependent ecosystems.
	• an assessment of the potential flooding impacts and risks of the project;	Chapter 18 (Hydrology and flooding) provides an assessment of the potential flooding impacts and risks of the project.
	• where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2018) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003); and *Policy & Guidelines for Fish Habitat Conservation & Management* (DPI, 2013); and	Sections 17.4 and 17.5 provide an assessment of the likely impacts on waterfront land.

Reference	SEARs	Where principally addressed in the EIS
	• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom, 2004).	Sections 17.4.2 and 17.5.2 provide an assessment of potential erosion and sedimentation impacts. Section 17.6.3 provide a description of the erosion and sediment control measures proposed to be implemented for the project, with further detail provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment*, Chapter 16 (Soils, geology and contamination), Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report*.

17.2. Assessment approach

17.2.1. Legislation and policy context

Key national and state legislation, guidelines and policies considered as part of the surface water and groundwater impact assessment included:

- Commonwealth *Water Act 2007* – provides the legislative framework for ensuring that the Murray-Darling Basin is managed in the national interest and leads to the development of the *Basin Plan 2012* and water resource plans (WRPs). The *Basin Plan 2012* sets water quality targets and objectives to protect water quality in the Murray-Darling Basin's rivers for people and livestock as well as for wetlands and floodplains. The WRPs set rules on how much water can be taken from the Basin, ensuring that the sustainable diversion limit is not exceeded over time (refer to Section 17.2.2.2).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments and Australian state and territory governments, 2018) – is a key guideline within the National Water Quality Management Strategy and provides a process for protection of water resources across Australia. These guidelines have been used to determine the existing condition of rivers and water quality objectives for the project (refer to Section 17.3.2.2).
- *Water Management Act 2000* (WM Act) – governs the issue of Water Access Licence (WALs) and approvals for water sources in NSW where water sharing plans (WSPs) have commenced (refer to Section 17.4.1 for further detail). The NSW *Water Act 1912 (Water Act)* continues to apply in those remaining water sources where a WSP has not been enacted. Exemptions for WALs are included in the Water Management (General) Regulation 2018.
- *Fisheries Management Act 1994* – contains provisions for the conservation of fish stocks, key fish habitat (KFH), biodiversity, threatened species, populations, and ecological communities. Consideration of KFH has helped to identify the sensitivity of waterways relevant to the project (refer to Section 17.3.5).
- State Environmental Planning Policy (Biodiversity and Conservation) 2021 sets out the planning and assessment requirements for all new developments in the Sydney Drinking Water Catchment, including the requirement for the development to have a neutral or beneficial effect (NorBE) on water quality. A NorBE assessment has been prepared for the project as the project footprint traverses the Sydney Drinking Water Catchment east of Gurrundah (refer to Sections 17.4.2.3 and 17.5.2.3).
- *NSW Aquifer Interference Policy* (DPI, 2012a) – clarifies the requirements for obtaining water licences and the assessment processes for aquifer interference activities under the WM Act and other relevant legislative frameworks (refer to Sections 17.4.3 and 17.5.3).

Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for further consideration of the relevant legislation, guidelines and policies.

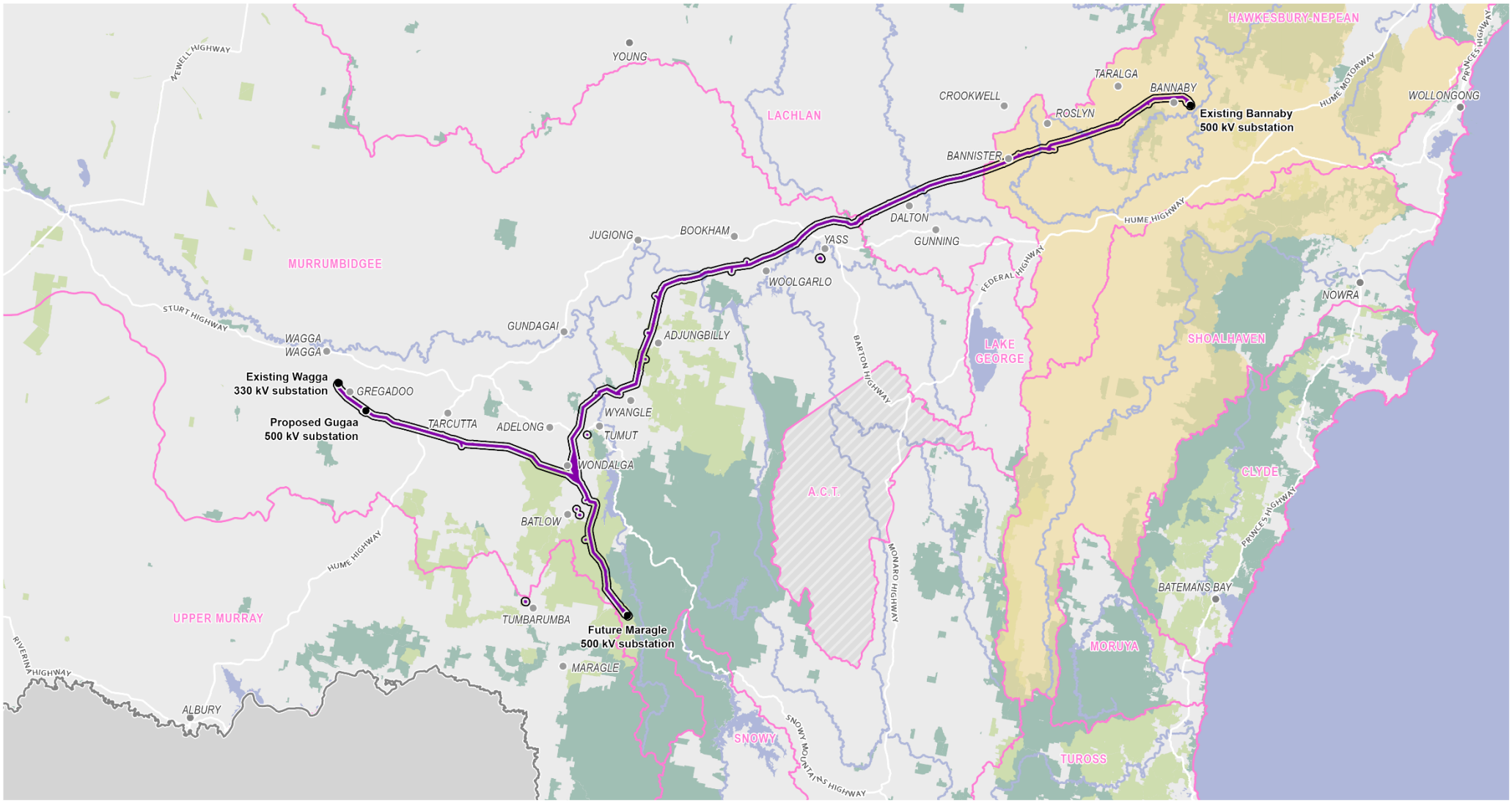
17.2.2. Methodology

17.2.2.1. Overview of key tasks

The key tasks undertaken for the surface water and groundwater impact assessment included:

- reviewing legislation, guidelines, and policies
- gathering data and desktop analysis of sources such as Australian Groundwater Explorer, climate data and elevation data to identify the existing environment
- conducting site visits between 4 April 2022 to 6 April 2022 and 24 to 26 August 2022 to verify information obtained from publicly available datasets and mapping
- identifying relevant requirements and waterway objectives
- assessing the potential significance of construction and operation impacts on surface water and groundwater (refer to Section 17.2.2.2)
- undertaking a minimal impacts considerations assessment to meet the requirements of the *NSW Aquifer Interference Policy* (DPI, 2012a)
- undertaking a preliminary assessment in accordance with *the Neutral or Beneficial Effect on Water Quality Assessment Guideline 2022* (WaterNSW, 2022) for the areas within the Sydney Drinking Water Catchment
- identifying mitigation measures to address any potential impacts.

The surface water and groundwater study area includes the project footprint with a one-kilometre buffer on either side. This larger area was searched to allow adequate interpretation of impacts on surface water, groundwater and potentially sensitive groundwater users. The surface water and groundwater study area is shown in Figure 17-1.



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

1:1,125,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

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FIGURE 17-1: Surface water and groundwater study area, major surface water catchments

17.2.2.2. Impact significance

The significance of any potential impact on local surface water and groundwater resources has been determined by considering the sensitivity of the receiving environment as well as the magnitude of the expected change as a result of the project.

There are many sensitive environmental features associated with waterways, such as KFH, wetlands and threatened aquatic ecosystems. The impacts of the project, including potential impacts of surface water, on these sensitive environmental features are assessed in the *Technical Report 1 – Biodiversity Development Assessment Report*.

The Strahler stream order classification is a 'top down' system in which streams of the first order have no upgradient streams flowing into them (DPI 2018a). If two streams of the same order merge, the resulting stream is given a number that is one higher. If two rivers with different stream orders merge, the resulting stream is given the higher of the two numbers. Under the Strahler stream order classification, first to third order streams are typically headwater streams. Streams classified as fourth through to sixth order are typically medium streams, and streams that are seventh order or larger are typically rivers.

To determine a potential impact significance of a specific location from changes in surface water quality, the distance to a waterway has been used as a measure of the sensitivity of an area and is termed the 'waterway buffer zone'. The waterway buffer zone is based on the Strahler stream order classification and the corresponding Vegetated Riparian Zone as defined by *Controlled activities - Guidelines for riparian corridors on waterfront land* (DPE, 2022c) and includes a multiplication factor of five. Table 17-2 includes the waterway buffer zones used in the surface water and groundwater impact assessment.

Table 17-2 Waterway buffer zones

Strahler stream order	Vegetated Riparian Zone width (DPE, 2022c)	Waterway buffer zone
1st	10 m either side of the waterway	Within 50 m of the waterway
2nd	20 m either side of the waterway	Within 100 m of the waterway
3rd	30 m either side of the waterway	Within 150 m of the waterway
4th and above	40 m either side of the waterway	Within 200 m of the waterway

For erosion risk and sedimentation, erosion risk was considered using *Modelled Hillslope Erosion* (Yang *et al.*, 2017).

The Magnitude of Impact evaluation is influenced by the estimated duration of impact, extent of impact and degree of change from pre-development conditions.

Table 17-3 provides the matrix of impact significance used for the surface water and groundwater impact assessment. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for definitions of the ratings.

Table 17-3 Matrix of impact significance

Magnitude of Impact	Sensitivity of Environmental Values		
	High	Moderate	Low
High	Major	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Negligible

17.3. Existing environment

17.3.1. Climate and rainfall

The climate across the surface water and groundwater study area varies from cool, temperate to hot, with dry summers and cool winters (BoM, 2022). Table 17-4 summarises recent historical climate data (2010 to 2022) for Wagga Wagga (AMO), Burrinjuck Dam and Goulburn TAFE climate stations.

Table 17-4 Summary of relevant data from climate stations

Station	Annual rainfall	Average temperature
Wagga Wagga (AMO) station (ID#72150)	Variable annual rainfall rate with wetter years recording rainfall in excess of 1,000 mm and drier years recording around 400 mm of rainfall. Rainfall was largely consistent throughout the year, with no obvious seasonal trend. However, average monthly potential evaporation is more variable than the annual evaporation rate.	Between 28°C and 33°C in summer and between 13°C and 15°C in winter.
Burrinjuck Dam station (ID#73007)	Variable annual rainfall rate with wetter years recording rainfall in excess of 1,500 mm and drier years recording 500 mm of rainfall. Rainfall was largely consistent throughout the year, with no obvious seasonal trend. The monthly range was more variable than at Wagga Wagga.	Between 26°C and 32°C in summer and between 12°C and 18°C in winter.
Goulburn TAFE station (ID#70263)	Variable annual rainfall rate with wetter years recording rainfall in excess of 900 mm and drier years recording 500 mm of rainfall. Rainfall was largely consistent throughout the year, with a weak seasonal trend of higher mean and variability in monthly rainfall during November to March. The average monthly potential evaporation is more variable than the annual evaporation rate with a noticeable trough throughout the cooler / wetter winter months, with potential evaporation being higher in the hotter, drier, summer months.	Between 23°C and 29°C in summer and between 12°C in winter.

Climate change impacts on surface runoff and recharge to groundwater (OEH, 2015) provides expected local climatic changes for the surface water and groundwater study area in the near future (ie 2020-2039) and far future (ie 2060-2079). These predictions were from the NSW and ACT Regional Climate Modelling project (NARCliM)), which predicts:

- a reduction in rainfall, runoff and groundwater recharge across the surface water and groundwater study area for the near future scenario
- an increase in rainfall and surface runoff and a decrease in recharge to the groundwater for the far future scenario.

Practical Consideration of Climate Change (DPI, 2012b) showed a trend of increased rainfall intensities for the 40-year Average Recurrence Interval one-day rainfall event across NSW. Higher intensity rainfall would result in higher runoff volumes, whereas the increased evaporation rates would likely lead to reduced recharge.

Temperature projections for the Murray Murrumbidgee and South East and Tablelands regions indicate higher average maximum and minimum temperatures for the near future (2030) and far future (2070), compared to baseline modelled climate from 1990 to 2009. The average maximum and minimum temperatures across the entire project footprint are expected to rise by 1°C and 4°C by 2030 and 2070, respectively (OEH, 2015). As average temperatures are predicted to increase due to climate change, evaporation rates can be assumed to rise correspondingly and further decrease recharge to groundwater.

17.3.2. Surface water

17.3.2.1. Surface water catchments and waterway characteristics

The surface water and groundwater study area is located in four major surface water catchments (from west to east) the Murrumbidgee River, the Upper Murray River, the Lachlan River and the Hawkesbury-Nepean River catchments. Each of the catchments and relevant waterways are summarised in Table 17-5 and shown in Figure 17-1. The majority of the project footprint is located within the Murrumbidgee River catchment, followed by the Hawkesbury-Nepean River and Lachlan River catchments. Only the worker accommodation facility at Tumbarumba is located within the Upper Murray River catchment. The project footprint also traverses the Sydney Drinking Water Catchment east of Gurrundah.

Delivery of water to households, industry and farms is managed by a combination of local councils or regional water authorities. The water authorities operating throughout the surface water and groundwater study area include Murrumbidgee Irrigation, Coleambally Irrigation, WaterNSW, Icon Water and Jemalong Irrigation. The WRPs and WSPs, which cover the surface water sources in the surface water and groundwater study area, are shown in Table 17-5.

The existing water quality across the four catchments that form part of the surface water and groundwater study area has been periodically monitored and assessed as part of the NSW Monitoring Evaluation and Reporting Program and is captured in the *State of the Catchments report* (DECC, 2010). The *National Water Quality Assessment* (Sinclair Knight Merz, 2011) provides a snapshot of water quality across inland waters in Australia. The assessment presented a comparison between water quality data against the relevant water quality guidelines for the region included in *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000) (referred to hereafter as ANZECC 2000 guidelines). The water quality parameters assessed included: cyanobacteria, microbial quality, nutrients, including total phosphorus (TP) and total nitrogen (TN), pH, salinity and turbidity. The data from monitoring locations closest to project footprint is summarised in Table 17-5. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for more detailed information on surface water quality, supply and catchment information.

Table 17-5 Summary of surface water catchments and water sources within the surface water and groundwater study area

Water catchment and description	Name of relevant water sharing/resource plans	Monitoring locations	Description of surface water quality
Murrumbidgee River catchment • This catchment has an area of 84,000 square kilometres. • The Murrumbidgee River drains much of southern NSW and most of the ACT. • Murrumbidgee, Tumut, Goobarragandra, Gudgenby, Naas, Molonglo, Queanbeyan, Cotter and Yass Rivers are key tributaries. • The two largest water storages are Blowering Dam and Burrinjuck Dam (Department of Planning and Environment (DPE), 2022h).	• WSP - Murrumbidgee Regulated River Water Sources 2016 - Murrumbidgee Unregulated River Water Sources 2012 • WRP - Murrumbidgee surface water (submitted in June 2020, withdrawn in April 2021 and resubmitted September 2022)	• Tumut River at Oddys Bridge (# 410073) • Murrumbidgee River at Gundagai (#410068)	• Temperatures were generally within guideline conditions at all monitoring locations apart from the Tumut River (#410073) where a median temperature of 12°C was recorded. • Conductivity was within guideline conditions at all monitoring locations. • TP, TN and turbidity were outside guideline values at each monitoring location. • pH was within guideline range at all monitoring locations.
Upper Murray River catchment • This catchment has an area of 15,330 square kilometres. • The Murray River flows from the Snowy Mountains, along the NSW-VIC border and through south-eastern SA to Lake Alexandrina where it meets the Southern Ocean. • Major NSW tributaries to the Upper Murray include the Geehi, Swampy Plains and Tooma Rivers and Tumbarumba Creek. • The two largest water storages are Hume Dam and Dartmouth Dam (DPE, 2022i).	• WSP - Murray Unregulated River Water Sources 2011 - NSW Murray and Lower Darling Regulated Rivers Water Sources 2016 • WRP - NSW Murray and Lower Darling surface water (submitted June 2020, withdrawn May 2021 and resubmitted September 2022)	• Tooma River at Warbrook (#401003) • Tumbarumba at Tumbarumba Creek (#401007)	• Temperature was generally within guidelines conditions at Tumbarumba (#401007). • Conductivity was within guideline conditions at Tumbarumba (#401007). • TP values exceeded guidelines and turbidity was generally within guidelines at Tooma River (#401003).

Water catchment and description	Name of relevant water sharing/resource plans	Monitoring locations	Description of surface water quality
Lachlan River catchment • This catchment has an area of 90,000 square kilometres (DPE, 2022j) • The Lachlan River joins the Murrumbidgee River. However, very little water reaches the Murrumbidgee River as most of it is extracted by water users or provides inflows to the wetlands in the lower Lachlan River catchment. • The Wyangala Dam is the main regulating storage in the Lachlan River catchment.	• WSP - Lachlan Regulated River Water Source 2016 - Unregulated Rivers Water Sources 2012 • WRP - Lachlan Alluvium (submitted in April 2020 and withdrawn in August 2021) - Lachlan surface water (submitted in June 2020, withdrawn in November 2020 and resubmitted March 2022)	• Lachlan River at Reid's Flat (#412027)	• Temperature was within guideline conditions. • Conductivity exceeded the guideline value range. • pH was within the guideline conditions. • TN and TP generally exceeded guideline conditions.
Hawkesbury-Nepean River catchment • This catchment has an area an area of 21,400 square kilometres. • River flows within much of the catchment are heavily controlled by Warragamba, Wingecarribee, Avon, Cataract, Cordeaux, Nepean, Mangrove Creek and Lyell dams. • The main rivers and tributaries are the Avon, Cataract, Colo, Cordeaux, Coxs, Grose, McDonald, Tarlo, Warragamba, Wollondilly and Wingecarribee Rivers as well as the Hawkesbury-Nepean River channel (DPE, 2022k).	• WSP - Greater Metropolitan Region Groundwater Sources 2011	• Tarlo River at Towrang (#2122713) • Wollondilly River at Murray Flats (#2122711)	• Temperatures were generally within guideline conditions at all monitoring locations apart from the Tarlo River (#2122713) where a median temperature of 14.2°C was recorded. • Conductivity was within the guideline conditions at Wollondilly River (#2122711) but exceeded the guideline value range at Tarlo River (#2122713). • TP exceeded guideline values at both sites. • Turbidity was within the guideline value range at all sites. • pH was within the guideline conditions at Tarlo River (#2122713) but exceeded the guideline conditions at Wollondilly River (#2122711).

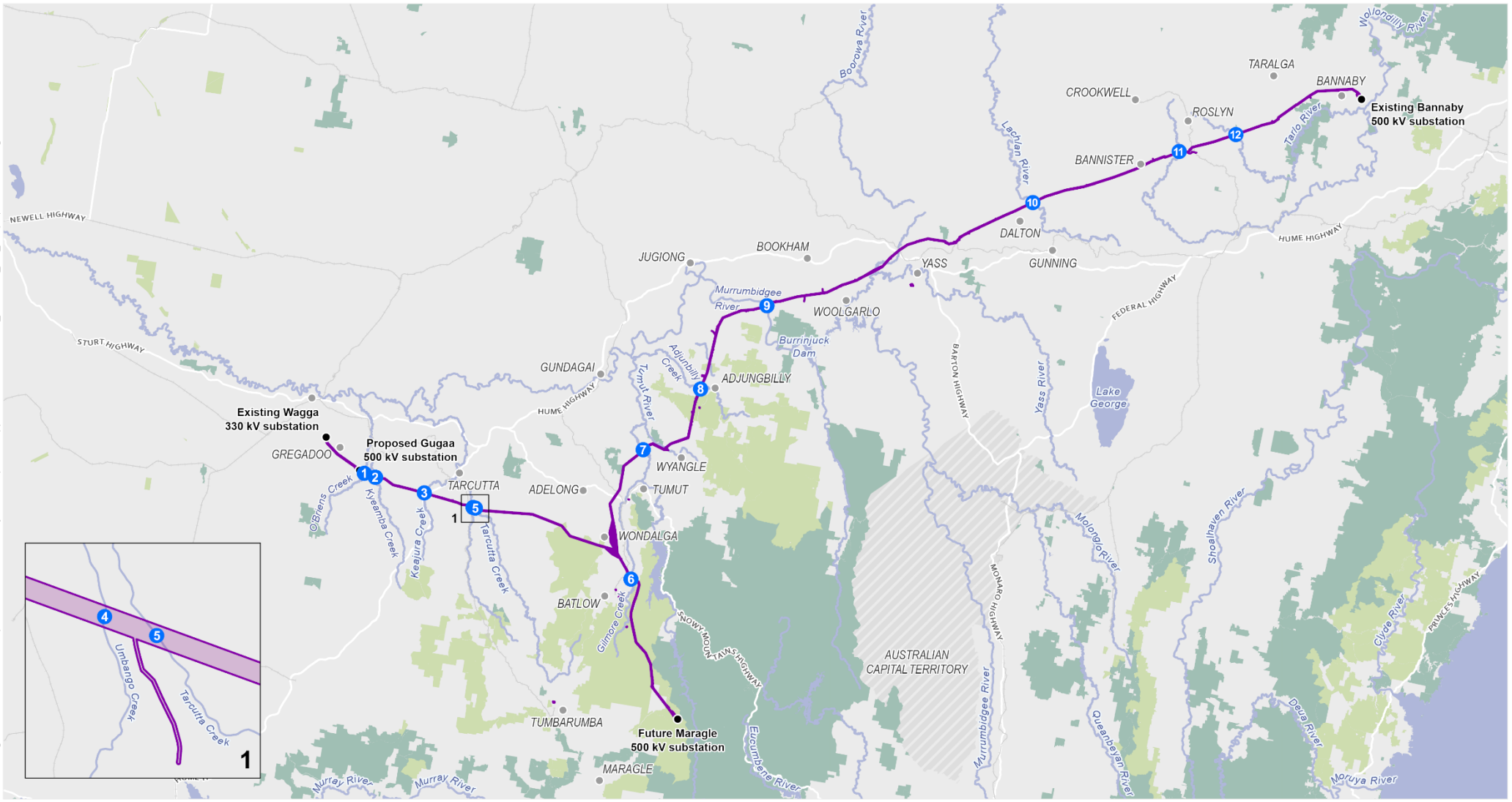
17.3.2.2. Geomorphology

Geomorphology relates to the form, shape, size and structure of waterways. The geomorphic condition of a waterway is dependent on the flows, vegetation, soil types and aquatic biodiversity, which can be affected by human-induced changes to catchments and waterways. Waterways that lack regular flow and have no riparian vegetation would be in a poor geomorphic condition and have high fragility. Recovery potential indicates the capacity of a river to return to good condition or to a realistic rehabilitated condition.

Table 17-6 summarises the major waterways within the surface water and groundwater study area that would be crossed by the transmission line, including the existing condition and recovery potential based on the *River Styles Framework* (DPI, 2019). Figure 17-2 shows the location of the major waterways and waterbodies relative to the project footprint.

Table 17-6 Existing condition and recovery potential of major waterways within the surface water and groundwater study area

Waterway	Strahler stream order	River condition, fragility and recovery potential
Murrumbidgee River	9	The Murrumbidgee River was assessed as being in moderate condition with moderate fragility and moderate recovery potential.
Lachlan River	6	The Lachlan River was assessed as being in moderate condition with moderate fragility and high recovery potential.
Wollondilly River/ Pejar Dam	5	The Wollondilly River / Pejar Dam was assessed as having low fragility and has no recovery potential. A condition was not assigned under the River Styles Mapping Framework (DPI, 2019) as the waterway at this location is classified as a water storage. However, upstream, and downstream of the crossing location, the Wollondilly River has been assigned a moderate condition.
Tumut River	8	The Tumut River was assessed as being in moderate condition with moderate fragility and moderate recovery potential.
Gilmore Creek	6	Gilmore Creek was assessed as being in moderate condition with moderate fragility and moderate recovery potential.
Umbango Creek	7	Umbango Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
Kyeamba Creek	7	Kyeamba Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
Keajura Creek	6	Keajura Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
O'Briens Creek	6	O'Briens Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
Tarcutta Creek	6	Tarcutta Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
Adjungbilly Creek	6	Adjungbilly Creek was assessed as being in poor condition with moderate fragility and moderate recovery potential.
Tarlo River	5	Tarlo River was assessed as being in moderate condition with moderate fragility and moderate recover potential.



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

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 17-2: Major waterway crossings within project footprint

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17.3.3. Groundwater

17.3.3.1. Groundwater sources and characteristics

Information on groundwater sources and quality and the corresponding WRPs and WSPs within the surface water and groundwater study area are provided in Table 17-7.

Groundwater quality influences how water is used by humans for town water or stock and domestic supply, for commercial purposes such as farming and irrigation, or for environmental uses such as aquatic and terrestrial groundwater dependent ecosystems (GDEs). One way to identify groundwater quality is to measure groundwater salinity, which is indicated by the electrical conductivity (measured in microsiemens per centimetre, or µS/cm).

The beneficial use category of a groundwater source refers to a general categorisation of groundwater uses based on water quality. The *NSW Groundwater Protection Policy* defines beneficial use categories for groundwater and provides corresponding salinity thresholds. Salinity thresholds for key beneficial use categories include:

- raw drinking water – less than 1,791 µS/cm
- irrigation – less than 4,478 µS/cm
- stock drinking water – less than 14,925 µS/cm.

Hydrostratigraphic units (HSUs) are defined as geological material of similar hydrogeological properties. For the surface water and groundwater study area, HSUs are defined as per groundwater sources listed within the WSPs.

Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for a more detailed description of the HSUs relevant to the surface water and groundwater study area and the beneficial uses of groundwater based on salinity.

Table 17-7 Summary of groundwater quality and sources within the surface water and groundwater study area

Groundwater source	Name of relevant water sharing/resource plans	Description of groundwater source and quality
Mid Murrumbidgee Alluvium, comprising: • Kyeamba Alluvial Groundwater Source • Gundagai Alluvial Groundwater Source • Mid Murrumbidgee Alluvium (GS31)	• WSP - Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources Order 2020 - Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources Order 2020 • WRP - Murrumbidgee Alluvium (submitted April 2020 but withdrawn August 2021 and is pending resubmission)	Within this groundwater source, shallow aquifers were defined as all water-bearing zones up to 40 metres below ground level and deep aquifers were defined as all water-bearing zones deeper than 40 metres below ground level. Based on a review of registered bores, the shallow aquifer system in the Cowra system varies in depth from about 25 metres in the Gundagai area and increases to 40 metres near Narrandera. The water quality for the Mid Murrumbidgee Alluvium (GS31) groundwater source is expected to be fresh, with electrical conductivity ranging from 150 µS/cm near the rivers to 950 µS/cm in the deep aquifer. This groundwater source is highly productive and highly connected to surface water sources. The quality in the shallow aquifer is quite variable, but is generally below 1,660 µS/cm (ie slightly brackish water) and fresh in most places including adjacent to the Murrumbidgee River.
Lachlan Fold Belt comprising: • Lachlan Fold Belt Murray Darling Basin Groundwater Source, including Yass Catchment • Lachlan Fold Belt (GS20)	• WSP - Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources Order 2020 • WRP - NSW Murray Darling Basin Fractured Rock (submitted April 2020 but withdrawn September 2021)	Within this groundwater source, shallow aquifers were defined as all water-bearing zones up to 30 metres below ground level and deep aquifers were defined as all water-bearing zones deeper than 30 metres below ground level. There is no available regional groundwater contour maps or proximal groundwater level information published for the Lachlan Fold Belt. The electrical conductivity in the Yass Catchment ranged from 300 to 6,100 µS/cm with NSW Government monitoring bores in the Murrumbateman area having a salinity range between 800 and 5,360 µS/cm. This indicates fresh to moderately brackish water. The Lachlan Fold Belt groundwater source is considered less productive as the bore yields are typically low, supplying less than 3L/s, which is below the criterion of greater than 5 L/s for highly productive groundwater sources. This groundwater source is typically deep and not linked to surface water flow.
Goulburn Fractured Rock	• WSP - Greater Metropolitan Region Groundwater Sources 2011	This groundwater source is a fractured rock system with water levels dependant on fracture depth and spatial orientation. There are no available regional groundwater contour maps or proximal groundwater level information published for the Goulburn Fractured Rock. There is also no regional groundwater quality data published for this groundwater source. However, based on rock type, groundwater is typically suitable for some domestic, agricultural and limited industrial uses. The groundwater source is assumed to be a highly productive groundwater source that is highly connected to surface water sources.

17.3.3.2. Groundwater bores

Groundwater level and use information was obtained from registered bores within the surface water and groundwater study area. Table 17-8 provides a count of the registered bores within the surface water and groundwater study area, their respective application, and a range of standing water levels. Further detail related to groundwater bores is provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment*.

Table 17-8 Registered groundwater bores and their groundwater level statistics

Bore application	Number of bores within the surface water and groundwater study area	Range of standing water level
Commercial and Industrial	1	0 – 0* m
Exploration	3	0 – 0* m
Irrigation	13	12 – 14 m
Monitoring	71	1 – 23.4 m
Stock and Domestic	15	2.5 – 2.5* m
Unknown	21	2.3 – 19.2 m
Water Supply	82	1.5 – 8.5 m
Total	**206**	

Note: * limited information available from WaterNSW

17.3.4. Surface water and groundwater interaction

Surface water and groundwater interaction is summarised in Table 17-9. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for a more detailed description.

Table 17-9 Surface water and groundwater interaction

Water catchment	Groundwater source	Interaction
Murrumbidgee River	Mid Murrumbidgee Alluvium	Groundwater and surface water systems are considered to be highly connected. The narrow and shallow nature of Mid Murrumbidgee Alluvium means it is likely to experience change between losing and gaining conditions along the river's length depending on geology, topography, river flow and local conditions.
Upper Murray River and Lachlan River	Lachlan Fold Belt	The connectivity between the groundwater and surface water systems is considered low. Much of the Lachlan fractured rock groundwater system is buried beneath porous rock systems with no major connection with the overlying surface water systems.
Hawkesbury-Nepean River	Goulburn Fractured Rock	Alluvial deposits occur along the valleys, creeks, and floodplains of the main rivers in the catchment. These alluvial deposits provide areas of localised groundwater-surface water interactions.

17.3.5. Sensitive receiving environments

Sensitive receiving environments, which may be impacted by changes in surface water and groundwater quality include KFH and threatened aquatic species, GDEs, wetlands and licensed groundwater users.

Only aquatic GDEs were considered in this review as they were considered most at risk. Aquatic ecosystems rely on the surface expression of groundwater, which includes surface water ecosystems that may have a groundwater component, such as rivers, wetlands, and springs. The aquatic GDEs identified

with the vegetation communities that have a high potential to be a GDE and are located within the project footprint are summarised in Table 17-10.

Table 17-10 Areas and associated risk of vegetation communities within project footprint

Area (ha)	Moderate risk	High risk
White Box, Yellow Box, Blakelys Red Gum, Grassy Woodland, and Dryland Native Grass	1.9	4.9
Non-TEC	1.9	3.5

Refer to *Technical Report 1 – Biodiversity Development Assessment Report* for more information on impacts to KFH and aquatic species, GDEs and wetlands.

With regards to licensed groundwater users, Section 17.3.3.2 provides an overview of the registered bores within the surface water and groundwater study area. Further details are provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment*.

17.4. Potential impacts – construction

17.4.1. Water supply and management

It is estimated that about 565 megalitres of water would be required for construction. This includes 498 megalitres of non-potable water and 67 megalitres of potable water. Water would be required during construction for:

- dust suppression for cleared transmission line structure sites and stockpiles of excavated materials
- concrete batching at construction compounds to construct transmission line structure foundations and substations
- civil work associated with substation construction
- general worker facilities at construction compounds and the Tumbarumba accommodation facility (AC1).

The water source is dependent on the location and nature of the construction activity and whether potable or non-potable water is required. Water sources would include:

- construction sedimentation basins
- farm dams
- rainwater tanks
- council standpipes or connection to council water supply systems
- groundwater bores
- purchase of water allocations from existing water users.

Where possible, non-potable water would be sourced from construction sedimentation basins and farm dams in agreement with the relevant landowners. However, these sources of water would not meet all the non-potable requirements in all locations. A more predictable and likely source of non-potable water would be the temporary purchase of water allocations from other water users. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for further discussion on the temporary purchase of existing water allocations from existing users.

The Water Management (General) Regulation 2018 specifies procedural, technical and licence requirements, and exemptions under the WM Act. If groundwater extraction or dewatering is required throughout the project, depending on the volume per year, the project may be exempt from a WAL. Under this regulation, a WAL or a water use approval are not required if groundwater extraction (such as for excavation to construct or maintain a building, road, or infrastructure) is less than three megalitres in any one water calendar year (commencing on 1 July each year). It is not anticipated a WAL would be required for this project. However, if it is required during construction, the Water Management (General) Regulation 2018 requirements would be adhered to.

The total volume of non-potable water required for construction is between 0.006 and 0.16 per cent of the total volume of water allocated under the WSPs in the project footprint. As such, the impact of the project on non-potable water users and water availability would be negligible.

Potable water would be sourced from council standpipes via water carts and taken to the construction compound locations, or from direct connections to council water supply systems as required.

Wastewater would be generated from the construction compounds, Tumbarumba accommodation facility (AC1) and other ancillary facilities and support sites. The total annual volume of wastewater generated during construction is expected to be approximately 8.81 megalitres. The majority of this is expected to be generated from the Tumbarumba accommodation facility (AC1) at about 7.52 megalitres per year. Proper management and disposal of wastewater is essential in protecting the health and quality of surrounding waterways and environment. As discussed in Chapter 4 (Project description - construction), wastewater treatment facilities may be established to treat wastewater from amenities at the Gregadoo Road compound (C06) and the Bannaby 500 kV substation compound (C12) in lieu of transporting offsite for processing. For all other construction compounds, wastewater would be stored in a suitably sized tanks and taken to a licensed facility for disposal at regular intervals during construction. Wastewater generated at the Tumbarumba accommodation facility (AC1) would require a connection into the town sewerage network. The wastewater generated by the Tumbarumba accommodation facility (AC1) over the construction period of the project is expected to be within the capacity of the Tumbarumba Sewage Treatment Plant.

17.4.2. Surface water

17.4.2.1. Impacts associated with water quality, erosion and sedimentation

Surface water quality impacts have the potential to occur during construction activities such as vegetation clearance; construction of access tracks, laydown and staging areas; establishment of the worker accommodation facility and construction compounds; material storage; transmission line and substation construction; and installation of waterway crossings.

These activities have the potential to result in soil erosion and subsequent deposition of sediment into downstream waterways (refer to Chapter 16 (Soils, geology and contamination) for further information on soil erosion).

Impacts on water quality could result from:

- elevated levels of contaminants from areas of environmental concern (AECs) (refer to Chapter 16 (Soils, geology and contamination) for a detailed list of AECs)
- nutrients (nitrogen and phosphorus) commonly present in agricultural areas that may become mobilised from disturbance of agricultural land for construction work
- gross pollutants such as paper and plastic packaging and materials from material use on construction sites and general construction staff litter
- sediment from vegetation and topsoil clearing, soil excavation, movement and storage and stormwater runoff through disturbed sites
- acid sulfate soil (however, there is a low potential of acid sulfate soils or saline soils exposure in low-lying areas of temporary or permanent flooded land)
- accidental spills of chemicals, fuels, hydrocarbons and heavy metals from use, refuelling and maintenance of equipment and construction machinery
- construction materials from stockpiles being transported into waterways
- tannins released during vegetation removal
- concrete dust or other pollutants from concrete, which may be transported to nearby waterways in surface water runoff after the first rainfall event.

The potential magnitude of impact, sensitivity of the receiving environment and impact significance without mitigation would vary for the construction activities described above and would be highly dependent on the proximity of work to waterways and the type of waterway (ie stream order) potentially impacted. Activities that would result in an impact of high significance without mitigation would typically be within 50 to 200 metres of a waterway, ie the waterway buffer zones included in Table 17-2. Activities located outside of this range would likely result in an impact of negligible to moderate significance without mitigation.

Table 17-11 provides a summary of the proposed construction activities and impact significance without mitigation.

Table 17-11 Water quality, erosion risk and sedimentation impacts to surface water

Project component	Impact magnitude	Sensitivity	Impact significance without mitigation
Transmission line structures	• low erosion risk due to relatively small area of earthwork • moderate risk to water quality given volume of earthwork and concreting	• low to high depending on proximity to waterways and soil erosion risk	• low to high depending on location
Transmission line easement clearance	• high erosion risk due to vegetation disturbance • low risk to water quality as impacts likely to be minor and localised	• low to high depending on proximity to waterways and soil erosion risk	• low to high depending on location
Proposed Gugaa 500 kV substation	• moderate erosion risk given volume of earthwork • high risk to water quality due to volume of earthwork and concreting	• moderate for erosion and sedimentation due to proximity to waterways and soil erosion risk • low for water quality due to not being located close to a Strahler 4th order and above waterway	• moderate

Project component	Impact magnitude	Sensitivity	Impact significance without mitigation
Modification of Wagga 330 kV substation	• low erosion risk given size of modification and existing environment • low risk to water quality given scale of work	• low based on not being located close to a waterway and soil erosion risk	• negligible
Modification of Bannaby 500 kV substation	• low erosion risk given size of modification and existing environment • low risk to water quality given scale of work	• moderate sensitivity as it is located within Sydney Drinking Water Catchment	• low
Telecommunications hut	• low risk to water quality due to impacts likely to be minor and localised	• low due to proximity to waterways	• negligible
Access tracks	• low to moderate erosion risk depending on location • moderate risk to water quality given extent of access tracks and the type of work	• low to high depending on proximity to waterways and soil erosion risk	• low to high depending on location
Construction compounds	• low to moderate erosion risk depending on size of construction compound • moderate risk to water quality given activities likely to be carried out at the construction compound and types of material stored	• low or high for erosion and sedimentation depending on proximity to waterways and soil erosion risk • low for water quality for all construction compounds except for Snowy Mountains Highway compound (C02) which is located within the Vegetated Riparian Zone of a Strahler 3rd order waterway	• low to high depending on location
Work accommodation facility	• moderate erosion risk based on size of facility • moderate risk to water quality given generation of domestic wastewater	• moderate for erosion and sedimentation based on proximity to waterways and soil erosion risk • low for water quality due to not being close to any environmentally sensitive features	• moderate for erosion and sedimentation • low for water quality
Utility connections, adjustments and protection	• low risk to water quality due to scale of work	• low to high depending on proximity to waterways and soil erosion risk	• low to high depending on location

To manage stormwater, sedimentation basins may be required at some construction compounds. Water from sedimentation basins would be discharged onsite in accordance with *Managing Urban Stormwater: Soils and Construction - Volume 1* (Landcom, 2004) or could be reused during construction eg dust suppression. With the implementation of the sedimentation basins and the mitigation measures listed in Section 17.6.3, water quality impacts from the construction activities described above are anticipated to be short-term and limited in extent at sensitive receiving environments.

The project footprint also crosses several major waterways identified by the SEARs. These waterways include Tumut River, Murrumbidgee River, Lachlan River, Wollondilly River and Tarlo River. Some construction activities within 200 metres of these waterways would be considered high risk and require the preparation and implementation of site-specific Erosion and Sediment Control Plans (ESCPs). However, the area that could be potentially impacted by construction of the project would be relatively small in comparison to the associated river catchments and with the implementation of mitigation measures listed in Section 17.6.3, the overall impacts are expected to be minor.

In addition, the project footprint is also located within the catchments of the dams identified by the SEARs, ie Blowering Dam, Burrinjuck Dam, and Wyangala Dam. For Blowering and Burrinjuck dams, the project footprint is located about 1.3 kilometres from the dams and crosses a small section of these dam catchments. For Wyangala Dam, the project footprint is located within the upper catchment, about 69 kilometres upstream of the dam. Given the distances, the small area of catchment potentially affected, and with the implementation of mitigation measures listed in Section 17.6.3, the risk of impact to Blowering and Burrinjuck dams is considered low and there is unlikely to be any impact on Wyangala Dam.

Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for further discussion on the waterways and dams identified by the SEARs.

17.4.2.2. Impacts associated with changes to geomorphology

Potential impacts on geomorphic conditions resulting from construction activities could include:

- changes to flow paths
- changes to flow conditions and channel shape
- sediment deposition (refer to Section 17.4.2.1).

The installation of waterway crossings for vehicle and equipment access may contribute to temporary changes to flow paths, channel shape and flow conditions. It is likely that the waterways impacted would be the smaller order ephemeral streams. Due to the likely number of waterway crossings, the magnitude of this impact would be moderate with the sensitivity of the receiving environment being low to high depending on erosion risk. As such, the potential significance of the impact without mitigation would be low to high depending on location.

Construction of transmission line structures would avoid higher order perennial streams (ie Strahler 4th order and higher) but may be unable to avoid disturbance to lower order ephemeral streams (ie Strahler 1st to 3rd order). Potential impacts on these smaller waterways could include changes to flow paths and direct disturbance to banks and channels. Due to the number of transmission line structures needed for the project, the magnitude of this impact would be moderate with the sensitivity of the receiving environment being low to high depending on proximity to waterways and soil erosion risk. As such, the potential significance of the impact without mitigation would be low to high depending on location.

Several construction compounds and the Tumbarumba accommodation facility (AC1) are intersected by or are located immediately adjacent to Strahler 1st and 2nd order streams. The construction compounds include Gregadoo Road (C06), Maragle 500 kV substation (C05), Yass substation (C10), Memorial Avenue (C14) and Bowmans Lane (C15) construction compounds. Snowy Mountains Highway compound (C02) is located adjacent to a Strahler 3rd order stream (ie Killarney Creek). There is a risk that construction of the construction compounds and Tumbarumba accommodation facility (AC1) near these lower order streams could result in changes in flow and bank stability, which in turn would lead to impacts to the geomorphology of the affected waterway. As the construction compounds would vary in size, the impact magnitude would

be low to moderate depending on the size of the construction compound and the type of activity undertaken at each construction compound. The sensitivity would be low to high depending on the location of the construction compounds relative to waterways. Higher Strahler order waterways are generally more sensitive as they are more likely to be perennial and contain KFH. Therefore, the impact significance would be low to high depending on location. With the implementation of the mitigation measures listed in Section 17.6.3, impacts on geomorphic conditions from construction activities are anticipated to be short-term and limited in extent at sensitive receiving environments.

Refer to Chapter 18 (Hydrology and flooding) for further information on potential impacts on water flow and flooding relating to changes to flow paths and conditions. Refer to Chapter 8 (Biodiversity) for further information on potential impacts from water flow during construction on flora and fauna.

17.4.2.3. Neutral or beneficial effect assessment

NorBE assessments apply to all releases of water, wastewater and other contaminants from the sites during construction within the Sydney Drinking Water Catchment that may affect water quality.

As shown on Figure 17-1, about 65 kilometres or about 17 per cent of the length of the project footprint traverses the Sydney Drinking Water Catchment, east of Gurrundah. This includes the Bannaby 500 kV substation, which is proposed to be modified by the project. As such, a NorBE assessment has been undertaken for construction of the project in accordance with the *Neutral or Beneficial Effect on Water Quality Assessment Guideline* (WaterNSW, 2022).

Potential construction impacts from the project that may affect water quality within the Sydney Drinking Water Catchment are mainly associated with erosion and sedimentation risks or spills. While the transmission line would cross waterways including the Wollondilly River, about 80 per cent of the length of the transmission line corridor in the Sydney Drinking Water Catchment is located on cleared, undulating agricultural land – which reduces the risks of sedimentation and erosion impacts. In steeper and vegetated land within the Sydney Drinking Water Catchment, retaining vegetation in steep areas (where the required clearances to the transmission line can be maintained) would be implemented to reduce sedimentation and erosion impacts.

The NorBE assessment concluded that the project is expected to have an overall neutral impact on water quality during construction. This was based on the implementation of the mitigation measures detailed in Section 17.6.3 and because the majority of impacts would be contained within the project footprint. Any work within the waterway buffer zones would have a moderate or high risk of sedimentation and erosion impacts and would require the preparation of site-specific ESCPs.

17.4.3. Groundwater

17.4.3.1. Impacts to groundwater flow paths/recharge, levels and quality

Potential impacts on groundwater levels may occur where the excavations for transmission line structures and substations intercept groundwater, and dewatering is required. Piling for transmission line structures would be to a maximum depth of 27 metres and earthwork at substations would be to a maximum depth of five metres.

Shallow excavations may also intercept perched or high unconfined aquifers[15], or groundwater near waterways in alluvial areas with high connectivity between groundwater and surface water. As such, dewatering may be required within excavated areas, which could potentially impact the flow paths of the surrounding areas, resulting in localised changes in groundwater levels.

Groundwater mounding or changes to the behaviour of infiltration and groundwater recharge may also occur during construction. Groundwater mounding may occur where soils are compacted or vegetation is removed. This can change the permeability of the sediments, impacting groundwater flow and resulting in groundwater level rise. Similarly, changes to the behaviour of infiltration and groundwater recharge may also occur due to vegetation removal, compaction of soils and construction of the transmission line structures.

The need and specific locations for blasting has not yet been confirmed. However, if blasting is required, this has the potential to fracture the surrounding rocks and alter groundwater flow paths. This could lead to mobilisation of existing groundwater contamination plumes and saline groundwater or increased seepage to the groundwater aquifer from overlying contaminated sediments.

Overall, substation construction and/or modification, which would involve earthworks to a maximum depth of five metres, would have the potential to cause the greatest impact on groundwater. Without mitigation, substation construction and/or modification is likely to have a moderate impact significance to groundwater flow paths/recharge and groundwater levels. This is primarily due to the moderate to high magnitude of the work involving large areas that need to be excavated, cleared, filled, compacted, and concreted. Substation construction and/or modification is predicted to have minimal impact on groundwater quality with the potential significance of the impact without mitigation being low.

All other activities during construction would have negligible to low potential impact on groundwater quality without mitigation. While the structures may require piling up to 27 metres deep, they would only require a relatively small surface area to be impacted, which is unlikely to restrict groundwater flows or alter water quality.

Overall, the assessment concluded that ‘no more than minimal harm’ to groundwater resources is expected in accordance with the *NSW Aquifer Interference Policy* minimal impact considerations. Therefore, an aquifer interference approval is not considered to be required. Further information regarding this assessment is provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment.*

17.4.3.2. Impacts to groundwater users

Construction activities can potentially interface with the groundwater in nearby bores. This would mainly relate to the construction of foundations for the transmission line structures, which require excavation to five metres below ground level, or piles, which may extend greater than 20 metres below ground level. This could impact existing groundwater users, particularly where groundwater levels are shallow.

While the magnitude of this impact would be low due to it being localised, the sensitivity of the receiving environment could be low to moderate based on depth to groundwater and location. The sensitivity of the receiving environment is dependent on the location of the bore and depth to groundwater. If bores are

[15] Perched aquifers are aquifers which occur above the regional water table. Whereas unconfined aquifers are aquifers that do not have a confining layer like a clay layer or solid rock which restricts flow from one aquifer to another.

located outside the project footprint, the sensitivity would be low. If bores are located within the project footprint, the sensitivity would be high, particularly if groundwater is also shallow (ie less than five metres).

As such, the potential significance of the impact without mitigation to groundwater users during construction would be low to high depending on the location and existing groundwater level. With the implementation of mitigation measures detailed in Section 17.6.3, it is anticipated that potential impacts would be minimised and/or addressed adequately.

17.5. Potential impacts – operation

17.5.1. Water supply and management

Non-potable water would be required during operation for maintenance activities and the operation of the proposed Gugaa 500 kV substation, Wagga 330 kV substation and Bannaby 500 kV substation.

The proposed Gugaa 500 kV substation would require 62 kilolitres of water per year, which is anticipated to be sourced from a rainwater tank that allows for water to be trucked in for top-up if required. The other substations would each require up to around 27 kilolitres of water per year which would be sourced from existing water supply arrangements.

Given the very low annual demands from each substation, the operation of the project would have negligible impact on water availability.

During operation, wastewater would only be generated from the substations. It is estimated that the annual total volume of wastewater generated would be 112.8 kilolitres. No additional infrastructure that produces wastewater would be constructed at either the existing Bannaby 500 kV substation or Wagga 330 kV substation. A free-standing toilet is planned for the proposed Gugaa 500 kV substation.

Wastewater from the substations would be disposed via connection to a town sewerage system or an on-site aerated water treatment system. Any contaminated water would be captured separately and transported to an appropriate waste disposal facility.

17.5.2. Surface water

17.5.2.1. Impacts associated with water quality, erosion and sedimentation

Surface water quality impacts have the potential to occur during operation of the project. These impacts may include:

- soil erosion and sedimentation from vegetation removal, maintenance activities and operation of permanent access tracks
- accidental spills of chemicals, fuels and heavy metal from refuelling and operation of equipment and vehicles
- gross pollutants such as paper and plastic packaging brought by maintenance and operational crew that were not properly disposed of
- an increase in stormwater runoff carrying additional nutrients and chemicals to waterways.

Similar to construction, the potential magnitude of impact, sensitivity of receiving environment and impact significance (without mitigation) would vary and would be highly dependent on the location of the work or permanent infrastructure to waterways and the type of waterway potentially impacted.

During vegetation removal associated with maintenance of the transmission line easement, there is the potential for erosion and sedimentation impacts on water quality. While the magnitude of impact is considered low due to the likelihood that groundcover would be maintained, the sensitivity of the receiving environment is considered low to high depending on proximity to waterways and soil erosion risk. As such, the potential significance of the impact without mitigation would be low to high depending on location.

The potential for erosion and sedimentation impacts on water quality from use of the permanent access tracks and waterway crossings would be related to increased local runoff, which may increase erosion and sediment conveyancing capacity. The magnitude of this impact would be low to moderate with the sensitivity of the receiving environment being low to high depending on proximity to waterways and soil erosion risk. As such, the potential significance of the impact without mitigation would be low to high depending on location.

Other water quality impacts (related to spills of fuels and chemicals and other pollutants) from the maintenance of transmission line structures and operation of permanent access tracks are likely to be minor, localised, and temporary. However, as the sensitivity of the receiving environment is dependent on proximity to waterways and soil erosion risk, the potential significance of these impacts without mitigation would also be considered low to high depending on location.

During operation of the modified Bannaby 500 kV substation, there is potential for water quality impacts to occur due to the impervious area being increased by about 1.62 hectares and the potential for stormwater runoff to carry pollutants to an unnamed tributary to Wollondilly River (ie within 40 metres of the waterway's banks). As the sensitivity of the receiving environment is considered to be moderate, the potential significance of the impact without mitigation would also be moderate. Scour protection would be included in the design of any infrastructure that is within a waterway channel. The design would incorporate features that minimise impact on flow conditions and natural functioning of the waterway and be in accordance with *Controlled activities - Guidelines for riparian corridors on waterfront land* (DPE, 2022c), in addition to further guidelines and legislation outlined in Section 17.2.1.

The concrete bench established for the proposed Gugaa 500 kV substation or deep piles constructed for the transmission line structures are unlikely to restrict water levels or flow directions or change water quality in the long-term. A moderate impact (magnitude) is expected for the construction of the proposed Gugaa 500 kV substation given the significant volumes of earthworks. However, it is considered to have a low sensitivity as it is not close to a waterway.

Impacts on water quality from the operation of other substations and the telecommunications hut are considered to have a low impact significance.

Operational water quality impacts would be managed through Transgrid's existing EMS, as detailed in Chapter 26 (Environmental management).

17.5.2.2. Impacts associated with changes to geomorphology

Geomorphology impacts from operation of the project are likely to be limited to the modified Bannaby 500 kV substation, permanent waterway crossings and access tracks close to waterways.

The modification of Bannaby 500 kV substation would be carried out within 'waterfront land' of a nearby unnamed tributary to Wollondilly River (ie within 40 metres of the waterway's banks). As such, the operation of the modified Bannaby 500 kV substation has the potential to impact the geomorphology of this waterway through erosion of channels due to the increased impervious area, which would generate larger

volumes of stormwater runoff. As the sensitivity of the receiving environment is considered to be moderate, the potential significance of the impact without mitigation would also be moderate. Scour protection would be included in the design of any infrastructure that is within a waterway channel. The design would incorporate features that minimise impact on flow conditions and natural functioning of the waterway. For work within or near waterways, the following guidelines would be considered and adhered to where relevant and practicable:

- *Controlled activities - Guidelines for riparian corridors on waterfront land* (DPE, 2022c)
- *Controlled activities - Guidelines for watercourse crossings on waterfront land* (DPE, 2022b)
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003)
- *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013).

Permanent waterway crossings and access tracks close to waterways that would remain after construction may further alter the flow and bank stability and consequently affect the geomorphology of the waterways. The number of waterway crossings and access tracks and their locations would be determined during detailed design. As detailed in Section 17.4.2.2, the waterways likely to be impacted are the smaller order ephemeral streams. The significance of the impacts would depend on site-specific conditions including the bank conditions after construction, erosion risk, flow rates and sensitivity of the receiving environment. Potential impacts on waterways would need to be considered on a case-by-case basis once the detailed design is confirmed.

17.5.2.3. Neutral or beneficial effect assessment

Similar to construction, a NorBE assessment has been undertaken for the operation of the project in accordance with the *Neutral or Beneficial Effect on Water Quality Assessment Guideline* (WaterNSW, 2022).

The Bannaby 500 kV substation, which is within the Sydney Drinking Water Catchment, would include a new concrete bunded bench area on which electrical transmission infrastructure would be installed. Any runoff or spills on the bunded bench area would be captured and treated before either discharge off-site (eg uncontaminated runoff) or disposal as per existing operations.

The NorBE assessment concluded that the project is expected to have an overall neutral impact on water quality during operation. This was based on the implementation of the mitigation measures detailed in Section 17.6.3 and existing Transgrid procedures for work near waterways as per the *Environmental Handbook* (Transgrid, 2021d) to mitigate water quality impacts. Refer to *Technical Report 12 – Surface Water and Groundwater Impact Assessment* for further information.

17.5.3. Groundwater

Localised changes to groundwater flow paths could occur during operation due to piles for the transmission line structures. However, the deep piles are unlikely to restrict groundwater flow paths in the long-term.

Groundwater recharge and levels could also be impacted during operation. New or increased impervious surfaces at the proposed Gugaa 500 kV substation, modified Bannaby 500 kV substation and transmission line structures could potentially reduce infiltration of rainfall and localised recharge to the groundwater resources. This could also affect groundwater levels. Surface runoff may transport the water to another area before infiltration/recharge occurs.

Groundwater quality may potentially be impacted through degradation of the infrastructure foundation (eg piles) or footing material if inappropriately selected to withstand the existing properties of the groundwater (and soil) environment (eg salinity). This impact would be avoided by selecting materials that would not be impacted by salinity, where possible. Maintenance activities may also impact groundwater quality through the infiltration of accidental spills of chemicals, fuels and heavy metals from refuelling and operation of equipment and vehicles.

The progressive construction of new or increased impervious areas at the proposed Gugaa 500 kV and modified Bannaby 500 kV substations may result in the mobilisation of underlying salts and contaminants to the aquifers. This could occur through the disturbance of contaminated soils or problem soils (eg saline, potential acid sulfate soils or acid sulfate soils) as part of maintenance activities.

Overall, the main impact on groundwater resources during operation would be from localised changes to flow paths and changes to groundwater recharge. While the magnitude of this impact would be low due to it being localised, the sensitivity of the receiving environment could be low to moderate depending on depth to groundwater and location. As such, the potential significance of the impact without mitigation would be considered negligible to low.

For all other potential impacts described above and impacts on groundwater users, the potential significance of the impact without mitigation would be considered negligible.

Overall, similar to construction, no more than minimal harm is expected on groundwater resources during operation of the project and an aquifer interference approval would not be required.

17.6. Management of impacts

17.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach as detailed in Chapter 26 (Environmental management). During construction of the project, a range of measures would be specified in the Soil and Water Management Plan (SWMP) prepared as part of the Construction Environmental Management Plan (CEMP). These measures are based on industry best practice to minimise potential impacts on waterways. The SWMP will set out measures to mitigate and manage impacts on water quality, including considerations for soil erosion and water pollution during construction and how these risks would be managed.

The SWMP would include site-specific or activity-specific ESCPs depending on the erosion risk. The SWMP and ESCPs would be prepared in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom, 2004) or other comparable guidelines.

Site-specific SWMPs may be developed for substation sites, construction compounds, and the worker accommodation facility due to the greater risk to water quality than just erosion and sedimentation. Additional site-specific SWMPs may also be prepared where similar risks are identified.

A Water Quality Monitoring Plan (WQMP) would also be prepared to describe the monitoring to be conducted during certain construction activities to facilitate a response to a potential water quality impact event. The WQMP objectives and guideline values would be specific to the major catchments and consider relevant legislation and include surface water and groundwater monitoring depending on the construction activity.

A spill response procedure would be developed to manage spill events during construction and operation. The procedure would include spill control measures and emergency response measures.

17.6.2. Avoidance and minimisation of impacts

Approaches to avoid and minimise surface water and groundwater quality impacts were considered in development of the project. These approaches included:

- selecting appropriate construction methodologies to minimise the requirement for dewatering during piling activities
- refining the project footprint to avoid and/or minimise unnecessary or substantial crossings of waterways, where practicable.

17.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts on surface water and groundwater are listed in Table 17-12. Chapter 16 (Soils, geology and contamination) provides additional mitigation measures that would be implemented to minimise impacts on waterways from contamination, erosion and sedimentation.

Table 17-12 Summary of surface water and groundwater mitigation measures

Reference	Impact	Mitigation measures	Timing	Relevant location
SW1	Water quality, erosion risk – erosion and sedimentation	An ESCP will be developed and implemented in consultation with a Certified Professional in Erosion and Sediment Control during construction for activities and areas that are considered higher risk. The plan will detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), and Volumes 2A (DEC, 2008b) and 2C (DECC, 2008a), commonly referred to as the 'Blue Book' • *Best Practice Erosion and Sediment Control* (IESCA, 2008) • Transgrid's Environmental Guidance Notes • Guidelines for controlled activities (Riparian corridors (DPE, 2022c) and Watercourse crossings (DPE, 2022b))	Construction	All locations
SW2	Water quality and geomorphology	Design of scour protection will be included for any infrastructure that is within a waterway channel. The design will incorporate features that minimise impact on flow conditions and natural functioning of the waterway, where possible. For work within or near waterways consider and adhere to the following guidelines • Guidelines for controlled activities (Riparian corridors (DPE, 2022c) and Watercourse crossings (DPE, 2022b)) • *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003) • *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013).	Detailed design and construction	Waterways
SW3	Surface and groundwater quality - monitoring	Water quality monitoring will be implemented to establish baseline water quality conditions at waterways of high sensitivity that may be impacted by nearby by construction and to detect any changes in water quality that may be attributable to the project during construction. The frequency, location and duration of sampling will be detailed in the monitoring program. Monitoring locations will include: • at a minimum two monitoring locations (one located upstream and one downstream of the transmission line crossing) for waterways with a Strahler 4th order or higher within the Sydney Drinking Water Catchment where construction activities within 200 metres of the waterway will be carried out and could result in impacts • monitoring for total dissolved solids, total suspended solids, total nitrogen, and total phosphorus.	Detailed design and construction	All locations
SW4	Water supply	Water supply options and management will be undertaken in accordance with agreements between the construction contractors and relevant water users and suppliers.	Detailed design and construction	All locations

Reference	Impact	Mitigation measures	Timing	Relevant location
SW5	Groundwater flow paths, levels and users	Alternative construction methodologies will be investigated and implemented as required to minimise impacts to GDEs and registered groundwater bores, if identified to be directly impacted during detailed design. Make good provisions will need to be made to the groundwater user(s) for bores that will be affected.	Detailed design and construction	All locations

17.6.4. Managing residual impacts or uncertainties

Following the implementation of mitigation measures identified in Table 17-12 and the implementation of the SWMPs, ESCPs and WQMP, further impacts on surface water and groundwater identified in this assessment are not anticipated and residual impacts would be minimal.

Uncertainties regarding groundwater levels and conditions within the project footprint would continue to be resolved through additional geotechnical investigations and addressed in detailed design.

18. Hydrology and flooding

This chapter provides a detailed summary of the assessment of potential hydrology and flooding impacts of the project. The full assessment is provided in *Technical Report 11 - Hydrology and Flooding Impact Assessment* (Aurecon, 2023c).

18.1. Environmental Assessment Requirements

18.1.1. Secretary's Environmental Assessment Requirements

Table 18-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to hydrology and flooding impacts of the project and where these requirements are addressed in this EIS.

Table 18-1 Secretary's Environmental Assessment Requirements – Hydrology and flooding

Reference	SEARs	Where principally addressed in the EIS
Water and soils		
Key issues	The EIS must address the following matters: • an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Goobarragandra River, Lachlan River, Murrumbidgee River, Tarlo River, Tumut River, Wollondilly River, Yass River and Blowering Dam, Burrinjuck Dam and Wyangala Water Catchment Areas, having regard to NSW Water Quality Objectives;	Refer to Chapter 17 (Surface water and groundwater quality).
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Refer to Chapter 17 (Surface water and groundwater quality) and Chapter 23 (Waste) provides further information on wastewater disposal arrangements.
	• an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the NSW Aquifer Interference Policy and relevant Water Sharing Plans;	Refer to Chapter 17 (Surface water and groundwater quality).
	• an assessment of the potential flooding impacts and risks of the project	Section 18.3.3 and Section 18.4 provide an assessment of the potential flooding impacts and risks of the project during construction and operation.
	• where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts on the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013); and	Refer to Chapter 8 (Biodiversity) and Chapter 17 (Surface water and groundwater quality).
	• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	Refer to Chapter 16 (Soils, geology and contamination) and Chapter 17 (Surface water and groundwater quality).

18.2. Assessment approach

18.2.1. Legislation and policy context

The assessment considered relevant state legislation, policies and guidelines, including:

- *Water Management Act 2000*
- *NSW Floodplain Development Manual* (Department of Infrastructure, Planning and Natural Resources, 2005)
- *Australian Rainfall and Runoff (2019) Guideline* (ARR 2019) (Australian Government: Geoscience Australia, 2019).

18.2.2. Methodology

The hydrology and flooding assessment involved:

- reviewing relevant legislation, policies and guidelines
- collecting data from publicly available resources such as Light Detection and Ranging data (LiDAR) and weather data from the Bureau of Meteorology
- carrying out a desktop review of existing flood studies
- carrying out hydrological and hydraulic flood modelling for regional models (project footprint) and local models (construction compounds, accommodation facilities, substations and telecommunications hut)
- assessing the impacts of flooding on the project as well as the project's impacts on hydrology and flooding, during construction and operation
- identifying mitigation measures to reduce the identified impacts.

The hydrological and hydraulic flood modelling for the regional model focused on assessing the flood risk and immunity for the transmission line structures and access tracks across the project footprint for a 1% annual exceedance probability (AEP) flood event. This is appropriate for the typical level of flood risk for these assets.

Modelling for the local flood models focused on assessing the flood risk for the following design flood immunity requirements:

- construction compounds (which includes potential helipad locations at some construction compounds as outlined in Chapter 4 (Project description – construction)) – 1 in 20 year event (5% AEP)
- worker accommodation facilities – 1 in 50 year event (2% AEP)
- substations – 1 in 100 year event (1% AEP) and probable maximum flood (PMF)
- telecommunications hut – 1 in 100 year event (1% AEP).

The flood immunity requirement for the substations and telecommunications hut was selected to align with Transgrid's design standards and the construction compounds and worker accommodation facilities was based on industry practice.

Modelling incorporated a climate change assessment and a probable maximum precipitation assessment for an understanding of potential worst-case impacts. It also assessed catchment areas using velocity and depth to determine their flood hazard classifications in accordance with ARR 2019 (refer to Figure 18-1).

The hydrology and flooding study area encompasses the project footprint and the three main hydrological catchments intersected by the project footprint, refer to Figure 18-2. These are the Murrumbidgee River, Lachlan River and the Wollondilly River catchments and all waterways within these catchments. *Technical*

Report 11 – Hydrology and Flooding Impact Assessment does not list the Upper Murray River and Hawkesbury-Nepean River catchments in its analysis as per Chapter 17 (Surface water and groundwater quality) and Chapter 16 (Soils, geology and contamination) because it only presents the specific catchments that interact with the project based on the river gauges used in the assessment. This includes the Wollondilly River catchment and the local catchment for the Tumbarumba accommodation facility (AC1), which are both tributaries of the Hawkesbury-Nepean River and Upper Murray River catchments, respectively. The hydrology and flooding study area is displayed in Table 18-2.

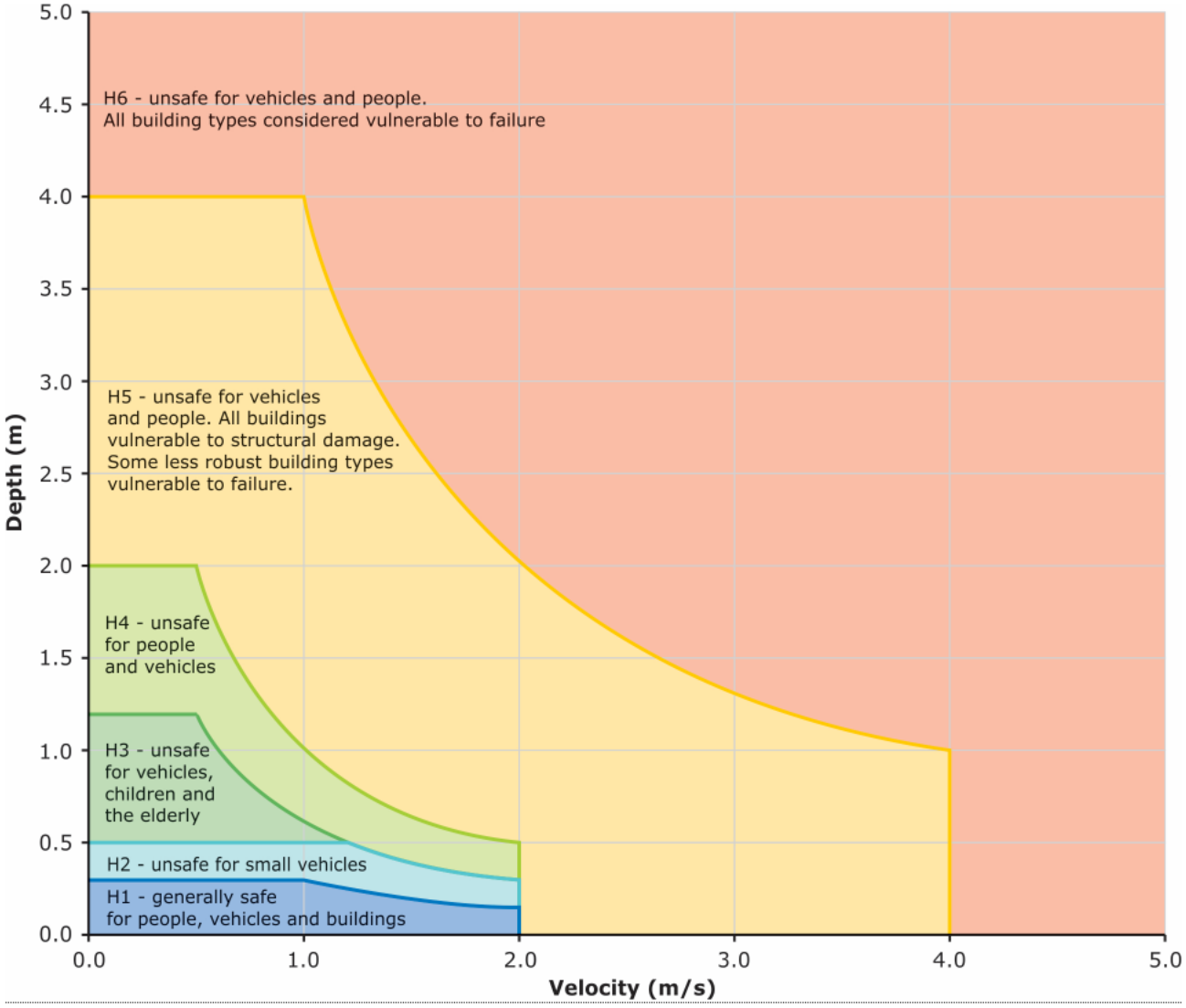
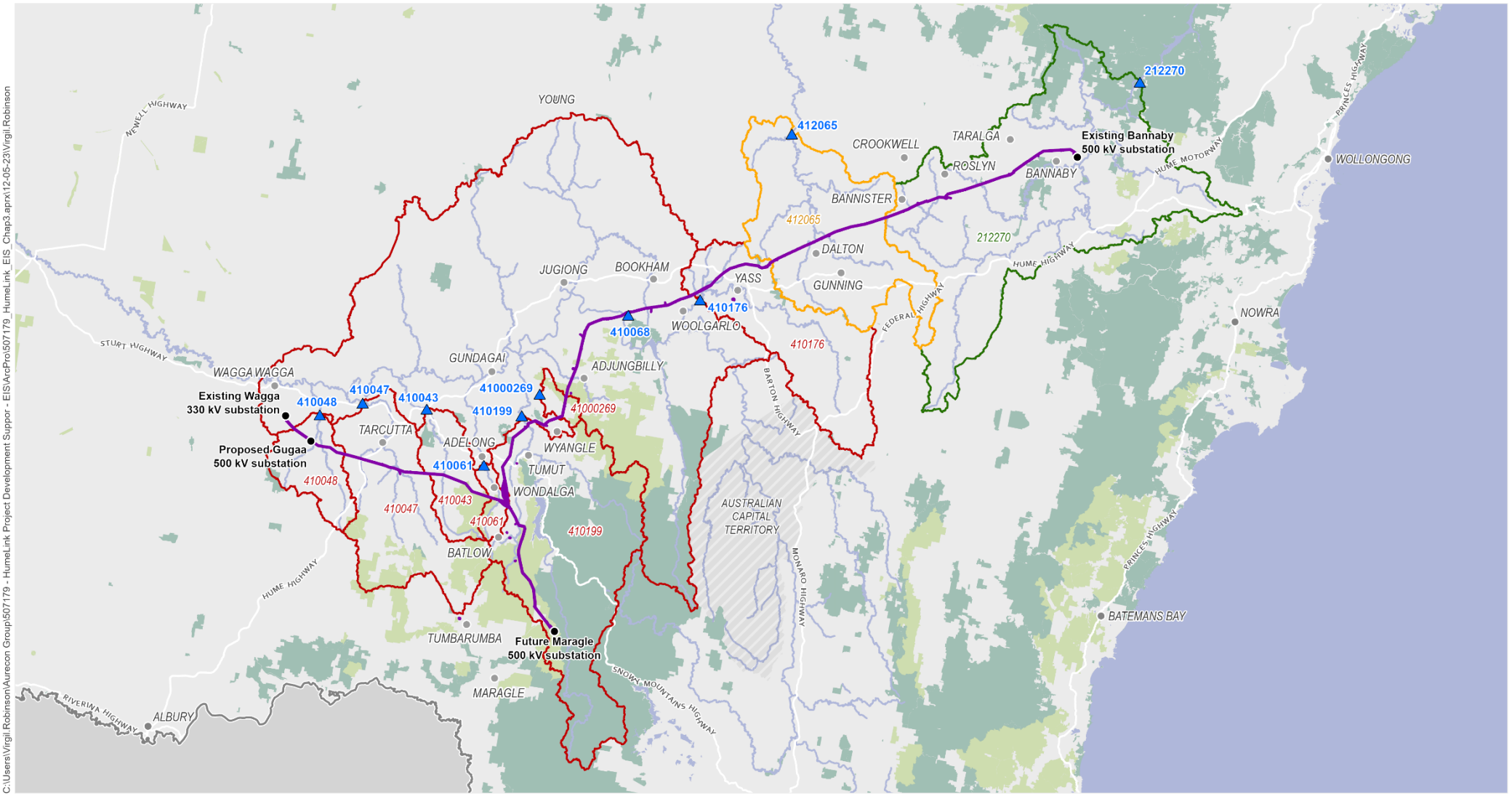


Figure 18-1 Flood hazard classifications as per ARR 2019

Detailed discussion of the methodology for the hydrology and flooding assessment is provided in *Technical Report 11 - Hydrology and Flooding Impact Assessment*.



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

1:1,200,000

0 25 50km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 18-2: Catchments, waterways and waterbodies that intersect the project footprint

18.3. Existing environment

18.3.1. Catchment characteristics

The primary catchments in the hydrology and flooding study area consist of the Murrumbidgee River, Lachlan River and Wollondilly River. Each catchment comprises a number of sub-catchments, which were defined by gauge stations. The flow gauge stations adopted for the analysis and the land use characteristics for each sub-catchment are described further in *Technical Report 11 - Hydrology and Flooding Impact Assessment.*

Table 18-2 Catchment characteristics

Catchment	Sub-catchment	Description of catchment
Murrumbidgee River catchment	Tumut River at Upstream Nimbo offtake (gauge #410199)	About 85 per cent of the sub-catchment is covered by dense forest. Major water storages such as the Blowering Dam, Talbingo Dam and Jounama Dam are located east of the project. Storage areas are connected by the Tumut River, which is the primary waterway for the catchment.
	Brungle Creek at Red Hill no.2 (gauge #41000269)	The upper reaches of the catchment are covered by bushland and dense forest. Brungle Creek is the main waterway flowing down to flatter parts of the catchment.
	Hillas Creek at Mount Adrah (gauge #410043)	Upstream areas of the sub-catchment are mostly covered by Green Hills State Forest with the western downstream area covered by heavily vegetated nature reserve. Hillas Creek is the main waterway which is formed by the intersection of Yaven Yaven Creek and Nacki Nacki Creek.
	Tarcutta Creek at Old Borambola (gauge #410047)	Downstream areas of the sub-catchment are covered by bushland with areas of heavily vegetated forest areas across the upstream reaches. Tarcutta Creek is the main waterway draining the catchment.
	Kyeamba Creek at Ladysmith (gauge #410048)	This sub-catchment consists of mostly grasslands. Kyeamba Creek is the main waterway which is joined by O'Briens Creek.
	Adelong Creek at Batlow Road (gauge #410061)	The sub-catchment is mostly covered by grassland across the downstream areas and Green Hills State Forest across the upper reaches. Adelong Creek is the main waterway draining across lower flatter areas of the catchment.
	Yass River at upstream Burrinjuck Dam (gauge #410176)	The topography is relatively flat with upstream areas covered by patches of dense forest. Downstream areas are mostly covered with bushland and grasslands. Yass River is the main waterway for the sub-catchment.
Lachlan River catchment	Lachlan River at Narrawa (gauge #412065)	The topography is generally flat and mostly covered by grassland with few patches of forest areas. Lachlan River is the main waterway in the catchment.
Wollondilly River catchment[1]	Wollondilly River at Jooriland (gauge #212270)	The topography is typically flat and covered with open space grasslands. Few patches of vegetation are found in upstream areas with heavier vegetated forest area across the downstream areas. Wollondilly River is the main waterway draining the catchment. Warragamba Dam storage area is located about 10 kilometres downstream of the gauge station outlet.

Note:
1 The Wollondilly River catchment is a sub-catchment of the larger Hawkesbury-Nepean River catchment

18.3.2. Existing flooding characteristics

Regional flood maps are provided in Attachment C of *Technical Report 11 - Hydrology and Flooding Impact Assessment*.

Based on the hydraulic modelling during a 1% AEP event, the downstream area of the Murrumbidgee River catchment experiences widespread floodplain flow. The flood extent is about three kilometres wide with a flood hazard classification of H5 or H6 in accordance with ARR 2019 (refer to Figure 18-1). This extends from the towns of Gundagai to Wagga Wagga – a distance of about 100 kilometres. Murrumbidgee River tributaries such as Tarcutta Creek, Gocup Creek and Tumut River, which intersect the project footprint, experience shallow widespread flooding. Flooding within the upstream area of the Murrumbidgee River catchment during a 1% AEP event does not impact the project footprint given its significant distance south of the project near Billilingra.

The Lachlan River catchment tributaries mostly experience contained flow along the project footprint during a 1% AEP event. However, the project footprint intersection at Jerrawa Creek experiences widespread flooding with flood hazard ranging up to H6. The areas near Bredalbane and Gunning within the Lachlan River catchment also experience flooding, but are a substantial distance from the project footprint.

The project footprint crosses multiple tributaries at the upstream extent of the Wollondilly River catchment. Where they intersect the project footprint, flood flow is concentrated and contained within the gullies during a 1% AEP event. Further downstream away from the project footprint, Mulwaree River south of Goulburn and Wollondilly River east of Goulburn, experience major regional flooding with flow widths of about 1.8 kilometres and flood depths between eight and 10 metres, respectively. Flood hazard classification ranges from H2 to H6.

18.3.3. Flooding history

The flood history at key towns near the project footprint (Wagga Wagga, Adelong, Gunning and Yass) was obtained from existing flood studies and is summarised below.

18.3.3.1. Wagga Wagga

Wagga Wagga has experienced multiple large floods from the Murrumbidgee River catchment with flood levels exceeding 10.5 metres at the Hampden bridge gauge in 1852, 1853, 1870 and 1891. Following significant flooding in the 1950s, a levee was built to provide flood protection for the town of Wagga Wagga. After the construction of the levee, major flood events occurred in 1974, 2010 and 2012. The flood levels of events in 1974 and 2012 exceeded 10.5 metres at the Hampden bridge gauge. The levee provided adequate flood protection to stop inundation of the southern and main part of town for both flood events (WMA Water, 2018). Wagga Wagga has experienced flooding as recently as 2022.

18.3.3.2. Adelong

Adelong experienced major flooding in 1984, 2010 and 2012. The flood event in October 2010 reached a peak of 4.61 metres (equivalent to 1% AEP event) on the Batlow Road stream, which was the largest recorded flood level in the 70 years of gauge data. The flood was primarily confined to commercial properties on Tumut Street and at the northern end of Selwyn Street. Residential properties on Tumut Street also experienced above-floor flooding (Lyall & Associates, 2018).

The January 1984 and March 2012 flood reached a peak gauge height of 3.52 metres and 3.11 metres respectively, which reflected 2% AEP and 5% AEP events. The1984 flood caused minor flooding in property located along Tumut Street where the 2012 flood event was generally confined to the in-bank area of Adelong Creek.

18.3.3.3. Gunning

Gunning experienced major flooding in 2010 and 2012. During the 2012 event, floodwater inundated parts of the Gunning Showground, but there were no reports of properties experiencing above-floor inundation. At the Goulburn AWS telemetered gauge to the east of Gunning, 90 millimetres were recorded during the 2010 event and 123 millimetres were recorded during the 2012 event (Lyall & Associates, 2014).

18.3.3.4. Yass

The Yass River at Yass has experienced numerous flood events. The April 1870 flood event is one of the largest events in the town's history before official records began in 1915. The Bow Bridge and OHH Bridge, which were under construction, were both destroyed by the flood event. As a result, the Hume Bridge design level was raised by about 15 feet. After official records began in 1915, the town of Yass experienced its largest flood event in October 1959. During the 1959 event, the flood level peaked about four feet below the Hume Bridge. Based on the Yass Stream Gauge rating, it is estimated to have achieved a peak gauge height of 10 metres (WMA Water, 2016).

18.4. Potential impacts – construction

18.4.1. Impacts from construction activities on flood behaviour

The following construction activities have the potential to affect local flood behaviour:

- excavations for substation and transmission line structure foundations
- establishment of new and upgraded access tracks
- stockpiling of material
- modification of existing surface levels (such as filling) for construction compounds and the worker accommodation facility.

18.4.1.1. Substations, transmission line structures and access tracks

Construction activities at the transmission line structure sites would involve excavation up to five metres deep to install foundations, which would be backfilled at completion. Other excavation activities would include levelling around the individual transmission line structure foundations, drainage and grading or preparation for construction benches at the transmission line structure site. Overall, the required earthworks are expected to be minor and to be carried out close to each transmission line structure. Hence, changes to the local area flood characteristic would likely be minor and localised.

Excavation at substation locations would be relatively minimal. Where excavation is proposed, minor changes in flow direction and levels may result due to the creation of new sags and gullies. This may result in an increase in flood levels and scour risk due to the concentration of flows. These impacts are likely to be localised and minor, and would be sufficiently managed through the implementation of measures, such as flow spreaders and scour protection. These measures would be developed further during detailed design.

Stockpiles of material from excavation, including any hazardous chemicals and materials, would be placed outside flood prone areas and overland flow paths. This would avoid potential obstruction to flow and subsequent impacts on flood behaviour.

There may also be minor impacts to local flood behaviour as a result of new or upgraded access tracks, and any associated waterway crossings, that would be established during construction and may be retained during operation of the project. The exact location of any waterway crossings and the requirement for any drainage structures to minimise impact on flooding would be confirmed during detailed design.

18.4.1.2. Construction compound sites

The potential construction impacts on flooding at the construction compounds were assessed using desktop assessment and two-dimensional modelling and are detailed in *Technical Report 11 - Hydrology and Flooding Impact Assessment* and summarised in Table 18-3.

Table 18-3 Summary of construction compound impacts on flooding

Construction compound	Impact on flooding
Wagga 330 kV substation compound (C01)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on local or regional flooding. This is because no regional flood risk, local drainage lines or overland flow paths have been identified at the construction compound in a 5% AEP event.
Snowy Mountains Highway compound (C02)	This construction compound is located north of an existing drainage line, which is a tributary of Gilmore Creek. The modelling results showed that any filling at this construction compound would obstruct the overland flow path running from east to west towards the Snowy Mountains Highway. This would result in offsite adverse impacts to the south of the construction compound. Establishing a new construction compound entrance off the Snowy Mountains Highway also has the potential to obstruct a highway table drain and an existing overland flow path. As such, the construction compound layout would need to be appropriately designed to minimise potential local flood impacts by limiting filling and including cross-drainage to maintain existing flow paths. There is no risk of impacts on regional flooding resulting from this construction compound.
Snubba Road compound (C03)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on flooding. This is because the construction compound is located on high ground near a ridge with drainage lines falling away from the construction compound, which means impacts on any local flooding are unlikely and there is no regional flood risk.
Maragle 500 kV substation compound (C05)	This construction compound would not impact local or regional flooding due to its location being higher up in the catchment and across steeper areas where stormwater runoff is mainly shallow overland flow. However, any filling at this construction compound for its establishment and/or use has potential to cross multiple drainage lines, which could create adjacent low points for stormwater to pond around the site. The local risk to drainage lines would be managed through appropriate consideration of drainage measures during detailed design.
Gregadoo Road compound (C06)	Any filling for establishment of this construction compound and/or construction activities along the northern and the eastern extents of this site could impact local flooding due to presence of a natural drainage line in this location and increase flood levels across adjacent properties (Lyall & Associates, 2022). However, this impact would be mitigated through limiting filling of the site or stockpiling of material to areas predicted to have no risk of flooding and consideration of potential drainage measures during detailed design. There is no risk of impacts on regional flooding resulting from this construction compound.
Honeysuckle Road compound (C07)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on local flooding as the construction compound is located on high ground and near a ridge. There is no risk of impacts on regional flooding resulting from this construction compound.

Construction compound	Impact on flooding
Red Hill Road compound (C08)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on local flooding as the construction compound is located on high ground and near a ridge with drainage lines falling away and there is only a minor upstream catchment area. There is no risk of impacts on regional flooding resulting from this construction compound.
Adjungbilly Road compound (C09)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on local flooding as it is located near a ridge with effectively no upstream catchment area. There is no risk of impacts on regional flooding resulting from this construction compound.
Yass substation compound (C10)	The establishment of this construction compound and proposed construction activities at this site would not have an impact on local flooding as it would use land within Transgrid's existing Yass substation and no earthwork is expected to occur at this location. There is no risk of impacts on regional flooding resulting from this construction compound.
Woodhouselee Road compound (C11)	Local flood modelling indicated that while filling at this construction compound for its establishment and/or use may result in changes to local flood behaviour, any impacts would be localised and negligible and managed through consideration of potential drainage measures during detailed design. There is no risk of impacts on regional flooding resulting from this construction compound.
Bannaby 500 kV substation compound (C12)	This construction compound would be located on high ground and near a ridge with only minor upstream catchments. Any filling for establishment of this construction compound and/or construction activities at this site have potential to result in minor adverse impacts on local flooding. The western side of the construction compound has the potential to divert drainage to the south onto the adjacent property resulting in a minor increase in flood levels between 10 and 20 mm. However, at the northern and eastern areas, the impacts are expected to be contained within the existing substation property. These impacts would be managed through fill extent limitations and stormwater management, which would be developed during detailed design. No adverse impacts upstream or downstream of the project footprint are expected to result. There is no risk of impacts on regional flooding resulting from this construction compound.
Memorial Avenue compound (C14)	The north-western part of this construction compound would intercept an existing drainage flow path, which has potential to cause localised flood impacts outside the construction compound boundary if this area is filled for establishment and/or use of this construction compound. However, these impacts would be managed by designing the construction compound layout to limit filling in the north-western part of the site. There is no risk of impacts on regional flooding resulting from this construction compound.
Bowmans Lane compound (C15)	The establishment and/or use of this construction compound has potential to obstruct the existing drainage flow line in the central area of the site, which flows into Little Gilmore Creek downstream. However, no adverse local flood impacts are expected with an appropriate design of the construction compound layout to limit filling in the central area of the site. There is no risk of impacts on regional flooding resulting from this construction compound.
Snubba Road compound (C16)	This construction compound is located about 450 m upstream of Gilmore Creek on its western side and 300 m upstream of Ridings Creek on its eastern side. Subject to implementation of appropriate stormwater management measures, no adverse impacts on local flooding are expected from establishment and/or use of this construction compound. There is no risk of impacts on regional flooding resulting from this construction compound.

Construction compound	Impact on flooding
Tumbarumba accommodation facility (AC1)	This worker accommodation facility would be located about 2.5 km north-east of Tumbarumba, at an elevation of about 705 mAHD. The footprint of the site intersects an existing drainage line that runs virtually through the central part of the site. Modelling showed that obstructing this drainage line to establish this facility would result in adverse local flood impacts across adjacent properties. This impact would be managed by a design that maintains an overland flow path at least 20 metres wide and by limiting any fill extents to avoid the drainage line. These measures would minimise flood impacts in the 2% AEP event. There is no risk of impacts on regional flooding resulting from this worker accommodation facility.

18.4.2. Impacts of flooding on construction activities

18.4.2.1. Substations, transmission line structures and access tracks

Flooding has potential to impact construction activities, particularly if these activities are undertaken in flood-prone areas.

During construction, the temporary stockpiling of spoil, topsoil, materials, equipment and machinery to support construction activities have the potential to be washed away or scoured out by overland flows in a flood event, particularly those located near waterways and drainage lines. Excavations have the potential to become filled with flood water, requiring dewatering and result in unstable embankments. These site-based risks would be managed through a Construction Environmental Management Plan (CEMP) that would outline practices and risk management to mitigate site-specific risks from flooding.

18.4.2.2. Construction compound sites

The potential construction impacts on flooding at the construction compounds were assessed using desktop assessment and two-dimensional modelling and are detailed in *Technical Report 11 - Hydrology and Flooding Impact Assessment* and summarised in Table 18-4.

Table 18-4 Summary of flooding impacts on construction compounds

Construction compound	Impact of flooding
Wagga 330 kV substation compound (C01)	During a 5% AEP event there would be local catchment ponding around this construction compound site. However, there would be no impact from flow paths or drainage lines. As such, activities at this site are not expected to be impacted by flooding. There would be no risk of regional flooding as the site is 300 m upstream of the nearest waterway.
Snowy Mountains Highway compound (C02)	The construction compound site is located north of an existing drainage line which is a tributary of Gilmore Creek. The site would be impacted by local catchment flooding in the 5% AEP along the existing drainage line across the southern side of the site. The modelling predicts flood depths of up to one metre along the south-western part of the site. This risk would be managed through an appropriately designed construction compound layout. Any regional flooding from Gilmore Creek is unlikely to impact the site due to the approximate 10 m difference in height between the regional peak water level and the construction compound elevation in a 1% AEP event.
Maragle substation compound (C05)	This construction compound site would be impacted by local upstream drainage, which would require local drainage management to maintain existing drainage behaviour. However, there is no local or regional flood risk.
Gregadoo Road compound (C06)	This construction compound site would experience minor local flooding along the western and eastern ends of the site in a 5% AEP event from shallow sheet flow. This risk would be managed through an appropriately designed construction compound layout. There is no risk of regional flooding impacts at this construction compound.

Construction compound	Impact of flooding
Yass substation compound (C10)	This construction compound site would experience minor local flooding in a 5% AEP event along the north-eastern end of the site. This risk would be managed through an appropriately designed construction compound layout. There is no risk of regional flooding impacts at this construction compound.
Bannaby 500 kV substation compound (C12)	The northern and western areas of the construction compound are predicted to have some minor impact from overland flow ponding around the upstream edges of the construction compound footprints. The eastern compound area is located immediately downstream of an existing basin, basin is understood to have an outlet structure consisting of a 900 millimetre by 900 millimetre pit with a 375 millimetre diameter outlet pipe. This was incorporated in the local model and modelled to discharge through the middle of the proposed construction compound footprint. No filling of the construction compound footprint was applied from the basin outlet to maintain a basin outlet flowpath. In the 5% AEP event, the existing basin is predicted to overtop and interact with the eastern compound area. The flood risk is generally minor and localised around the construction site footprint. The need for a drainage corridor through the site to maintain the existing drainage behaviour or a stormwater management plan to manage these potential impacts would be considered further during detailed design. There would be no risk of regional flooding.
Bowmans Lane compound (C15), Snubba Road compound (C16), Tumbarumba accommodation facility (AC1)	These sites would experience minor local flood risks due to existing local drainage that flows through the sites. These risks would be managed through appropriately designed construction compound and worker accommodation facility layouts. There is no risk of regional flooding impacts at these sites.
Snubba Road compound (C03), Honeysuckle Road compound (C07), Red Hill Road compound (C08), Adjungbilly Road compound (C09), Woodhouselee Road compound (C11)	These construction compound sites are located on high ground with no local or regional flood risk.

To facilitate construction of the project, helicopters may be used to deliver materials and equipment and transfer workers to construction areas particularly within the high alpine regions. Several construction compounds deemed generally suitable have been identified to potentially include helipad(s), with the helipad locations to be confirmed during detailed design. Design of the helipad locations within construction compounds would consider such issues as drainage lines and local flooding risks as identified in this section to avoid and/or minimise potential for adverse flood impacts.

18.5. Potential impacts – operation

18.5.1. Impacts from operation of the project on flood behaviour

18.5.1.1. Transmission line structures and access tracks

The footings of each transmission line structure would require an area of up to 300 to 450 square metres, depending on ground conditions and the proposed transmission line structure type. Due to size, the footings are expected to only influence flood levels and flow paths local to the structure. Therefore, it is not expected that transmission line structures would impact flooding beyond the project footprint.

Permanent access tracks are not expected to impact flood behaviour, where they are located away from overland flow paths. However, for access tracks and any permanent waterway crossings with potential to impact flooding, the detailed design would consider the need for cross-drainage culverts or bridge structures to minimise adverse flood impacts. Further mitigation measures are detailed in Section 18.6.3.

Where excavation is proposed, minor changes in flow direction and levels may occur due to the creation of new sags and gullies. This may result in increases in flood levels and scour risk due to the concentration of flows. These impacts are likely to be localised and minor, and can be managed by implementing the mitigation measures provided in Section 18.6.3.

18.5.1.2. Telecommunications hut

The proposed telecommunications hut is outside the regional and local flood extent up to the 1% AEP event. As such, this structure would not result in adverse flooding impacts during operation of the project.

18.5.1.3. Substations

Proposed Gugaa 500 kV substation

The proposed Gugaa 500 kV substation would be constructed at Gregadoo, about 850 metres west of O'Briens Creek which discharges to Kyeamba Creek. Lyall & Associates (2022) undertook a flood investigation, which indicated the proposed Gugaa 500 kV substation site would obstruct existing overland flow from the south. As a result, increases in flood levels would likely occur along the south-western boundary of the site. This potential flood impact would be managed through refinement of the drainage infrastructure, such as channels and culverts, during detailed design.

Bannaby 500 kV substation modification

The Bannaby 500 kV substation modification would involve extending the existing substation footprint by about 10 hectares to the north and west. The proposed Bannaby 500 kV substation extension is located upstream of its local catchment immediately adjacent to the existing substation footprint and crosses local drainage lines. The substation extension would divert overland flows and increase the risk of flood water ponding on the existing substation infrastructure and access road. The potential increase in risk of flooding within the substation and access road would be addressed through consideration of drainage measures required during detailed design. No adverse impacts downstream of the substation are predicted subject to the capacity of the adopted drainage measures.

18.5.1.4. Wagga 330 kV substation modification

The Wagga 330 kV substation modification is assumed to be at existing grade with no filling proposed. There is no risk of regional flooding based on the regional scale modelling undertaken. No local drainage lines or overland flow paths were identified across the substation based on the local modelling results. Given this, the Wagga 330 kV substation modification is not expected to have an impact on flooding.

18.5.2. Impacts of flooding on operation of the project

18.5.2.1. Transmission line structures and access tracks

The flood modelling undertaken revealed areas of the project footprint that would be at risk from major and minor flooding. The areas within the project footprint at risk from major flooding are:

- Tywong Creek intersection
- O'Briens Creek intersection
- Kyeamba Creek intersection
- Tarcutta Creek / Umbango Creek intersection
- Plain Creek intersection
- Tumut River / Gocup Creek intersection
- Jerrawa Creek intersection.

If the transmission line structures are located within a flood-prone area, the transmission line structure footing may be impacted by flooding. This flood risk would be considered further in confirmation of transmission line structure locations during detailed design. However, based on the form and height of the transmission line structures (up to 76 metres), flooding is unlikely to directly impact the transmission lines and therefore their operation.

Access tracks that cross or are near waterways are likely to be impacted in flooding conditions and would require regular maintenance to manage the scour risk and drainage infrastructure conditions. It is anticipated that access tracks would not be used during heavy rain or flood events. The design of access tracks would consider the required elevation of the road and suitable cross-drainage to achieve the desired level of flood immunity.

18.5.2.2. Substations

Proposed Gugaa 500 kV substation

Flood investigation undertaken by Lyall & Associates identified that an existing drainage line (tributary of O'Briens Creek) would be blocked by the proposed Gugaa 500 kV substation. The level of impact on operations would be subject to the adopted height of the substation bench and drainage infrastructure, which would be confirmed during detailed design. The assessment recommended drainage mitigation in the form of a trapezoidal-shaped channel and a series of culvert structures to capture upstream water from the existing drainage line and divert overland flow around the substation footprint. This would be considered further during detailed design (refer to mitigation measure HF5 in Section 18.6.3).

Bannaby 500 kV substation modification

The Bannaby 500 kV substation is located along a tributary of the Wollondilly River. No distinct waterways interact with the substation. As a result, flooding in this area is caused by local drainage overland flow that heads to Wollondilly River.

The proposed access road to the Bannaby 500 kV substation extension would form an obstruction to a drainage line and require cross-drainage structures to minimise the impact of flooding on the existing substation. This would require incorporation of suitable cross-drainage into the substation during detailed design to improve drainage of the site.

Wagga 330 kV substation modification

The modified Wagga 330 kV substation would remain within the existing substation property boundary. As such, it is assumed that the modification would not require filling. In a 1% AEP event, local catchment ponding is expected around the site with no notable flow paths or drainage lines impacting the site. As such, the new area of the modified Wagga 330 kV substation is not expected to be impacted by flooding.

18.6. Management of impacts

18.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach as detailed in Chapter 26 (Environmental management). During construction of the project, a range of measures would be specified in the Soil and Water Management Plan (SWMP) prepared as part of the Construction Environmental Management Plan (CEMP). These measures are based on industry best practice to minimise potential impacts on waterways, including consideration of flood risk and drainage requirements. The SWMP will set out measures to mitigate and manage impacts on hydrology and flooding, including considerations for site layouts and material storage locations.

18.6.2. Avoidance and minimisation of impacts

Approaches to avoid and minimise hydrology and flooding impacts were considered when siting temporary and permanent infrastructure in the project footprint. In particular, the potential for flooding was a key consideration in the short-listing criteria and selection of the preferred option for the proposed Gugaa 500 kV substation site (refer to Appendix E (Options Report)). General construction practices for all project components that would also avoid and minimise potential hydrology and flooding impacts include:

- spreading excess excavated material evenly around the site similar to existing levels after completion of the foundation backfilling
- removing excess excavated material from the site that would influence drainage and flood behaviour and disposing them in accordance with the appropriate waste classification
- locating stockpiles and chemical storage areas outside the flood prone area and considering temporary remediation work such as stabilising the area according to the *Blue Book* (Landcom, 2004) requirements.

18.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts on hydrology and flooding are listed in Table 18-5.

Table 18-5 Summary of mitigation measures – hydrology and flooding

Ref	Impact	Mitigation measures	Timing	Relevant location
HF1	Drainage design and stormwater management	Suitable on-site drainage design and stormwater management strategies and plans will be implemented to limit adverse flood impacts on surrounding properties during construction.	Detailed design and construction	All construction compounds
HF2	Impact of earthworks to establish new access tracks on flooding	The detailed design will consider the potential impacts on flooding associated with earthworks for new access tracks and the need for cross drainage culverts or bridge structures. The cross drainage infrastructure will be sized appropriately to minimise adverse flood impacts.	Detailed design	Access tracks
HF3	Impact on flooding at the Snowy Mountains Highway construction compound (C02)	Overland flow up to the 5% AEP event across the southern extent of the Snowy Mountains Highway compound (C02) is to remain unobstructed from bulk filling, site infrastructure and/or stockpiling. Selective placement of sensitive or vulnerable infrastructure (eg electrical equipment, buildings, machinery, stockpiles, pedestrianised areas etc) will be considered in flood prone areas.	Detailed design and construction	Snowy Mountains Highway compound (C02)
HF4	Impact on flooding and drainage at construction compounds and Bannaby 500KV substation	Existing drainage and overland flowpaths will be maintained at the Maragle substation compound (C05), Gregadoo Road compound (C06) and Bannaby 500 kV substation. Where filling is required, suitable drainage design and stormwater management strategies and plans will be implemented to limit adverse flood impacts on surrounding properties. Selective placement of sensitive or vulnerable infrastructure (eg electrical equipment, buildings, machinery, stockpiles, pedestrianised areas etc) will be allocated to areas away from drainage lines. On site detention will be incorporated where increases in site stormwater discharges exceed predevelopment flows and will be designed in accordance with the Blue Book (Landcom, 2004).	Detailed design and construction	Maragle substation compound (C05), and Gregadoo Road compound (C06) and Bannaby 500 kV substation
HF5	Impact on flooding and drainage at Gugaa 500 kV substation	Suitably sized cut-off drains and cross drainage culverts will be designed and constructed to maintain existing flood behaviour around and downstream of the substation footprint.	Detailed design and construction	Proposed Gugaa 500 kV substation

18.6.4. Managing residual impacts or uncertainties

The construction compounds and worker accommodation facility layouts for the project would be confirmed during detailed design by the construction contractors. Currently, the proposed construction compounds and worker accommodation facilities were generally represented in the models as fill pads with an elevation above the 1% AEP flood level (except where the locations are flat or next to existing substations). This conservative approach captured the influence of any potential filling or earthworks that may occur during construction that would impact on local flooding, representing the worst-case scenario. Any residual adverse impacts associated with these sites would be managed through appropriate design of site layouts (including any fill extent limitations) and incorporation of suitable drainage design measures, which will be confirmed during detailed design by the construction contractors.

The locations of transmission lines structures and access tracks are also subject to confirmation during detailed design. The final location of these transmission line structures and access tracks would consider potential flooding impacts within the project footprint to minimise impacts where feasible. It is assumed any residual impacts would be negligible due to the small scale of the transmission line structures compared to regional-scale flooding.

19. Hazards and risks

This chapter provides a detailed summary of the assessment of potential hazards and risks of the project. The full assessment is provided in *Technical Report 13 – Bushfire Risk Assessment* (Aurecon, 2023d), *Technical Report 14 – Aviation Impact Statement* (Aviation Projects, 2023) and *Technical Report 15 – Electric and Magnetic Field Study* (Aurecon, 2023e).

19.1. Environmental Assessment Requirements

19.1.1. Secretary's Environmental Assessment Requirements

Table 19-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to hazards and risks of the project and where these requirements are addressed in this chapter.

Table 19-1 Secretary's Environmental Assessment Requirements – hazards and risks

Reference	SEARs	Where principally addressed in the EIS
Hazards		
Key issues	The EIS must address the following matters: • an assessment of potential hazards and risks associated with electric and magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA);	Section 19.5.1 provides an assessment of potential hazards and risks associated with EMF during operation (in consideration of the latest ARPANSA advice).
	• an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, the handling and use of any dangerous goods and potential impacts to high pressure gas pipelines;	Section 19.4 and Section 19.5 provide an assessment of risks to public safety, including bushfire risks, emergency egress and evacuation, and dangerous goods. There are no high pressure gas pipelines located within the project footprint or associated with the project. Section 19.4.4 provides an assessment of hazards and risks associated and interacting with utilities during construction.
	• assess potential impacts on aviation safety, including: - defined air traffic routes, aircraft operating heights, approach / departure procedures, radar interference, communication systems, navigation aids, use of emergency helicopter access, aerial baiting and culling in the National Parks, safe and efficient aerial application of agricultural fertilisers and pesticide; - identify aerodromes within 30 km of the transmission line and consider the impact to nearby aerodromes and aircraft landing areas; and - address impacts on obstacle limitation surfaces.	Section 19.4.3 and Section 19.5.3 provide an assessment of impacts on aviation safety. Chapter 11 (Land use and property) provides an assessment of potential impacts on aerial agricultural operations (eg aerial spreading of fertilisers and aerial spraying). Section 19.3.3 identifies nearby aerodromes. These include certified aerodromes within 30 nm (55.56 km) and non-certified aerodromes within 3 nm (5.56 km) of the project footprint, based on assessment requirements from Commonwealth CASA. Section 19.4.3 and Section 19.5.3 provide an assessment of impacts on nearby aerodromes. Section 19.4.3 and Section 19.5.3 provide an assessment of potential impacts on obstacle limitation surfaces (OLS).

19.2. Assessment approach

The assessment of hazards and risks focused on the project's potential to adversely affect human health and the quality of the surrounding environment, land uses and communities during construction and operation.

19.2.1. Legislative and policy context

Key legislation, policies and guidelines considered as part of the assessment of hazards and risks included:

- *Work Health and Safety Act 2011* (Commonwealth) and Work Health and Safety Regulation 2017
- *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005)
- *Dangerous Goods (Road and Rail Transport) Act 2008* and Dangerous Goods (Road and Rail Transport) Regulation 2022
- *Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1 Hz to 100 kHz)* (International Commission on Non-Ionising Radiation Protection (ICNIRP), 2010)
- *Rural Fires Act 1997*
- *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (PBP) (NSW RFS, 2019)
- *Electricity Supply Act 1995* and Electricity Supply (Safety and Network Management) Regulation 2014
- *National Electricity Network Safety Code* (Energy Networks Australia, 2019)
- *National Construction Code 2022* (Australian Building Codes Board, 2022)
- *Australian Standard AS3959:2018 Construction of Buildings in Bushfire-Prone Areas* (Standards Australia, 2018)
- *Australian Standard AS5577:2013 Electricity Network Safety Management Systems* (Standards Australia, 2013)
- *Australian/New Zealand Standard AS/NZ7000:2016 Overhead Line Design* (Standards Australia, 2016)
- *Managing the Risk of Intrusions into the Protected Operations Airspace of Airports Guideline F* (NASF, 2012)
- *Civil Aviation Act 1988* (Commonwealth) and Civil Aviation Regulations 1988
- Civil Aviation Safety Regulations 1998
- *Aviation Impact Assessment guidance* (Airservices Australia, 2022)
- *Guidelines for undertaking wild dog and fox aerial baiting on National Parks and Wildlife Service estate, Version 2* (Department of Planning, Industry, and the Environment (DPIE), 2020g).

19.2.2. Methodology

This section provides details on the methodologies to assess the potential general hazards and risks associated with the project.

19.2.2.1. Electric and magnetic field assessment

Electric and magnetic fields (EMF) exists wherever electricity is generated, transmitted or distributed in transmission lines or cables, or used in electrical appliances. Adverse health effects due to the extremely low frequency (ELF) EMF that are generated from electrical infrastructure have not been established, despite being the subject of extensive worldwide research for more than 40 years. However, the possibility that health effects may exist has not been ruled out. Section 19.5.1 provides further information on EMF risks relevant to the project with reference to scientific research.

While no risk to human health has been established, Transgrid has adopted an approach of 'prudent avoidance' in accordance with good engineering and risk minimisation practice, guidance from Energy Networks Associations (ENA) and reference to World Health organisation guidance. Prudent avoidance is a precautionary concept developed to address the possibility of health effects from prolonged exposure to field levels much lower than those for which effects have been established. Under this approach, subject to reasonable cost and practicality considerations, the owners of electrical infrastructure should design their facilities to reduce the intensity of the EMF where prolonged exposure is possible.

In Australia, ARPANSA is responsible for protecting the health and safety of people and the environment from EMF. In July 2015, ARPANSA officially adopted the ICNIRP's *Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1 Hz to 100 kHz)* (ICNIRP, 2010), in full, as they were consistent with ARPANSA's understanding of the scientific basis for the protection of the general public (including the foetus) and workers from exposure to ELF EMF. Transgrid's position on EMF exposure is to comply with these ICNIRP guidelines.

As a result, the EMF study methodology involved:

- describing EMF risks in relation to human health with reference to relevant research
- modelling the EMF for the proposed 500 kV transmission lines at one metre above ground level (in accordance with international standards[16]) and covering the range of structure types, conductor configurations and other relevant parameters associated with the transmission lines
- modelling locations where the proposed transmission lines would cross an existing major line (ie 132 kV or higher) or run parallel to it
- assessing the anticipated EMF levels for the transmission lines against the relevant criteria as follows:
    - magnetic fields: 2,000 milligauss being the ICNIRP Guidelines 'Reference Level'
    - electric fields: 9.1 kV per metre[17], ensuring compliance with the ICNIRP Guidelines 'Basic Restriction'
- assessing the compliance of the proposed transmission lines and substations against 'prudent avoidance' principles
- identifying requirements based on relevant EMF guidelines to be adopted during the detailed design.

The ICNIRP Guideline 'Basic Restrictions' are derived from the levels at which interactions with the central nervous system are established, with a safety factor applied. ICNIRP 'Reference Levels' are conservatively set such that, provided they are met, the Basic Restrictions would also be met without the need for more comprehensive analysis.

Further detail on the methodology for the EMF study including an overview of EMF and human health is provided in *Technical Report 15 – Electric and Magnetic Field Study*.

[16] American National Standards Institute IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines

[17] As per *Technical Report 15 - Electric and Magnetic Field Study*, Transgrid has established that for 330 kV and 500 kV transmission lines, an electric field of 9.1kV/m would comply with the ICNIRP Basic Restriction.

19.2.2.2. Bushfire risk assessment

The bushfire risk assessment considered the potential for the project to both impact and be impacted by bushfires and involved:

- identifying specific bushfire survey areas within the project footprint that may experience exposure to bushfire risk during construction or operation
- completing desktop assessments of risks to the project footprint through a review of general vegetation and climate data
- completing desktop assessments of risks to bushfire survey areas, including a review of vegetation mapping, satellite imagery and contour data
- carrying out field investigations to assess existing vegetation, slope, and access to bushfire survey areas
- carrying out spatial analysis and modelling of bushfire values including Bushfire Attack Level (BAL) and Asset Protection Zones (APZs) for bushfire survey areas
- recommending mitigation measures to be implemented during construction and operation to avoid or minimise bushfire risk, including design measures.

The bushfire survey areas are locations that may experience elevated exposure to bushfire risk during construction or operation and comprise temporary or permanent structures or locations where workers may work in buildings, sleep or assemble.

Further detail on the methodology for the bushfire risk assessment is provided in *Technical Report 13 – Bushfire Risk Assessment*.

19.2.2.3. Aviation impact assessment

The aviation impact assessment involved:

- identifying any potential infringements to the OLS and Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surfaces
- assessing the likely impacts of infringements into air route protection surfaces
- assessing likely impacts on aeronautical navigation aids and air traffic control surveillance systems
- identifying relevant civil aviation safety requirements and standards with respect to existing aerodrome conditions and whether these standards are met, especially in relation to whether obstacle lighting may or may not be required
- assessing low-level flight operations, including aerial agricultural spraying operations, aerial baiting culling and aerial firefighting
- consulting with aircraft operating agencies, including Department of Defence, Royal Flying Doctor Service, NSW National Parks and Wildlife Service, Ambulance Service of NSW and NSW Police Air Wing
- recommending management measures to minimise impacts and ensure aviation safety is maintained throughout the construction and operation of the project.

Further detail on the methodology for the aviation impact assessment is provided in *Technical Report 14 – Aviation Impact Statement*.

19.2.2.4. Other hazards and risks

For the purposes of the assessment, other hazards and risks relate to the handling and use of any dangerous goods and hazardous materials, impacts on utilities, and existing emergency egress and evacuation routes and plans. The qualitative assessment was used to identify construction and operational activities that may have the potential to cause risks to health and safety of public and workers. Any further work, health and safety hazards that are not specifically considered in this EIS would be addressed by the relevant construction contractors in accordance with relevant guidelines and legislative requirements. Hazards and risks during operation would be addressed through safety in design processes during detailed design and managed through Transgrid's existing procedures for operation and maintenance activities.

19.3. Existing environment

19.3.1. Electric and magnetic fields

Existing sources of EMF within and close to the project footprint include 500 kV, 330 kV and 132 kV transmission lines, 11 kV distribution lines, low voltage distribution lines and street lighting wires. Existing substations within the project footprint include Wagga 330 kV substation, future Maragle 500 kV substation, Bannaby 500 kV substation, Yass 330 kV substation, Gullen Range 330 kV substation, Crookwell 2 330 kV substation, and numerous 11 kV pole-top transformers. A figure showing the existing transmission lines is provided in Chapter 3 (Project description – infrastructure and operation).

19.3.2. Bushfire risk

This risk of bushfire is influenced by regional weather and climate, ignition sources, vegetation, slope and access. The risk profile along the project footprint is dynamic, varying according to weather cycles that influence vegetation and fuel loads. This risk profile varies through the following cycles:

- Over many years, changes in the southern oscillation index may result in sustained periods of hot dry weather (El Niño) or cooler wetter cycles (La Niña), which correspondingly may increase or reduce the likelihood of bushfire risk.
- From year to year, fine vegetation fuel loads change through natural accumulation or removal through bushfire or hazard reduction burns. The amount of fine vegetation (sticks, leaves and vegetation less than six millimetres thick) is the primary fuel influence on bushfire spread and intensity.
- Seasonally, the risk profile changes with the onset of the fire season in summer months and the occurrence of days of elevated fire danger (associated with a period of dry days, low humidity, and high temperature and winds). The statutory Bush Fire Danger Period runs from 1 October through to 31 March, although it may vary due to local conditions (NSW RFS, 2021).
- Daily, the risk profile changes, as weather conditions influence the moisture content of fine vegetation fuels and their capacity to carry fire.

Bushfire prone land (BFPL) is defined by local council as land able to support a bushfire or subject to a bushfire attack. Category 1 BFPL generally support the highest intensity bushfires and are considered the highest risk vegetation. Category 2 and 3 BFPL comprise lower risk vegetation. Figure 19-1 presents the BFPL in and around the project footprint.

The highest risk vegetation associated with Category 1 BFPL includes:

- forests
- woodlands
- timber plantations of State forests, Crown land and adjoining national parks.

The lower risk vegetation associated with Category 2 and 3 BFPL includes:

- rainforest
- vegetation separated from other larger tracts of vegetation
- grasslands
- freshwater wetlands
- alpine heathlands.

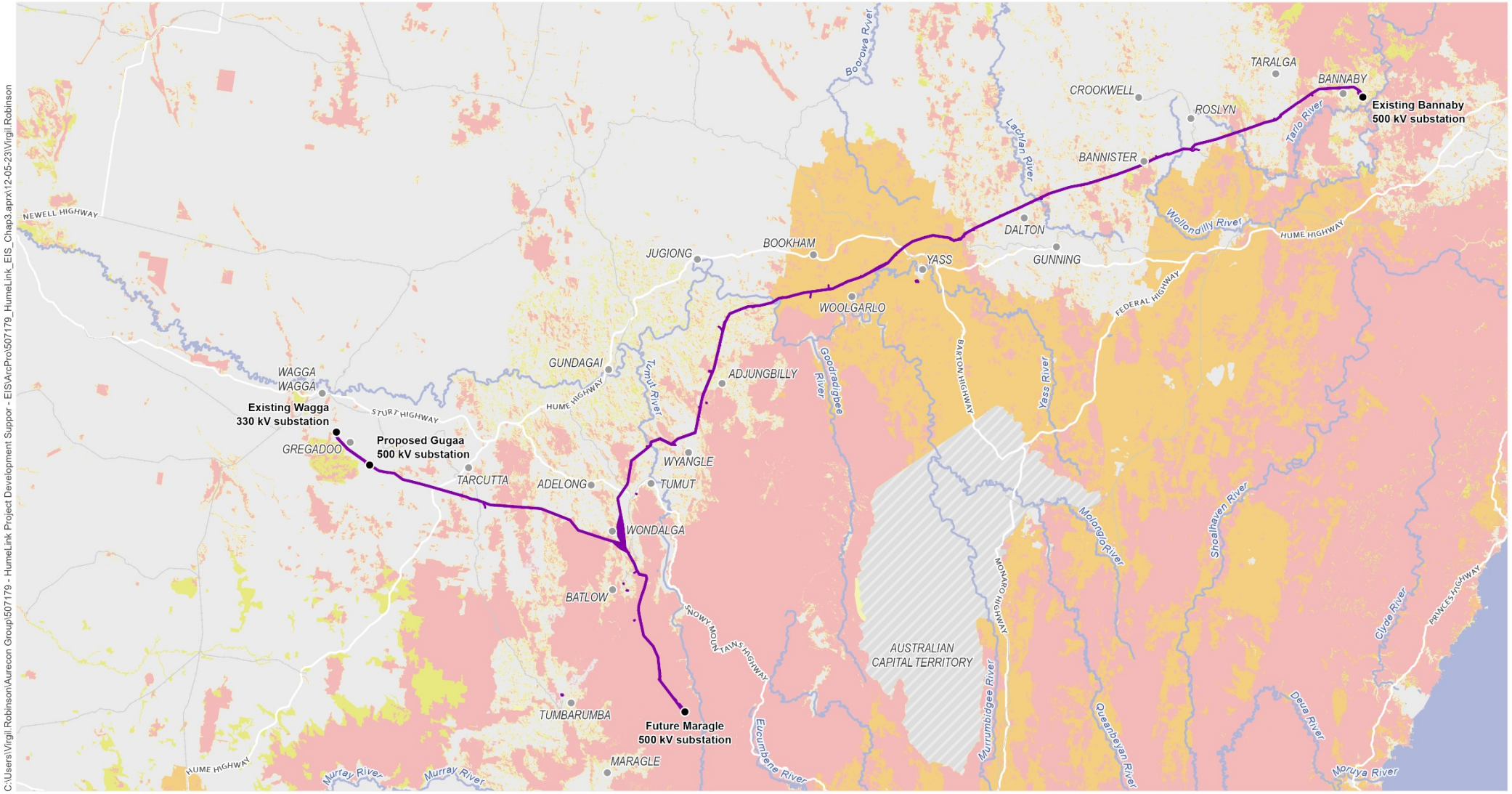
Large areas of the project footprint are categorised as Category 1 BFPL, particularly between Wondalga and the future Maragle 500 kV substation, Red Hill and Adjungbilly, and from Roslyn east towards the existing Bannaby 500 kV substation (refer to Figure 19-1).The remaining parts of the project footprint consist of either Category 2 and 3 BFPL or are located outside of mapped BFPL. Areas where the project footprint is located outside of mapped BFPL are mainly within Wagga Wagga City and Upper Lachlan Shire Local Government Area (LGAs).

A large area that encompasses the southern extent of the project footprint near the future Maragle 500 kV substation was affected by a forest fire ignited by lightning in the 2019–20 bushfire season (refer to Figure 19-2). In January 2013, the Cobbler Road bushfire, which was a grass fire, burnt over 14,000 hectares of the project footprint, south of the Hume Highway near Talmo. Other parts of the project footprint have also historically supported fast-moving grassfires, resulting in loss of life, and major property and stock losses.

There are a range of existing ignition sources within the project footprint that are a potential risk to starting fires. These include:

- lightning strike
- fire spreading from legal and illegal burning off
- faulty or inappropriate use of machinery or equipment or faulty electrical infrastructure
- accidental ignitions from motor vehicle accidents, discarded cigarette butts or fire spreading from campfires
- arson activities
- trees falling and coming in contact with electrical infrastructure
- failure of electrical infrastructure.

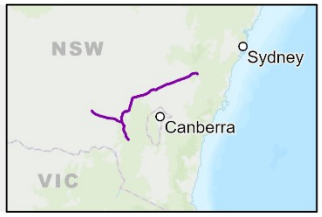
The frequency of elevated fire danger days that may support high intensity fire events is predicted to increase as a result of climate change (Abram et al 2021, Dowdy 2020, Lucas et al 2007). This may subsequently increase bushfire events that have the potential to negatively impact the community, including Transgrid infrastructure (as has occurred historically, most recently during the 2019–20 bushfire season (refer to Figure 19-2)). Refer to Chapter 22 (Climate change and greenhouse gas) for further information on predicted climatic conditions.



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Project footprint
National park and reserve
State forest
Waterway
Major road
Railway
Substation

Bush Fire Prone Land
Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Vegetation Buffer



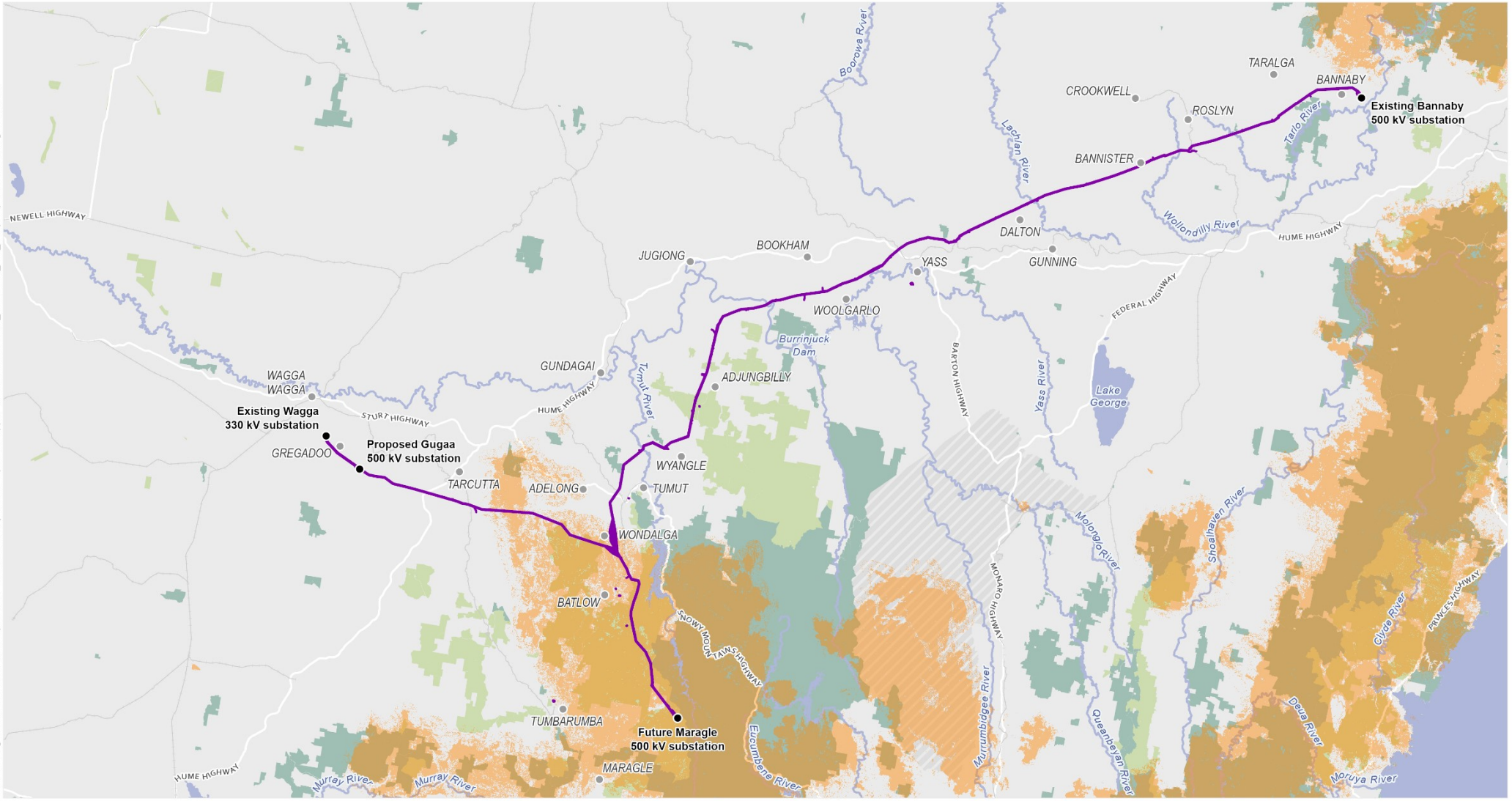
Source: *Aurecon, Transgrid, NSW Rural Fire Service, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 19-1: Bush Fire Prone Land



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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 19-2: FESM Severity extent (2019-2020)

19.3.3. Aircraft operations and aviation facilities

To identify the project's risks to aircraft operations and aviation facilities, an aviation assessment was undertaken to identify the locations of existing facilities in the vicinity of the project footprint. The International Civil Aviation Organisation and Civil Aviation Safety Authority (CASA) definition of an aerodrome is generic to all types of areas that are suitable for the arrival, departure and surface movement of aircraft. There are two types of aerodromes: certified and non-certified.

Certified aerodromes are aerodromes that require certification under the Civil Aviation Safety Regulations 1998. Part 139 of the Civil Aviation Safety Regulations 1998 sets out requirements and standards for certified aerodromes including standards for facilities, obstacle control, operational procedures and safety management. There are three certified aerodromes located within 30 nautical miles[18] (55.6 kilometres) of the project footprint, as shown on Figure 19-3:

- Goulburn Airport – located about 29 kilometres south of the project footprint
- Tumut Airport – located about 4.7 kilometres south of the project footprint
- Wagga Wagga Airport – located about 7.5 kilometres north-east of the project footprint and co-located with an Australian Defence Force apprentice training school.

Non-certified aerodromes are not regulated by CASA and include private airstrips, aircraft landing areas (ALAs), helicopter landing sites (HLSs) and airstrips other than certified aerodromes. CASA recommends an area of interest of three nautical miles (5.6 kilometres) be used to assess potential impacts of proposed developments on aircraft conducting taking off and landing operations at a non-certified aerodrome. There are 35 ALAs and four HLSs within three nautical miles (5.6 kilometres) of the project footprint. These occur mainly within the LGAs of Snowy Valleys (north of Batlow), Yass Valley, Cootamundra-Gundagai Regional and Upper Lachlan Shire (mainly east of Bannister).

Scheduled passenger flights regularly operate between Wagga Wagga Airport and Canberra, Melbourne, and Sydney. There are currently no scheduled passenger flights operating from Tumut and Goulburn Airports, though it is likely that some have operated in the past.

Air routes between airports are provided with a lowest safe altitude (LSALT), which is the lowest altitude that an aircraft can fly on that route without visual reference to the ground or water. Grid LSALTs can also be provided for an area of 1 degree of longitude by 1 degree of latitude, which can be used for any aircraft inside that grid. Manual of Standards Part 173 – Standards Applicable to Instrument Flight Procedure Design of the Civil Aviation Safety Regulations 1998 prescribes a minimum obstacle clearance of 1,000 feet (305 metres) below the published LSALT be maintained along each air route. Sixteen air routes and four Grid LSALT areas are situated above the project footprint. However, non-scheduled passenger transport operations could be conducted throughout the area encompassed by the project footprint.

Other aerial operations within and adjacent to the project footprint include:

- aerial application operations, including activities such as fertiliser, pest and crop spraying
- aerial baiting in national parks and other estate managed by National Parks and Wildlife Service (NPWS)
- emergency services operations, including aerial firefighting and medical emergency evacuations.

[18] PANS-OPS surfaces exist out to a radius of 30 nautical miles from a certified aerodrome with published instrument approach procedures.

These aerial operations are described in more detail below.

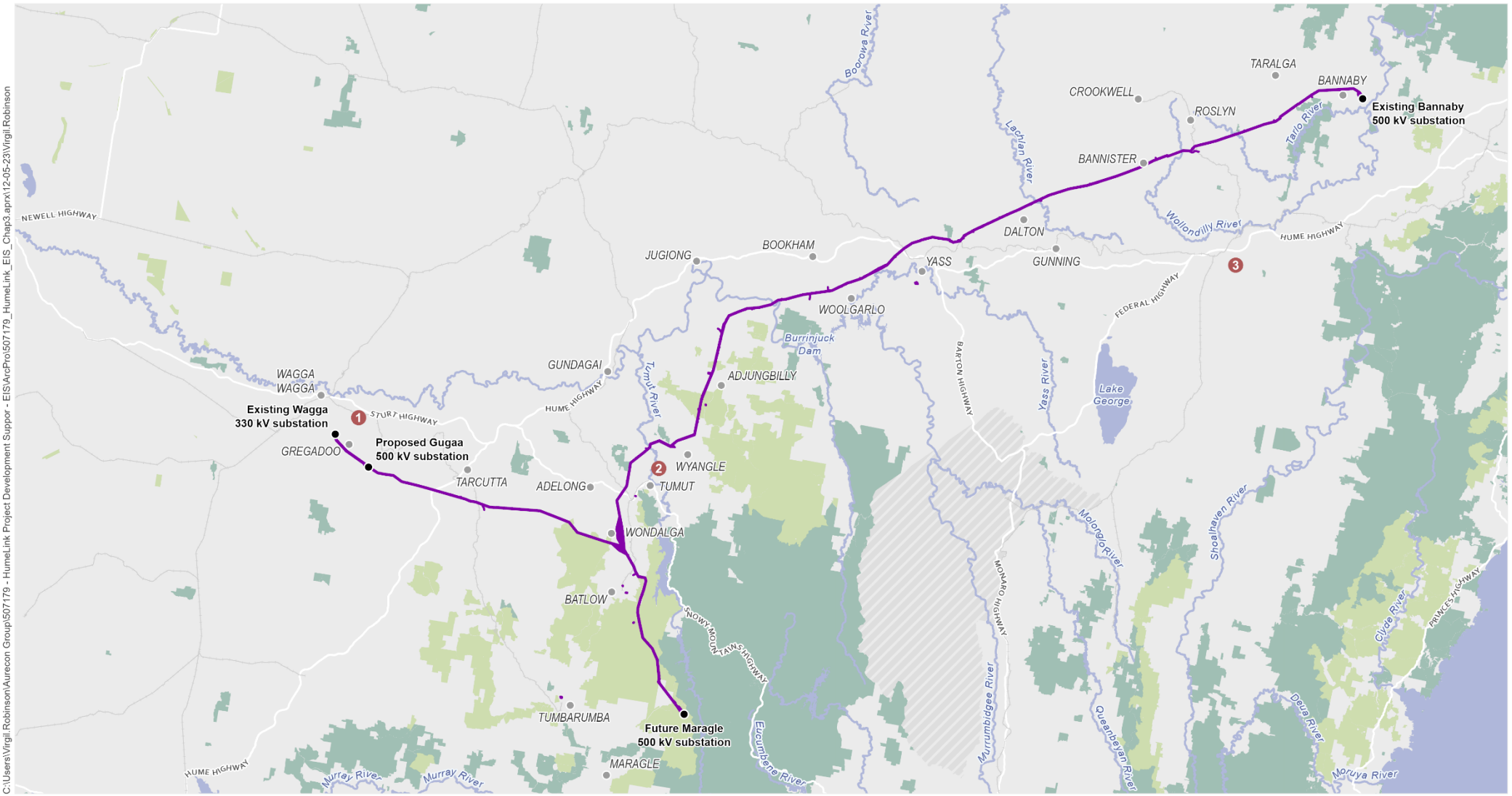
Aerial application operations are conducted from various ALAs surrounding the project footprint and are generally performed during the day below 500 feet (152 metres) above ground level (AGL), usually between two metres and 30.5 metres AGL. Further detail on aerial application operations for agricultural purposes is provided in *Technical Report 4 – Agricultural Impact Assessment*.

Aerial baiting in NPWS estate is a typical method for fox and wild dog control and is generally undertaken in helicopters. Aerial baiting is carried out in accordance with the *Guidelines for undertaking wild dog and fox aerial baiting on National Parks and Wildlife Service estate, Version 2* (DPIE, 2020g). Aerial baiting managed by NPWS may occur within neighbouring public and private properties where agreement from the respective adjoining land manager is obtained and where baiting is part of a cooperative, cross-tenure baiting program. The NPWS guidelines require that aerial baiting must only be carried out during daylight hours and, when flying to and from NPWS estate, operators are required to fly at a minimum of 500 feet AGL and at a safe height to remain clear of obstacles and hazards.

Aerial firefighting and medical emergency evacuations may also occur throughout the area surrounding the project footprint. Similar to aerial baiting, these services are more likely to use helicopters. Aerial firefighting operations are only conducted after extensive planning and review by local emergency services to ensure risks such as existing obstacles and hazards are appropriately considered. When used, emergency medical helicopter flights are able to choose a suitable landing area away from obstacles and hazards or, if required, can conduct winching operation to retrieve patients in areas not suitable for a landing.

The project footprint is wholly contained within uncontrolled airspace (Class G) – ie airspace in which an air traffic control (ATC) service is not provided – and is situated outside any Special Use Airspace that is reserved for military flying training operations. The project footprint is also outside the clearance zones associated with aviation navigation aids, radar interference and communication systems.

The closest navigation facilities to the project footprint are at Wagga Wagga Airport, about 7.5 kilometres north-east of the transmission line and Wagga 330 kV substation, and at Goulburn Airport, about 29 kilometres south of the project footprint. There are no aviation navigation facilities at Tumut Airport. The closest ATC communication systems are at Mount Bobbara, about 124 kilometres north-east of Wagga Wagga and 27.8 kilometres north of the project footprint near Bookham; and Mount Majura, about 54 kilometres south of the project footprint near Yass (refer to Figure 19-3).



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

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Projection: GDA 1994 MGA Zone 55

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FIGURE 19-3: Certified aerodromes within 30 nautical miles of project footprint

19.3.4. Utilities

The project footprint intersects a number existing Transgrid assets including the Wagga 330 kV substation, Yass 330 kV substation and Bannaby 500 kV substation. Several existing high voltage transmission lines (eg 132 kV and 330 kV) also run parallel and/or intersect the project footprint for the majority of its length.

The project footprint also contains a number of existing local utility services including wastewater and water supply assets, telecommunication lines, and power distribution lines (eg 11 kV, 33 kV and 66 kV lines) that may require relocation and/or protection during site establishment for the project.

There are no major utilities, such as water or gas pipelines within the project footprint that would require relocation and/or protection. The closest gas pipelines are the Moomba to Sydney and Dalton to Canberra underground gas pipelines, located about 3.5 kilometres from the project footprint at Dalton. The closest major water pipelines are the Oura to Ungarie underground water pipeline and Jugiong to Boorowa underground water pipeline, which are located 15 kilometres from the project footprint at Gregadoo and Gobarralong, respectively. Further detail on utilities within the project footprint is provided in Chapter 11 (Land use and property).

19.4. Potential impacts – construction

During construction, potential hazards and risks to construction workers, the surrounding community or environment would include:

- bushfires
- aviation safety
- interaction with existing utilities
- the onsite storage, handling and transport of dangerous goods and hazardous materials
- changes to emergency egress and evacuation routes.

These hazards and risks are described in the following sections.

19.4.1. Electric and magnetic fields

During construction, the transmission line would not be energised (ie would not be operational) and would therefore not generate an electric or magnetic field. Existing electrical infrastructure such as substations have been designed to meet relevant EMF standards and therefore construction work in proximity to existing infrastructure would not create EMF risks.

19.4.2. Bushfire impacts

During construction, potential impacts from a bushfire burning within or into the project footprint (including ember attack, radiant heat, and direct flame contact) can pose a risk to the health and safety of workers and the community and result in damage or destruction of construction plant and equipment.

There are also several potential ignition sources relating to construction that have the potential to ignite adjacent vegetation and result in bushfires that impact private property, including dwellings and other structures, and pose a risk to life and assets. Bushfires spreading through adjacent forest areas may result in loss of timber within State forests and private plantations and have substantial ecological impacts.

Prior to the establishment of cleared areas and APZs, the risk of ignition and fire spread is elevated from construction activities, particularly during the Bush Fire Danger Period (October to March). The risk of fire is highest near heavily vegetated areas within Category 1 BFPL and cured unmanaged grasslands (including pastures and grasslands which form part of woodlands), as well as near stockpiles of removed vegetation.

The project footprint traverses a range of vegetation communities (forest, woodland and grassland) and slope classes, which influence bushfire behaviour and rate of spread. These factors create a dynamic risk profile along the extent of the project footprint. However, bushfire impacts during construction are unlikely where construction activities occur within established APZs and procedural controls are implemented, or where construction is located outside of BFPL.

Table 19-2 provides further detail on the potential ignition sources during construction.

Table 19-2 Ignition sources related to construction

Ignition source	Description
Hot works	Construction activities that involve hot works, such as grinding, welding, or cutting, may result in sparks, which could increase the risk of bushfire ignition. Sparks can spread via wind, posing a high ignition risk to dry vegetation.
Construction equipment	Construction equipment, such as bulldozers and excavators, pose a bushfire risk through activities that can produce sparks and ignite adjoining vegetation. Sparks can be accidentally produced when steel blades encounter rocks and are a high ignition risk to adjacent vegetation where mitigation and control measures are not applied. Fires igniting adjoining vegetation may spread quickly under adverse conditions such as elevated fire danger days, potentially impacting life, and property.
Electrical faults in equipment	Electrical faults in equipment can create a high ignition risk to adjacent vegetation. Equipment would need to be checked for potential faults or visible weaknesses regularly to reduce the potential for failure in accordance with manufacturers' specifications.
Motor vehicles	Motor vehicle exhaust systems are a potential ignition risk to adjacent grassland and other vegetation, with particular reference to diesel powered trucks and light vehicles with pollution controlling exhaust devices, which may emit burning diesel particles. This is a high ignition risk to adjacent vegetation. Vehicles may also collide with equipment or infrastructure, which may result in spilt fuel, or sparks that may be an ignition risk to adjacent vegetation.
Accidental ignitions	Accidental ignitions, eg from discarded cigarette butts, are non-deliberate ignitions that can occur from errors, and are not specified under any other ignition risk.
Dangerous materials	Dangerous materials include chemicals, explosives, or otherwise flammable materials. Inappropriate storage and handling of these materials, and insufficient fuel-free buffers around work areas, are a potential ignition risk to adjacent vegetation, through increased risk of chemical fire or explosion. There is also a risk from a grass fire or bushfire burning a storage area and igniting hazardous materials.

The site of the proposed Tumbarumba accommodation facility (AC1) is in, and adjoins, BFPL and may be subject to fires burning towards it or ignitions spreading from it during construction. The Tumbarumba accommodation facility (AC1) is classified as a Special Fire Protection Purpose (SFPP) development as per PBP (NSW RFS, 2019) and, therefore, is subject to specific bushfire protection requirements including emergency management and evacuation plans, APZs, construction requirements, access provisions and services supply. The worker accommodation facility would be on BFPL and therefore must also satisfy the aims and objectives outlined in PBP (NSW RFS, 2019).

Construction activities would follow the procedures identified in the HumeLink Bush Fire Emergency Management and Evacuation Plan (BFEMEP) and Construction Environmental Management Plan (CEMP) to avoid and minimise bushfire risks associated with construction of the project (refer to Section 19.6.3).

19.4.3. Aviation safety

The main risks to aviation safety during construction would be associated with construction of transmission line structures and the use of cranes. Transmission line structures would have a maximum height of 76 metres AGL and construction cranes would have a maximum height of 91 metres AGL (about 15 metres above the height of the transmission line structures).

Infringement of the OLS and PANS-OPS for either Goulburn or Tumut aerodromes is not expected during construction of the project. However, an infringement of OLS is expected at Wagga Wagga Airport. Temporary construction cranes associated with the transmission line structures near Wagga Wagga could infringe the PANS-OPS surface associated with the two runway approach segments. Approval to operate construction cranes would be required from Wagga Wagga Airport before the construction of transmission line structures can start in this area (refer to Section 19.6.3).

Construction of the project would not have an impact on flight operations conducted in accordance with the visual flight rules (VFR) and instrument flight rules (IFR) prescribed in the Civil Aviation Safety Regulations 1998. The use of cranes during construction would also not infringe on the respective protection surfaces of the air routes or Grid LSALTs above the project footprint.

The use of cranes and erection of transmission line structures within the project footprint during construction may also result in risks to aerial applications of fertilisers and pesticides, aerial baiting in NPWS estate, and emergency services operations. The cranes and transmission line structures would result in additional obstacles, which could result in incidents if not effectively managed and mitigated and aircraft are operating in close proximity. Risks to aerial operations would be minimised with the implementation of mitigation measures provided in Section 19.6.3, including notifying relevant stakeholders of construction of the project. In addition, some of these operations largely make use of helicopters, which have flexibility to avoid construction cranes and transmission line structures.

19.4.4. Interaction with utilities

As identified in Section 19.3.4 the project footprint contains a number of existing local utility services including wastewater and water supply assets, telecommunication lines, and power distribution lines (eg 11 kV, 33 kV and 66 kV lines). Consultation with utility service providers that own and/or operate these assets has begun and would continue during detailed design and construction of the project to mitigate the risk of unplanned and unexpected disturbance of utilities. While the final transmission line alignment is likely to cross some utilities, it is expected that the transmission line structures could be situated within the project footprint to avoid directly impacting on utilities.

Potential impacts on local services and utilities would include relocation, connection and/or protection work, which may result in minor, short-term service outages to surrounding areas. These impacts would be determined during detailed design in consultation with the relevant service operators and asset owners.

The project also involves rebuilding around two kilometres of the existing 330 kV single circuit transmission line (Line 51) south of the Wagga 330 kV substation. Construction activities that interact directly with electrical infrastructure or that are located close to active electrical infrastructure would be undertaken in accordance with relevant legislative and safety requirements, as well as Transgrid systems, guidelines and procedures, including, but not limited to:

- Electricity Supply (Safety and Network Management) Regulation 2014
- Transgrid's Electrical Network Safety Management System
- *Transgrid's Public Electrical Safety Awareness Plan*.

19.4.5. Dangerous goods and hazardous materials

During construction, various hazardous materials and chemicals would be required to be used and stored on site, which could cause risks associated with worker health or environmental contamination if inappropriately managed. Hazardous materials and chemicals that would be used during construction would typically include (but not be limited to):

- acetylene
- adhesives, glues, and epoxies
- concrete and other mortar products
- contact cleaners
- cold-galvanising spray
- fuels, oils and lubricants (such as diesel, unleaded petrol, and thinners)
- paints and other paint markers
- pesticides, herbicides and other chemicals associated with biosecurity measures
- sulfur hexafluoride (SF_6) gas.

The construction compounds and work sites would be arranged so that hazardous materials and chemicals are stored at a suitable distance from sensitive receivers and in accordance with suppliers' instructions, Australian Standards, and relevant legislation such as *Work Health and Safety Act 2011* and Work Health and Safety Regulation 2017. The CEMP and sub-plans would also specify procedures regarding storage, handling and disposal, and potential spill and clean-up of hazardous materials. Chapter 16 (Soils, geology and contamination) and Chapter 23 (Waste) provide further information on the proposed management of hazardous materials and chemicals, including appropriate methods of disposal.

Transportation of dangerous goods to and from the project footprint would be undertaken in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and Dangerous Goods (Road and Rail Transport) Regulation 2014. Extended routes would avoid areas (such as road tunnels) prohibited by NSW Road Rule 300-2 (carriage of dangerous goods in prohibited areas). The onsite storage and handling of dangerous goods would be in accordance with *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).

Based on the management approach described above and included in Section 19.6, and adherence to relevant legislation, the risk associated with onsite storage, handling and transport of dangerous goods and hazardous materials would be low.

19.4.6. Changes to emergency egress and evacuation routes

The stringing of the transmission line over roads would require full or partial short-term road closures. This may affect emergency vehicle access or evacuation routes. However, it is expected that potential impacts or temporary changes to access or evacuation routes – if detours were required – would be minor and managed through the implementation of mitigation measures provided in Chapter 20 (Traffic, transport and access) and consultation with the relevant road authority.

In addition, work sites would be arranged so that emergency access and evacuation routes are maintained and, if required, made available for emergency vehicle passage. Consultation would be carried out with emergency service providers and local councils in relation to changed traffic conditions and/or access points to the project footprint.

New access points and access roads and tracks to construction compounds, the proposed Gugaa 500 kV substation and the Tumbarumba accommodation facility (AC1) would be designed in accordance with relevant road standards guidelines. This would assist with emergency service vehicle access and safe evacuation routes if required.

19.5. Potential impacts – operation

During operation, potential hazards and risks to the surrounding community or environment and maintenance and operational crews may be associated with but not limited to:

- EMF
- bushfires
- aviation safety
- the onsite storage, handling and transport of dangerous goods and hazardous materials
- changes to emergency egress and evacuation routes.

These are described in the following sections.

19.5.1. Electric and magnetic fields

Transgrid has designed the project to reduce the intensity of the EMF generated and minimise the fields that people would encounter over prolonged periods. An overview of the scientific understanding of EMF and the likely levels of EMF generated by the project is provided below.

19.5.1.1. Overview of EMF risks relevant to operation

A large number of studies have been conducted over many years to investigate the possibility of adverse health consequences from ELF EMF, including childhood leukaemia, childhood cancers, cancers in adults, depression, suicide, cardiovascular disorders, reproductive dysfunction, developmental disorders, immunological modifications, neurobehavioural effects and neurodegenerative disease.

A link between prolonged exposure to ELF EMF and childhood leukaemia has persisted which led the International Agency for Research on Cancer to classify magnetic fields as a “possible carcinogen”. However, as no mechanism for an effect has been established after 30 years of laboratory research, the UK National Radiological Protection Board’s Advisory Group stated in 2001:

“In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the evidence is currently not strong enough to justify a firm conclusion that such fields cause leukaemia in children.”

Reviews by the WHO in 2007, ICNIRP in 2010 and European Commission in 2015 identified that the scientific evidence supporting the other health effects is very weak or does not support it at all.

EMF also have the potential to interfere with active implanted medical devices (AIMDs) such as cardiac pacemakers and insulin pumps. However, the highest magnetic fields associated with 500 kV transmission lines are substantially lower than those found to cause interference with AIMDs. In the case of hearing aids or cochlear implants, it is possible for audible interference (‘buzzing’) to be experienced within the transmission line easement or directly below the conductors, but this would not damage the devices or the ear (British Cochlear Implant Group, 2020).

The possibility of EMF effects on plants and various animals, including cows, sheep, pigs and horses has been studied since the 1970s. In 1991, Sir Harry Gibbs published the findings of an extensive inquiry into community needs and high voltage transmission line development and concluded:

“No reason exists for concern as to the effect of the fields on animals or plants.”

In 2011, the UK Government adopted a National Policy Statement (NPS) for Electricity Networks Infrastructure. The NPS states:

“There is little evidence that exposure of crops, farm animals or natural ecosystems to transmission line EMFs has any agriculturally-significant consequences.”

In 2005, Fernie and Reynolds (2005) published a review of bird studies and found that:

“most studies indicate that EMF exposure of birds generally changes, but not always consistently in effect or direction, their behaviour, reproductive success, growth and development, physiology and endocrinology, and oxidative stress under EMF conditions.”

The project is not considered to impact on organic or bio-dynamic certification and there are no known storage areas located nearby. As such, any EMF generated from the project is unlikely to have notable adverse effects on animals or plants.

19.5.1.2. EMF levels for transmission lines

The potential EMF from operation of the proposed transmissions lines for the project have been assessed against the ICNIRP Guidelines in accordance with the principle of prudent avoidance (refer to Section 19.2.2.1).

In all locations, under all conditions, the electric fields directly below the lines would be less than 9.1 kilovolts per metre, with the average at 5.9 kilovolts per metre, and would therefore comply with the Basic Restrictions under the ICNIRP Guidelines. At 15 metres or further from the lines, the electric fields

would be five kilovolts per metre or lower and would also comply with the ICNIRP Guidelines Reference Levels. The electrical equipment used for the transmission of electricity for HumeLink would operate at a frequency of 50 Hertz (Hz), which falls into a range referred to as ELF.

At the edge of the easements, the highest predicted electric fields would range from 0.2 to 0.6 kilovolts per metre, or three to 12 per cent of the ICNIRP Guidelines Reference Level. Where the electric fields cross existing high voltage lines, the field contribution from the proposed 500 kV lines would interact with the existing fields from the undercrossing lines, resulting in a complex field distribution with some increases in field levels up to 5.4 kilovolts per metre. The fields at the easement edges would be substantially unchanged. Where they run parallel to existing high voltage lines the proposed lines are not expected to cause any material increase in the existing electric fields.

The amount of current being carried by the transmission line (its 'load') has direct bearing on the magnetic fields produced and is continually varying. Table 19-3 lists magnetic fields that could be experienced at one metre above ground level under various operating scenarios.

Table 19-3 Magnetic fields under different transmission line load conditions

Load condition	Description
Typical conditions	Directly beneath the proposed lines, the highest predicted magnetic fields range from less than 3.5 per cent to 4.5 per cent of the ICNIRP Guidelines Reference Level.
	At the edge of the easements, the highest predicted magnetic fields range from less than 0.6 per cent to 1.7 per cent of the ICNIRP Guidelines Reference Level.
Normal peak load conditions (ie maximum current allowed during normal operation)	Directly beneath the proposed lines, the highest predicted magnetic fields range from less than 9.5 to 10.5 per cent of the ICNIRP Guidelines Reference Level.
	At the edge of the easements, the highest predicted magnetic fields range from 1.5 to 4 per cent of the ICNIRP Guidelines Reference Level.
Emergency conditions (ie when higher currents may briefly be allowed)	Directly beneath the proposed lines, the highest predicted magnetic fields are less than 19 per cent of the ICNIRP Guidelines Reference Level.
	At the edge of the easements, the highest predicted magnetic fields range from less than 5 to 5.5 per cent of the ICNIRP Guidelines Reference Level.

There would be little interaction with the magnetic fields of existing 330 kV and 500 kV transmission lines nearby, except at the undercrossings, where the field contributions from the two lines would interact. The highest resulting magnetic fields would be very localised and the magnetic fields at the easement edges would be substantially unchanged. The highest magnetic field is predicted to occur at the undercrossing of the new 500 kV transmission line between Wondalga and the future Maragle 500 kV and the Lower Tumut-Wagga 330 kV line and is modelled at 253 milligauss. This value is significantly below the ICNIRP Guidelines Reference Level of 2,000 milligauss.

Where the proposed transmission lines run parallel to existing transmission lines, due to the relatively wide separation (60 metres to 70 metres) between them, there would be little interaction between them, and the fields associated with the respective lines would be much the same as when the individual lines are separated and not running in parallel. It is unlikely that proposed transmission line work at VNI West and Jeremiah Wind Farm (subject to approval) or the modifications to the Wagga 330 kV would result in cumulative EMF impacts.

Overall, it unlikely that there would be any prolonged human exposure to EMF from the proposed transmission lines given the design has adopted 'prudent avoidance' principles, the project would comply with the ICNIRP guidelines and dwellings would not be permitted within the easement.

19.5.1.3. EMF levels for substations

Table 19-4 provides an overview of the EMF associated with substations for the project.

Table 19-4 EMF impacts at substations

Location	Description
Proposed Gugaa 500 kV substation	The substation would be designed to ensure that EMF in accessible areas of the substation would be within the ICNIRP Occupational Guideline Levels. In addition, EMF levels outside the substation fence line where the general public can access would be designed to be below the ICNIRP General Public Guideline Reference Levels. Given the nearest dwelling is about 540 m north, potential health risks are not expected.
Future Maragle 500 kV substation	The connection of transmission lines to the future Maragle 500 kV substation is not expected to change the overall EMF impacts associated with the proposed operation of the substation. The connection of transmission lines to the line bays would be designed to ensure that EMF levels are below the ICNIRP Guideline Level. There are no nearby dwellings identified.
Bannaby 500 kV substation	Modifications to the existing Bannaby 500 kV substation would be designed to ensure that EMF within those areas of the substation accessible to authorised persons are well below the ICNIRP Occupational Guideline Levels and the EMF levels outside the substation are below the ICNIRP Guideline Reference Levels for General Public. Given the nearest dwelling is about 680 m south-east, potential health risks are not expected.
Wagga 330 kV substation	The proposed modifications to the Wagga 330 kV substation are not expected to change the overall EMF impacts associated with the existing operation of this substation. The closest dwelling is about 270 m south-east and the Wagga 330 kV substation has been designed to operate within the ICNIRP Public Reference Levels and the proposed modification would also be designed to ensure compliance with these levels.

19.5.2. Bushfire impacts

19.5.2.1. Project-related ignition sources

There are potential bushfire ignition sources relating to operation of the project (similar to those described in Table 19-2), if appropriate management and mitigation measures are not implemented:

- hot work during maintenance activities that generate sparks
- substation and transmission line operation if direct contact of vegetation or mechanical failure occurs
- electrical faults in maintenance equipment
- motor vehicles
- accidental ignitions, including from workers smoking
- storage or use of hazardous materials, which could result in chemical fire or exposure.

These sources have the potential to ignite adjacent vegetation and result in bushfires that impact private property including dwellings and other structures and pose a risk to life and operational infrastructure. Bushfires spreading through adjacent forest areas may result in loss of timber within State forest and private plantations and result in substantial ecological impacts. The risk of fire is highest near heavily vegetated areas within Category 1 BFPL, cured unmanaged grasslands (including pastures and grasslands that form part of woodlands) and near stockpiles of removed vegetation.

To manage bushfire risk, ongoing vegetation management would occur within the transmission line easement in accordance with Transgrid and nationally established industry standards *AS/NZS7000:2016 Overhead Line Design* and to avoid direct contact with live transmission lines. This includes a higher frequency of inspections of easements with fast-growing vegetation such as forest vegetation, which is generally associated with a higher bushfire risk. Transmission lines would be inspected regularly to reduce

the potential for mechanical failure such as failure of conductors and insulators, line-to-line contact, or line failure, which in turn would reduce the potential for unwanted ignitions that may result in bushfire.

Bushfire impacts from operation of new substation components at Wagga 330 kV substation, Bannaby 500 kV substation, and Gugaa 500 kV substation and transmission line operation are unlikely. This is because operation would occur within established substation APZs and Transgrid's procedural controls would be implemented, including ongoing vegetation management within the transmission line easements.

19.5.2.2. Potential impacts from bushfires

A bushfire can impact assets through direct flame contact, radiant heat and/or embers threatening a building and people sheltering within it. Bushfires could be started through natural ignition sources such as a lightning strike. APZs reduce potential bushfire impacts (where a building is prepared and built in accordance with bushfire construction standards). APZs would be established from the earliest stages of construction and maintained throughout operation. APZs would minimise but not eliminate the risk of bushfire impacting assets.

Other strategies to manage overall bushfire risk during operation include:

- controls for risks through engineering design, including consideration of transmission line structure height, material selection (ie non-combustible materials) and BAL mapping
- controls for risks through land management, with reference to APZs and in consideration of existing land features such as slope, vegetation and climate, and transmission line clearances
- emergency preparedness and response procedures, including maintaining sufficient access routes.

In the case of a nearby bushfire, risk mitigation measures and procedures for working around transmission lines are typically included in aircraft operator and firefighter training. A large proportion of the proposed transmission lines would be located near or parallel to existing high voltage transmission lines, where these procedures would already be required.

Potential risks from transmission lines to ground-based firefighting can include situations where dense smoke and hot gases from large fires under or near a transmission line cause arcing. As such, ground-based firefighting, backburning or initial attack on spotfires are not possible within a horizontal distance of about 25 metres from the transmission line. These public safety risks, including transmission line risks, would be managed with procedural controls, community briefings, and incident briefings as part of a bushfire incident action plan.

19.5.3. Aviation safety

The main risks to aircraft movements during operation of the project are associated with the transmission lines and their structures. Potential risks on aviation safety are described below.

19.5.3.1. Non-certified aerodromes

Impacts to flight operations depend on a number of factors including the proximity and location of the ALA relative to the transmission line infrastructure; the type and size of the aircraft used and the landing and take-off manoeuvres at a particular ALA. For example, ALAs that are aligned parallel to the transmission line could have flight operations limited to one side of the airstrip to avoid flying over of the transmission line. ALAs that are aligned pointing towards the transmission line may be limited to taking off and landing in

one direction to avoid the transmission line. If the transmission line is in close proximity to the ALA, the impact may result in the ALA being completely unusable.

A desktop assessment of ALAs and HLSs within three nautical miles (5.6 kilometres) of the project footprint (the search area) was undertaken to determine the potential impact on ALAs and HLSs from the project. The results of the desktop assessment are summarised in Table 19-5.

Table 19-5 Potential indicative impacts on non-certified aerodromes during operation

Level of impact	Impact description	Number of ALAs and HLSs impacted
Major	The project is expected to compromise the use of the ALA. This may include the aerodrome being unusable or a significant modification to its layout being required to enable aviation operations to continue.	4 ALAs
Moderate	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.	4 ALAs
Minor	The project would result in some flights paths to require a minor adjustment to avoid the transmission line for some types of flight operations.	8 ALAs 1 HLS
No impact	The project is unlikely to have an adverse impact upon flight operations as the ALA or the HLS is far enough away from the transmission line or oriented, in relation to the transmission line, so that flight operations are unlikely to be impacted if pilots are aware of the location of the transmission line.	15 ALAs 3 HLSs

The desktop assessment identified 35 ALAs within the search area. Most ALAs (15) identified within the search area are unlikely to be impacted by the project. Eight ALAs were found to have a minor impact and require minor adjustments and four ALAs were found to have a moderate impact. Based on the location and aspect of the ALAs, up to four ALAs were assessed as either being unusable as a result of the project or requiring significant modification to the layout or flight operations (ie major impact). These ALAs are located in the Snowy Valleys and Yass Valley LGAs and are either within the project footprint or in close proximity to the project footprint (ie less than 400 metres away).

Due to the number of airstrips in the area that may be close to the project footprint, an alternative site is likely to be available within a short distance and further away from the project footprint should an ALA be subject to major impacts from the project. Landowners may also have other operational airstrips on their properties that would be unaffected by the proposed transmission line, allowing aerial application flight operations to continue on their property without a significant impact to the cost of the aerial application on a particular property.

Transgrid will continue to consult with landowners on potential impacts to ALAs and minimise impacts where practicable during detailed design.

With regard to HLSs, helicopters are able to operate in close proximity to trees, buildings and other structures, allowing an HLS to be located nearer to structures than ALAs used for fixed wing aircraft operations. All HLS would have 'minor' or 'minor to no' impact, requiring a minor adjustment to avoid the transmission line.

Risks to certified aerodromes are considered under Section 19.5.3.3 and relate to infringements into the OLS and PANS-OPS.

19.5.3.2. Aircraft operations and flight routes

Similar to construction, operation of the project would not have an impact on flight operations conducted in accordance with the VFR and IFR prescribed in the Civil Aviation Safety Regulations 1998. The transmission line structures would also not infringe on the respective protection surfaces of the air routes or Grid LSALTs above the project footprint.

The location of the transmission line structures would be provided to Airservices Australia to be included on aeronautical charts once detailed design is completed. Once the transmission line is included on the charts, pilots planning to operate in the area during construction would be aware of them.

The transmission lines and their structures may result in risks to aerial applications of fertilisers and pesticides, aerial baiting in NPWS estate and emergency services operations. The transmission lines and their structures would result in additional obstacles which could result in incidents if aircraft are operating in close proximity.

These risks would be managed and minimised with the inclusion of the transmission line structures on aeronautical charts, pilot briefings and the Aerial Application Association of Australia formal risk management program. This would allow pilots to have the best possible knowledge of the obstacle environment around the intended flight(s). These measures are consistent with current practices associated with low-level flights near large transmission lines.

Aerial baiting operations in NPWS estate are generally undertaken in helicopters, which can operate closer to obstacles and at lower speeds than fixed wing aircraft. Due to the inherent nature of helicopter operations and adherence to requirements detailed in *Guidelines for Undertaking Wild Dog and Fox Aerial Baiting on National Parks and Wildlife Service Estate* (DPIE, 2020), it is unlikely that the transmission line would have an adverse impact on aerial baiting flight operations.

Similarly, the transmission lines are not expected to affect emergency services operations within and surrounding the project footprint. Emergency medical helicopter flights can choose a suitable landing area away from obstacles such as trees, powerlines, buildings or, if required, can use a winch to retrieve patients in areas not suitable for a landing. They can operate near such structures after identifying them and considering their impact on the flight operation.

19.5.3.3. Certified aerodromes

Risks to certified aerodromes relate to infringements into the OLS and PANS-OPS. The OLS infringements into the Wagga Wagga Airport during construction would remain during operation except they would only be limited to some transmission line structures near Gregadoo (near Gregadoo East Road and Angels Lane). However, as stated in Section 19.5.3, the infringements are unlikely to have an impact on flight operations at the airport. There would be no infringement of the PANS-OPS surfaces at Wagga Wagga Airport during operation.

Similar to construction, there would be no infringements of the OLS and PANS-OPS for either Goulburn or Tumut aerodromes during operation of the project.

19.5.3.4. Aviation navigation facilities

The open lattice construction of the proposed transmission line structures is not known to have radar interference with ATC surveillance systems. As such, the project would not impact aviation navigation, ATC or communication facilities described in Section 19.3.3.

19.5.4. Dangerous goods and hazardous materials

No dangerous goods and hazardous materials would be held or stored along the transmission line during operation, although small amounts may be transported, and used on site during maintenance activities.

During operation of the project, hazardous materials and chemicals similar to those used in construction may be required to be stored at the substation sites for operational and maintenance requirements, as well as small amounts of pesticides for vegetation management. Inappropriate storage of dangerous materials, and insufficient clearance around work sites during maintenance activities are a potential ignition risk to adjacent vegetation, due to the increased risk of chemical fire or explosion. However, the materials and chemicals would only be required in small amounts compared to those required during construction, and would be below the thresholds in State Environmental Planning Policy (Resilience and Hazards) 2021. Further detail on hazardous materials and chemicals during operation is provided in Chapter 23 (Waste).

Leaks or accidental spills of hazardous materials and chemicals stored onsite may impact the surrounding community, the environment and/or workers. However, with the implementation of the management measures provided in Section 19.6.3, these materials would not pose a substantial risk during operation of the project. In addition, the proposed Gugaa 500 kV substation would be designed in accordance with relevant Transgrid guidelines and Australian Standards, which would minimise the risk of leaks from operational infrastructure.

19.5.5. Changes to emergency egress and evacuation routes

The operation of the project would not have an impact on existing emergency vehicle egress or evacuation routes. Access tracks established during construction that are retained for operation of the project, and connections to the local road network, would be designed in accordance with relevant standards and guidelines. This would assist with emergency service vehicle access and safe evacuation routes if required.

19.6. Management of impacts

19.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management).

A BFEMEP would be prepared for the project and would specify procedures to respond to a bushfire starting and spreading during project construction and operation (refer to mitigation measure HR5). The implementation of the BFEMEP is expected to appropriately manage the bushfire risk during construction.

19.6.2. Avoidance and minimisation of impacts

The project footprint has been developed in consideration of the need to minimise impacts on landowners and maximise distance from dwellings where possible (refer to Chapter 2 (Strategic context and project need) and Appendix E (Options Report)). This minimises hazards to the surrounding community from the project because the risk decreases with the distance from the source, such as those associated with EMF and use/storage of dangerous goods and hazardous materials.

The new substation and transmission line infrastructure would be designed to meet the ICNIRP guidelines and comply with the policy of 'prudent avoidance' to manage EMF risks by:

- designing the transmission line, including the height of the ground clearances to reduce the EMF directly under the transmission lines
- using 'vee' insulator strings, which enable the design to be relatively compact, thereby reducing the EMF
- arranging the phases of the two circuits to provide maximum field cancellation
- maximising the distance of the transmission line corridor from dwellings and other occupied premises to increase the distance from the EMF source
- designing the transmission lines to have a low reactance conductor phasing arrangement, which would result in mutual cancellation of the fields from different phases.

Where possible, potential bushfire impacts have been reduced during design development, with the project avoiding national parks, nature reserves, and state conservation areas, which are typically highly forested and associated with Category 1 BFPL. Where avoidance is not possible, the design would ensure risks are managed through the implementation of ongoing vegetation clearance, APZs and other mitigation measures, as provided in Section 19.6.3.

The project footprint has also been refined to minimise impacts on certified and non-certified aerodromes, where possible. This include avoiding impacts on Tumut Airport and consideration of minimising impacts on Wagga Wagga Airport, ALAs and HLSs (refer to Appendix E (Options Report)). Detailed design would seek to further minimise potential aviation safety risks where possible through the refinement of the transmission line route within the project footprint. The mitigation measures provided in Section 19.6.3 would also assist in further minimising the potential risks.

19.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that will be implemented to avoid or minimise potential hazards and risks are listed in Table 19-6.

Table 19-6 Summary of hazards and risks mitigation measures

ID	Impact	Mitigation measures	Timing	Relevant location
HR1	Protection zones and landscaping	APZs will be managed in accordance with *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers requirements* (NSW RFS 2019) (PBP), and associated criteria.	Detailed design, construction and operation	Substations and project buildings within construction compounds and the temporary accommodation facility
HR2	Easement management	Vegetation within the proposed transmission line easement will be managed in accordance with Transgrid's existing vegetation management standards consistent with the clearance requirements principle identified in *AS/NZS7000:2016 Overhead Line Design*.	Detailed design, construction and operation	Transmission line easements
HR3	Ancillary buildings	The final location of the telecommunications hut will need to be assessed with a visual inspection to confirm potential bushfire risk.	Detailed design	Telecommunications hut
HR4	Access	Access to substations and project buildings within the bushfire survey area will be established in accordance with: • *Planning for Bushfire Protection 2019 requirements* (NSW RFS 2019) criteria • Access requirements will be in accordance with NSW Fire Trail Standards (NSW RFS 2016) and Fire Trail Construction and Design Maintenance Manual (Soil Conservation Science 2017).	Construction and operation	Access tracks to substations and project buildings within bushfire survey areas
HR5	Bush Fire Emergency Management and Evacuation Plan (BFEMEP)	The project will be designed and constructed in accordance with a BFEMEP. The BFEMEP will be prepared by a suitably qualified person and will include: • Bushfire Emergency Evacuation Plan • Bush Fire Risk Management Plan (BRMP) protocols during construction, considering activities during days with fire danger rating 'high' or greater • bushfire response and notification measures to report fires at the earliest opportunity • bushfire mitigation measures including maintaining APZs and mechanisms for the handling and use of any dangerous goods • bushfire risk induction and training for personnel, including risks and management measures associated with construction equipment and activities • fire reporting, emergency areas, on-site refuges, and evacuation procedures and is to be consistent with *Development Planning: A guide to developing a bush fire emergency management and evacuation plan* (NSW RFS, 2014). The BFEMEP will be consistent with relevant Australian standard and development plans and guides. For the Special Fire Protection Purpose (SFPP), the BFEMEP will include planning for the early relocation of occupants in the event of a potential bushfire or other emergency situation.	Detailed design, construction and operation	All locations

ID	Impact	Mitigation measures	Timing	Relevant location
		A copy of the BFEMEP will be provided to the Local Emergency Management Committee for its information prior to occupation of the development.		
HR6	Aviation safety	The detailed design of the transmission line structures with coordinates and elevations will be provided to relevant stakeholders (including Airservices Australia, Department of Defence and ALA owners along the transmission line route). The notification will be made as early as possible.	Detailed design	All locations
HR7	Aviation safety	Consultation with CASA will be undertaken to confirm whether obstacle lighting and marking of the transmission line structures are required. The provision of markers on cables and structures within three nautical miles (5.6 kilometres) of the final transmission line route will be considered with the appropriate stakeholders.	Detailed design and construction	Transmission line route between Wagga 330 kV substation and Gugaa 500 kV substation
HR8	Aviation safety	Approval to operate construction cranes that infringe the OLS for Wagga Wagga Airport will be obtained in advance of the proposed activity. Wagga Wagga Airport management will be provided with details of the crane operations at least seven days prior to their commencement via the Notice to Airmen (NOTAM) procedure.	Construction	Transmission line between Wagga 330 kV substation and Gugaa 500 kV substation
HR9	Chemicals, fuels and hazardous substances	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on the site plans.	Construction and operation	All locations
HR10	Dangerous goods and hazardous materials	Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018).	Construction	All locations
HR11	Emergency response	The Wagga 330 kV substation and Bannaby 500 kV substation Emergency Response Manuals will be updated to include the modifications and required revised emergency response procedures.	Detailed design and operation	Wagga 330 kV substation and Bannaby 500 kV substation
HR12	Emergency response	An Emergency Response Manual will be prepared for the proposed Gugaa 500 kV substation and will include emergency response procedures.	Detailed design and operation	Proposed Gugaa 500 kV substation
HR13	Electric and magnetic fields	The detailed design for the transmission line and substations will be developed to comply with the following criteria: • Magnetic fields: 2,000 milligauss being the ICNIRP guideline 'Reference Level' • Electric fields: 9.1 kV per metre, ensuring compliance with the ICNIRP guideline 'Basic Restriction'.	Detailed design	Transmission line and substations

19.6.4. Managing residual impacts or uncertainties

Through the implementation of the mitigation measures detailed in Section 19.6.3, residual impacts resulting from the identified hazards and risks would be appropriately managed.

With respect to EMF, Transgrid adopts a precautionary approach to the management of EMF for all of its projects by:

- taking EMF into account in the design and location of new facilities, such as this project
- closely monitoring ongoing research and reviews by scientific panels and international policy developments
- regularly reviewing its policies and practices in light of the latest scientific information
- providing up-to-date information to interested parties on request.

20. Traffic, transport and access

This chapter provides a detailed summary of the assessment of potential traffic, transport and access impacts of the project. The full assessment is provided in *Technical Report 16 – Traffic and Transport Impact Assessment* (Aurecon, 2023f).

During the development of HumeLink and the preparation of the traffic and transport impact assessment, Transgrid has undertaken extensive consultation with community and stakeholders since early 2020. Engagement included consultation with relevant local councils on matters such as local road constraints and indicative traffic routes. The summary of consultation undertaken for traffic and transport is detailed in Chapter 6 (Engagement) with specific feedback provided in Appendix C (Engagement Outcomes Report). Transgrid will continue to engage with community and stakeholders on traffic and transport through the detailed design, construction and operation of HumeLink.

20.1. Environmental Assessment Requirements

20.1.1. Secretary's Environmental Assessment Requirements

Table 20-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to traffic and transport impacts of the project and where these requirements are addressed in this EIS.

Table 20-1 Secretary's Environmental Assessment Requirements – traffic, transport and access

Reference	SEARs	Where principally addressed in the EIS
Transport		
Key issues	The EIS must address the following matters: • an assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local and State road network and the rail network; and	Section 20.4 provides an assessment of potential traffic and transport impacts during construction of the project. Section 20.5 provides an assessment of potential traffic and transport impacts during operation of the project. Chapter 11 (Land use and property) provides an assessment of impacts associated with temporary changes to existing property access.
	• details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road.	Chapter 3 (Project description – infrastructure and operation) provides a description of ongoing maintenance activities for the project, which includes measures to maintain access roads and tracks required for the project. Sections 20.4 and 20.5 provide an assessment of potential transport and traffic related impacts, including impacts on road condition and maintenance. Section 20.6 outlines mitigation measures to be implemented, including measures to maintain road condition.

20.2. Assessment approach

20.2.1. Legislative and policy context

Key legislation, guidelines and policies considered as part of the traffic and transport impact assessment included:

- *Roads Act 1993* – objectives include to govern the use and access to public roads, manage the opening and closing of public roads as well as providing classification of roads and identifying the functions of road authorities. Section 138 of the Act provides requirements for when a consent is required from the appropriate roads authority to erect a structure or carry out work in, on or over a public road (refer to Section 20.6.3). Road occupancy licences may also be required to conduct activities within a public road. As noted in Chapter 5 (Statutory context), any section 138 consent required for the project for classified roads would need to be granted consistent with the project approval in accordance with section 5.24 of the EP&A Act.
- *Rail Safety Act 2008* – regulates the carrying out of various activities within railway corridors.
- *NSW Heavy Vehicle Access Policy Framework* (Transport for New South Wales (TfNSW), 2018) – outlines a strategic approach to heavy vehicle access in NSW for both state and council roads aimed at achieving safe and efficient movement of road freight.
- *2026 Road Safety Action Plan* (TfNSW, 2022a) – sets out a road safety delivery framework and adopts the principles of the Safe System approach, which aims to eliminate fatal and serious road injuries to all road users. The mitigation measures provided in Section 20.6.3 consider the approach to road safety and the key principles identified in the plan.
- *Traffic control at work sites – Technical Manual Version 6.1* (TfNSW, 2022b) – outlines best practices for traffic control for work sites. The mitigation measures provided in Section 20.6.3 include the implementation of this manual at all traffic control sites during the construction and operation of the project.
- relevant Austroads Guides – these guides inform the design, construction, maintenance and operation of the road network in Australia and New Zealand.

20.2.2. Methodology

20.2.2.1. Overview of approach

The approach to the assessment of potential traffic and transport impacts involved:

- defining the traffic study area by identifying access routes anticipated to be used for movement of construction workers and materials
- carrying out desktop analysis to identify and qualitatively assess existing transport conditions
- calculating traffic generation and distribution within the traffic study area as a result of construction and operation of the project
- assessing the impacts on Level of Service (LoS) on access routes within the traffic study area based on the traffic generated by the project
- assessing impacts on traffic and transport during construction and operation
- detailing appropriate traffic and transport mitigation and management measures.

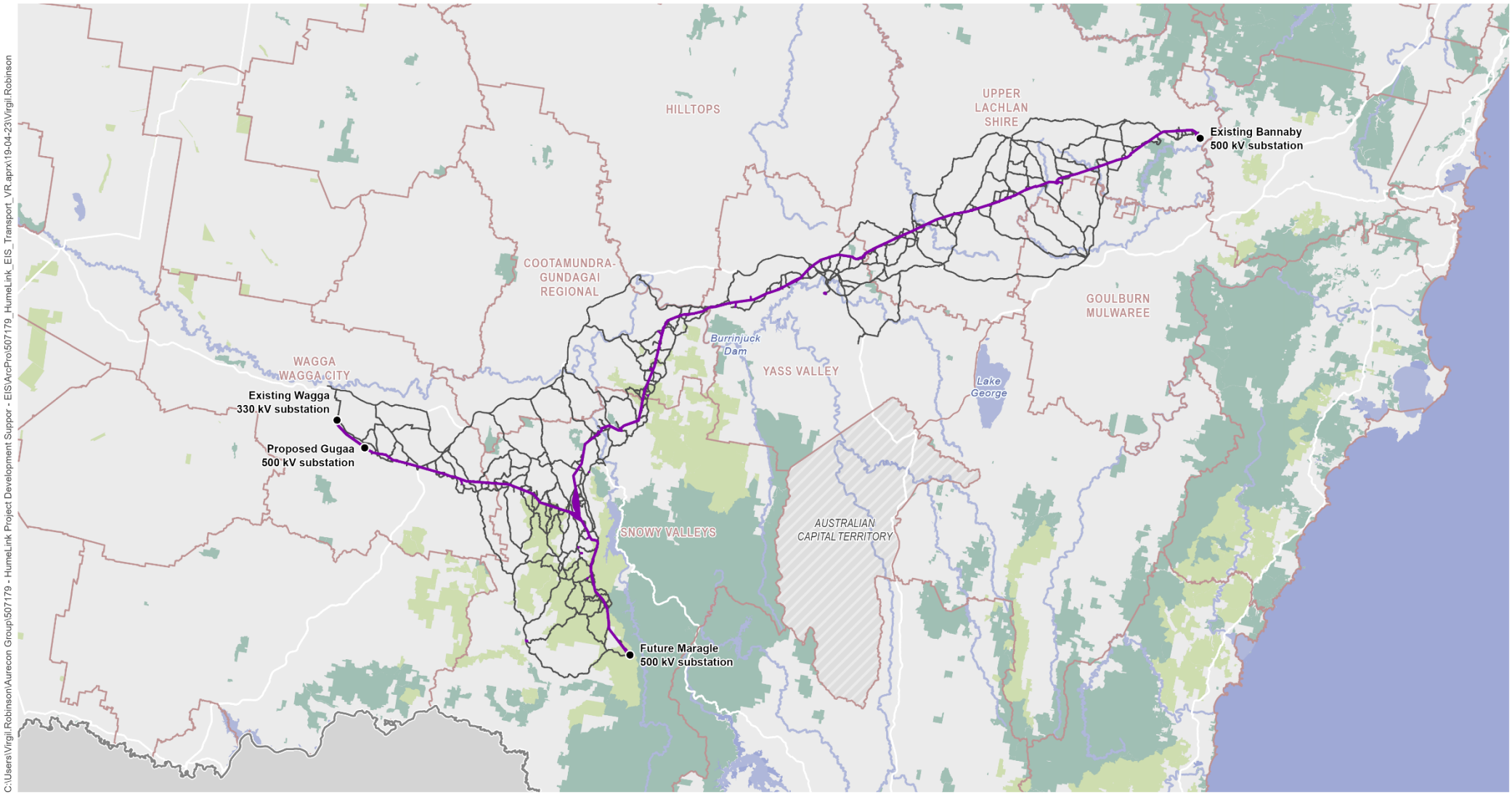
The traffic study area, illustrated by Figure 20-1, comprises the anticipated access routes within the existing road network required for the construction and/or operation of the project. The access routes are located across multiple Local Government Area (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Yass Valley, Goulburn-Mulwaree, Upper Lachlan Shire and Hilltops.

The assessment has also identified and assessed impacts more broadly to the existing:

- active and public transport services within the LGAs and the traffic study area
- OSOM road network for delivery of oversized equipment from ports to substations
- rail network that crosses the project footprint.

Two studies (Rex J Andrews, 2021a and Rex J Andrews, 2021b) have been used to identify and assess the most suitable OSOM routes for movements from the Port of Newcastle to the existing Bannaby 500 kV substation site and to the proposed Gugaa 500 kV substation site.

Further detail on the methodology and approach to the traffic and transport impact assessment is provided in *Technical Report 16 – Traffic and Transport Impact Assessment*.



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

1:1,100,000

0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 20-1: Traffic study area

20.2.2.2. Access route identification

The traffic study area was determined by identifying the existing roads and access tracks that may be used to provide access to:

- the project footprint (within which the transmission line structures, construction compounds, substations, proposed worker accommodation facility and other work sites would be located)
- the surrounding existing road network
- the surrounding towns and urban centres where it is anticipated that project workers would be accommodated.

The access routes were identified using Geographic Information System (GIS) tools. Representative accommodation locations were assumed to be on the major roads in Wagga Wagga, Tumut, Yass and other urban centres at a reasonable distance from the project footprint, in addition to the proposed worker accommodation facility at Tumbarumba.

In general, any access route expected to be used for access to the transmission line structures are assumed to be representative locations. Should alternative access routes be used in nearby areas, impacts are expected to be comparable. During detailed design, the final access tracks proposed for use would be refined, and the existing roads connecting to the tracks would be identified.

20.2.2.3. Road network performance

LoS criteria is used to describe the existing and proposed road network performance during construction. LoS relates to the operation of a road considering its traffic volumes and its designated capacity.

LoS is classified from A to F, with A representing the best operating conditions and F the worst operating conditions. As a reference, to provide an acceptable LoS, most road design and planning activities aim to maintain LoS at C or D.

20.3. Existing environment

20.3.1. Road network and existing performance

The existing road network across the traffic study area consists of a combination of national, state, regional and local roads. These roads are shown on Figure 4-5 in Chapter 4 (Project description – construction).

The Hume Highway is the only national road within the traffic study area and is located within the Wagga Wagga City, Cootamundra-Gundagai Regional, Yass Valley, and Upper Lachlan Shire LGAs. Within the traffic study area, the Hume Highway is a dual carriageway which generally consists of four traffic lanes and has a posted speed limit of 110 kilometres per hour.

The state roads within the traffic study area include the Barton Highway, Snowy Mountains Highway, Sturt Highway, Batlow Road, Crookwell Road / Goulburn Road and Gocup Road. These state roads also include several other roads as part of their network and typically consist of two traffic lanes (one in each direction). The Barton Highway and Sturt Highway have a maximum posted speed limit of 110 kilometres per hour; the other roads have a maximum posted speed limit of 100 kilometres per hour. The speed limit on state roads decreases to 50 or 60 kilometres per hour through or near towns.

There are 31 regional roads within the traffic study area. Most are sealed (the exception is Laggan-Taralga Road in the Upper Lachlan Shire LGA, which is unsealed). The regional roads generally consist of two lanes of traffic, although Bunnaby Street, Burrinjuck Road, Orchard Street and Woodhouselee Road in the Upper Lachlan Shire LGA and Burrinjuck Road in the Yass Valley LGA are unmarked. The speed limit is generally 100 kilometres per hour, which reduces to 60 or 80 kilometres per hour on approach to towns and 50 kilometres per hour through towns.

There are 248 local roads within the traffic study area. Of these, 149 are unsealed. The local roads vary between one and two lanes of traffic. The speed limit is generally 80 or 100 kilometres per hour, which reduces to 50 kilometres per hour through or near towns.

Hammond Avenue, which forms part of the Sturt Highway in Wagga Wagga City LGA, is the busiest road in the traffic study area. It carries a peak hourly traffic volume of 910 vehicles in one direction of travel (TfNSW, 2022c). The Hume Highway and Barton Highway within Yass Valley LGA and the Hume Highway in Cootamundra-Gundagai Regional LGA are the only other roads with peak hourly volumes over 350 vehicles in one direction of travel.

Regional roads in the traffic study area have typical peak volumes between 20 to 70 vehicles in one direction. Local roads have typical peak volumes of 10 to 70 vehicles in one direction of travel.

During peak hour, most of the roads forming the existing road network within the traffic study area are operating at LoS A, indicating free-flow driving conditions, where vehicles are almost completely unimpeded in their ability to manoeuvre within the traffic stream. Only one road, Hammond Avenue, part of Sturt Highway within Wagga Wagga City LGA, was observed to operate at LoS B, which still indicates reasonably free-flow driving conditions.

Further detail on all the roads in the traffic study area is provided in *Technical Report 16 – Traffic and Transport Impact Assessment*.

20.3.2. Heavy vehicle route restrictions

All the state roads and some regional roads (such as Tumbarumba Road and Elliot Way in Snowy Valleys Council LGA, as well as Binda Road in Upper Lachlan Shire LGA) are approved for the movement of restricted access vehicles, eg 25/26 metre B-double, and oversize and/or OSOM vehicles. However, none of the roads in the traffic study area are approved for movement of road trains.

Local roads are generally not part of the approved network for movement of RAVs, road trains and OSOM vehicles. A few local roads in State forest areas allow movement of RAVs with a general condition that “All drivers are required to hold a current Forest Operators Licence and follow Contractor Haulage Operations Plans”.

20.3.3. Road safety

Crash history data was analysed and summarised for each LGA to understand the crash severity and to provide a safety overview of road network conditions along the indicative access routes. The number of crashes recorded between 2016 and 2020 for all LGAs within the traffic study area are as follows:

- Wagga Wagga City LGA – 130 crashes
- Snowy Valleys LGA – 151 crashes
- Cootamundra-Gundagai Regional LGA – 89 crashes
- Yass Valley LGA – 164 crashes
- Upper Lachlan Shire LGA – 124 crashes
- Goulburn-Mulwaree LGA – 106 crashes
- Hilltops LGA – 2 crashes.

20.3.4. Rail network

The existing railway lines that cross the project footprint were identified using the NSW Public Level Crossing Finder (TfNSW, 2022d). The following operational and non-operational railway lines were identified:

- Main Southern Railway Line (operational) – located in the project footprint north of the Hume Highway about seven kilometres north-west of Yass
- Wagga Wagga Tumbarumba Railway Line (non-operational) – located in the project footprint about nine kilometres south-east of Tarcutta
- Tumut Railway Line (non-operational) – located in the project footprint north of the Snowy Mountains Highway about two kilometres north-west of Gadara
- Kunama Railway Line (non-operational) – located in the project footprint about six kilometres north-east of Batlow
- Goulburn Crookwell Railway Line (non-operational) – located in the project footprint about two kilometres north-west of Woodhouselee, near Woodhouselee Road.

20.3.5. Public transport

20.3.5.1. Regional train and coach network

NSW TrainLink operates regional trains and coaches within and passing through the project footprint. Train services operate daily between Sydney and Melbourne on the Main Southern Railway Line and several times a week between Goulburn and Griffith on the Main Southern Railway Line and Hay branch line west of Wagga Wagga. Regional coach services operate to and from Queanbeyan, Wagga Wagga, Cootamundra and Tumbarumba. These regional coach services are generally scheduled once daily, or several times a week.

20.3.5.2. Bus services

In addition to regional coach services, there are a number of bus services operated by local private operators in Wagga Wagga City, Yass Valley and Upper Lachlan Shire LGAs. These services generally vary from daily to weekly services except for Wagga Wagga, where the services include multiple services across the day.

20.3.6. Active transport

Active transport facilities include dedicated on-road or off-road infrastructure, which allow safe movement of pedestrians and cyclists. These can be segregated in the form of footpaths or dedicated pathways shared by pedestrians and cyclists.

Within the traffic study area, formal active transport facilities are generally only provided in towns. Outside of the towns and urban areas, there are limited active transport facilities due to the rural nature of the regional and local roads and general high speed environment.

Wagga Wagga has an active travel plan under implementation in two stages for developing a cycling/shared path network to link outer suburbs to the town centre area (City of Wagga Wagga, 2022). The access routes include roads along some cycling/shared path links, including Kooringal Road and Kyeamba Avenue.

For other towns near the project footprint, pedestrians and cyclists would typically use wide shoulders to travel along roads. These towns include Adelong, Batlow, Crookwell, Dalton, Goulburn, Gundagai, Gunning, Murrumbateman, Taralga, Tarcutta, Tumbarumba, Tumut and Yass.

20.4. Potential impacts – construction

During construction of the project, there is the potential for traffic and transport impacts associated with the movement of construction vehicles associated with plant and equipment, materials and workers.

20.4.1. Road network impacts

20.4.1.1. Traffic generation

Table 20-2 provides the overall estimated traffic movements generated by the project during construction for substations and transmission line work. Based on the preliminary construction program, up to 65 locations are estimated to be in use concurrently during construction of the transmission line structures, telecommunications hut, substations and construction compounds during the peak construction period. These active work sites would be distributed across the project footprint and accessed from various roads within the traffic study area.

Table 20-2 Indicative vehicle movement across the traffic study area during construction of substations and transmission line work

Activity	Typical daily movements (LVs)	Maximum daily movements (LVs)	Typical daily movements (HVs)	Maximum daily movements (HVs)
Wagga 330 kV substation	52	106	26	92
Proposed Gugaa 500 kV substation	86	190	36	102
Bannaby 500 kV substation	52	106	26	92
Transmission line work	346	656	99	155

Note:

Vehicle movements are each way (ie a heavy/light vehicle arriving and leaving a site, either within a day or separate days counts as two movements).Typical and maximum daily movements are based on the current program of work. Vehicle movements associated with the connection to the future Maragle 500 kV substation and the telecommunications hut are included in transmission line work.

Table 20-4 provides the overall estimated traffic movements generated by the project during construction for roads adjacent to the construction compounds and the worker accommodation facility.

Table 20-3 Indicative vehicle movement across the traffic study area to/from construction compounds

Location	Daily movement* (vehicles per day in both direction of travel)				Peak hour movement* (vehicles per day in both direction of travel)			
	Typical construction		Construction peak		Typical construction		Construction peak	
	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Wagga 330 kV substation compound (C01)	60	70	120	140	12	14	24	28
Snowy Mountains Highway compound (C02)	120	50	240	100	24	10	48	20
Snubba Road compound (C03)	100	40	200	80	20	8	40	16
Maragle 500 kV substation compound (C05)	25	30	50	60	5	6	10	12
Gregadoo Road compound (C06)	100	105	200	210	20	21	40	42
Honeysuckle Road compound (C07)	25	30	50	60	5	6	10	12
Red Hill Road compound (C08)	30	35	60	70	6	7	12	14
Adjungbilly Road compound (C09)	35	40	70	80	7	8	14	16
Yass substation compound (C10)	10	65	20	130	2	13	4	26
Woodhouselee Road compound (C11)	60	40	120	80	12	8	24	16
Bannaby 500 kV substation compound (C12)	100	85	200	170	20	17	40	34
Memorial Avenue compound (C14)	5	45	10	90	1	9	2	18
Bowmans Lane compound (C15)	5	25	10	50	1	5	2	10
Snubba Road compound (C16)	100	40	200	80	20	8	40	16
Tumbarumba Accommodation Facility (AC1)	50	10	100	20	10	2	20	4

20.4.1.2. Traffic distribution

Heavy vehicle traffic would be distributed across the traffic study area, making deliveries to work sites or disposing of construction material.

Light vehicle traffic would originate from the proposed worker accommodation facility and towns close to the project footprint and would be distributed from these locations to active work sites and construction compounds.

Roads adjacent to substation construction sites, existing substations and construction compounds are expected to experience higher volumes of heavy vehicle traffic, due to the deliveries of materials to these locations for longer durations of the construction program than other work sites. These roads would also carry some light vehicles for workers travelling to and from construction compounds and across the project footprint. However, within the traffic study area, 90 per cent of the access routes are expected to be used for a short duration of the overall construction program with only 10 per cent of the routes used for the full duration. Refer to *Technical Report 16 – Traffic and Transport Impact Assessment* for further detail.

20.4.1.3. Road network performance

The traffic impact within the traffic study area during construction is likely to be more apparent on local roads, access tracks and at specific access locations within the project footprint.

During the peak construction period, the peak hourly increase in total traffic on all roads providing access to the project would range between six to 82 vehicles per direction of travel and the median total increase in traffic on roads would be 22 vehicles per direction of travel. This is considered low. The peak hourly increase in heavy vehicle traffic on all roads providing access to the project would range between two to 42 vehicles per direction of travel and the median increase in heavy vehicle traffic would be 12 vehicles per direction of travel. In summary, the overall increase in construction traffic due to the project is considered relatively minor in light of the available capacity on roads.

With the additional construction traffic, there would be a minor increase in the level of congestion on roads within the traffic study area, but there would be no change in LoS. Due to the quiet nature of the existing local environment – owing to the low existing levels of traffic and the regional rural setting – the additional traffic would result in some noticeable change. However, with regards to road capacity, all roads would operate reasonably in free-flow conditions. This demonstrates that the road network in the traffic study area would keep on operating at nearly the same level of network performance as at present.

The assessment indicates the expected impact of additional traffic on road network performance would be low. In particular, when considering the construction program and the distribution of construction and ancillary site locations over the full geographical extent of the project, the expected additional volume of construction traffic generated by the project on national, state and regional roads (taking into consideration the design capacity) is expected to be insignificant.

The delivery of materials to transmission line structures is anticipated to be via a combination of both road delivery and air delivery (ie by helicopter). The use of helicopters would be informed during detailed design, subject to various considerations including access, ground conditions and landing locations. In general, the use of helicopters would reduce the potential for impacts on the road network within the traffic study area. The flying paths and the landing platforms are required to be in line with the Civil Aviation Safety Authority (CASA). For the purposes of this assessment, it has been assumed that all deliveries of materials would be via the road network.

20.4.1.4. Road condition

Road condition generally deteriorates over time due to weather and vehicle use. This may lead to pavement cracking and rutting and formation of potholes and corrugations. Unsealed roads are more susceptible to deteriorating than sealed roads. In addition, heavy vehicles are more likely to cause road conditions to deteriorate more noticeably than light vehicles. With the minor increases in heavy vehicle traffic during construction described in Section 20.4.1.1, the impact on the condition of the sealed roads within the traffic study area is expected to be low. However, this would depend on the existing pavement condition and applicable load restrictions.

Impacts would be most likely to occur on the unsealed roads used to access construction compounds due to the volume of proposed heavy vehicle traffic. These roads include:

- Snubba Road
- Livingstone Gully Road
- Honeysuckle Road
- Red Hill Road.

Potential impacts on road condition would be managed through the implementation of mitigation measures detailed in Section 20.6.3. These measures would include:

- dilapidation surveys on all local roads to record the existing road condition prior to construction
- a road condition assessment to assess potential damage to roads accessed by project-related construction traffic.

20.4.1.5. Stringing of the transmission line across roads

The national, state and regional roads crossed by the proposed transmission line include Hume Highway, Snowy Mountains Highway, Gocup Road, Batlow Road, Tumbarumba Road, Burrinjuck Road, Rye Park Road, Grabben Gullen Road, Crookwell Road / Goulburn Road, and Taralga Road.

During stringing of the proposed transmission line at these locations, there is the potential for short duration road closures (full or partial). The specific arrangements for any road closures would be confirmed during detailed design in consultation with the relevant road authority and subject to the requirements of a road occupancy licence and/or a section 138 consent under the *Roads Act 1993*. Where full road closures are required, traffic would be provided with a detour route determined in consultation with the relevant road authority.

The anticipated impacts of full or partial road closures would be temporary and would largely relate to an increase in travel time and distance due to a reduction in road capacity or speed restrictions, or the need to detour where a road has been fully closed. Potential impacts on road users would be minimised through the implementation of mitigation measures detailed in Section 20.6.3.

20.4.1.6. Road safety

As indicated in Section 20.4.1.1, the additional traffic associated with construction of the project is not expected to adversely impact network performance, and roads would continue to operate at the same LoS with reasonably free-flow driving conditions. As a result, the project is unlikely to result in behavioural changes by road users such as increased overtaking, lane changing and incidences of abrupt change in speed. In the absence of these behavioural changes, no impact is anticipated on road safety within the traffic study area.

Where construction activities are likely to impact the existing operational conditions of a road (ie during full or partial road closures), temporary traffic management measures would be required to address the risk of accidents. In addition, any temporary connection to the road network to provide access to construction compounds or other work sites would be designed in accordance with relevant Austroads Guides to minimise road safety risks.

20.4.1.7. Road network and property access

As discussed in Chapter 4 (Project description – construction), road improvements would be required to facilitate safe vehicle access to the proposed Gugaa 500 kV substation, ancillary facilities, and where access tracks require connection to the existing road network. In addition to the existing roads, several new or upgraded access tracks would be required to provide safe access to the work sites during construction.

Connections with the existing road network would be constructed in accordance with the relevant approvals under the *Roads Act 1993* and Austroads Guides, and any occupancy licence(s), and in consultation with the relevant road authority to ensure appropriate standards are achieved. During the connection work, there is the potential for short duration road closures (partial or full). If closures are required, the anticipated impacts would be short term and largely relate to temporarily reduced road capacity or speed restrictions. Where feasible, these activities would be planned outside the peak traffic period to minimise the impacts.

In addition to impacts associated with access to the road network, access to and from properties or within properties may also be temporarily impacted. Access may be restricted by activities such as line stringing or deliveries. However, these restrictions would be short term and undertaken in consultation with landowners. Further consideration of property access impacts is included in Chapter 11 (Land use and property) and Chapter 13 (Social).

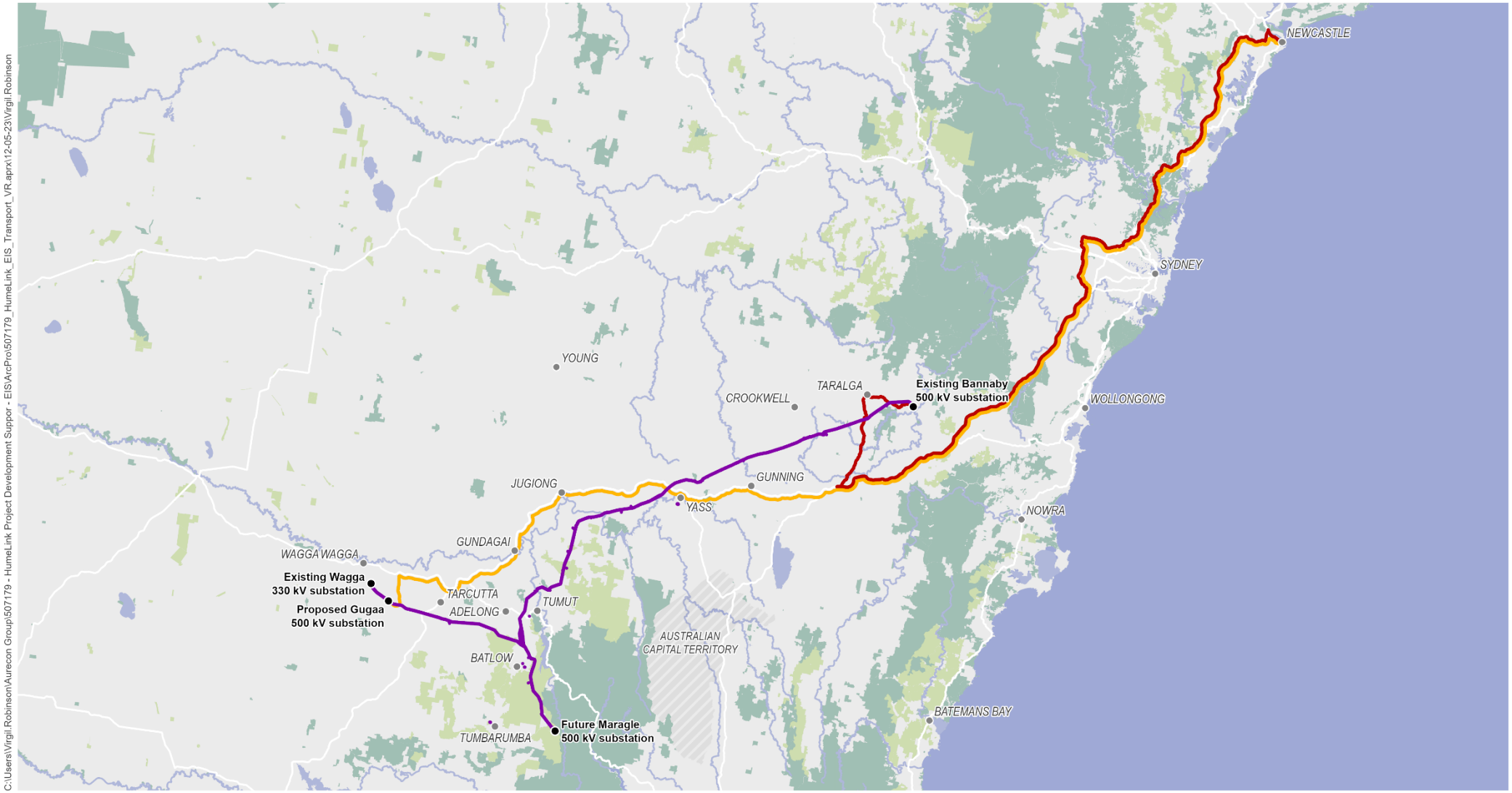
20.4.1.8. OSOM deliveries

Two OSOM haul routes have been identified and assessed in two separate reports to transport OSOM components from Newcastle port to the existing Bannaby 500 kV substation and proposed Gugaa 500 kV substation (Rex J Andrews, 2021a and Rex J Andrews, 2021b). These reports indicate that OSOM deliveries could be undertaken subject to various minor requirements including but not limited to:

- traffic management, spotter, assistance of police and pilot vehicles for pinch points
- approval to access the routes from relevant authorities and councils
- trailers to be raised to travel over a hump in the road
- restrictions on vehicles due to overhead structure (5.3 metre maximum loaded height)
- construction of a suitable access road for the swept path of the largest load to the proposed Gugaa 500 kV substation.

The construction contractors would confirm the haulage route and obtain the approvals that would need to be granted from relevant stakeholders. Figure 20-2 shows the location of the two most suitable OSOM haul routes considered in this assessment.

The indicative total OSOM vehicle movements for the duration of the project would be an estimated 20 OSOM deliveries to the proposed Gugaa 500 kV substation and four to the existing Bannaby 500 kV substation. Minor modifications along delivery routes would be required to facilitate OSOM access, including some widening and modification of the intersection of Gregadoo East Road and Livingstone Gully Road and temporary removal of several road signs. As only minor modifications would be required, and with implementation of the mitigation measures detailed in Section 20.6.3, impacts on road users are expected to be short term and negligible.

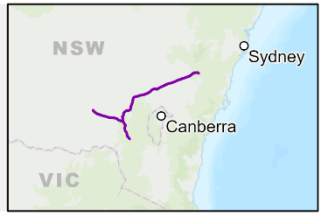


Project footprint
State forest
National park and reserve
Waterbody
Waterway

Major road
Substation

OSOM routes

Port of Newcastle port to Bannaby 500 kV substation
Port of Newcastle port to proposed Gugaa 500 kV substation



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

1:1,750,000
0 30 60 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 20-2: Indicative haulage routes for OSOM deliveries to the project footprint

20.4.2. Rail network and public transport impacts

The only operational railway line crossed by the proposed transmission line would be the Main Southern Railway Line about seven kilometres north-west of Yass. It is anticipated that stringing activities at this location would be undertaken during planned rail possessions (periods during which rail lines are not in use) in accordance with rail line owners' or operators' requirements. As such, no disruptions to regional rail services or other rail network operations are anticipated.

As construction traffic is not anticipated to adversely impact road network performance, regional coaches and bus services are not expected to experience delays due to increased construction traffic within the traffic and transport study area.

However, during stringing activities over roads, there is potential for regional coaches and bus services to experience temporary delays as detailed in Section 20.4.1.5. Any potential impact would be minimised through the implementation of mitigation measures detailed in Section 20.6.3.

20.4.3. Active transport impacts

Within the traffic study area, formal active transport facilities are generally only provided in towns. The potential for the interaction of active transport users with construction traffic would be negligible, considering the low volume of additional construction traffic in these areas and presence of off-road active transport facilities.

Outside towns, traffic associated with construction activities is expected to be mainly in the vicinity of transmission lines and substations, where no active transport provisions exist. The impact of construction traffic is therefore expected to have no impact on active transport at these locations.

20.5. Potential impacts – operation

20.5.1. Road network impacts

During operation, there would be limited potential for traffic and transport impacts associated with anticipated routine maintenance.

Access to the existing and proposed substations would mostly be on existing access roads. The one exception would relate to the proposed Gugaa 500 kV substation, which would require a new access road from Livingstone Gully Road; the new access road would be established during construction. The existing access road to the Bannaby 500 kV substation from Hanworth Road would also be upgraded.

Access to the transmission lines would be via existing access tracks or those constructed specifically for the project.

The substations and transmission lines would be inspected by Transgrid operational staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and transmission line structures, including an annual fly over of the transmission line route
- general building maintenance
- vegetation trimming, landscaping and maintenance of asset protection zone
- fire detection system inspection and maintenance
- fence repair
- stormwater and drainage infrastructure maintenance.

Routine inspections of the transmission lines would typically involve two to three maintenance workers driving a light vehicle from public roads to the easement using access tracks, then along the easement inspecting each transmission line structure. Structures would be inspected on a six-yearly cycle. In addition, there would be reactive and ad hoc fault transmission line maintenance in response to unexpected issues.

During operation, the substations would not accommodate full-time staff or contractors. Maintenance at these substation sites would typically include ad hoc attendance (typically one to two times a month) of one or two switching operators to undertake planned and unplanned switching of equipment. It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

For the telecommunications hut, trips would be carried out around once a year for routine maintenance as well as defect rectifications which could occur on an as-required basis.

As a result, operational traffic impacts on the road network would include:

- temporary increases in traffic movements at inspection/maintenance locations for the duration of the activities, which is anticipated to be up to:
    - five light vehicle trips and one heavy vehicle trip for transmission line maintenance
    - four light vehicle trips for each substation site
- impacts associated with the ongoing maintenance of new access tracks and roads developed during construction, particularly where these new assets connect with the existing public road network.

Based on the above, operation and maintenance activities would generate an insignificant quantity of traffic. As a proportion of road volume capacity available, and in terms of the current high level of service for the road network within the traffic study area, the additional vehicles generated by the operation of the project would represent no perceptible change. As such, operation of the project would have a negligible impact on road network performance.

In addition, the low volumes of light and heavy vehicles required for operation and maintenance activities are anticipated to have a negligible impact on road condition.

20.5.2. Rail network and public transport impacts

During operation, no regular maintenance is anticipated where the transmission line crosses railways, aside from isolated occurrences of inspections of transmission line structures. During these events, work would be undertaken in consultation with rail authorities, by appropriately authorised personnel and within the required clearances from existing rail lines. As such, negligible impacts are anticipated on railway operation.

The low traffic generated for operation of the project, combined with the infrequent nature of the traffic movements, would have limited interaction with public transport services. As a result, operational traffic is anticipated to have a negligible impact on public transport.

20.5.3. Active transport impacts

Within the traffic study area, active transport provisions such as footpaths exist in urban environments only. The traffic for operational and maintenance activities is expected mainly in the vicinity of transmission lines and substations, where no active transport provisions exist.

The increase in traffic due to operation of the project is expected to have a negligible impact on active transport.

20.6. Management of impacts

20.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). For construction, all mitigation measures would be consolidated in a Construction Environmental Management Plan (CEMP).

Traffic impacts are primarily anticipated during construction, when industry standard mitigation measures would be carried out to manage potential impacts. These include the development of a Traffic and Transport Management Plan (TTMP) which would identify requirements for the minimisation of traffic impacts. The TTMP would form part of the CEMP. The TTMP would be prepared in consultation with each relevant council and Transport for NSW to identify the key management and response strategies to minimise potential delays and disruptions that may arise due to the project. It would include (as a minimum):

- measures to minimise disruption to pedestrians, cyclists and motorists
- management of safe vehicle access/egress from construction compounds and other work sites
- measures to manage OSOM vehicle movements during construction
- management of long-distance travel through driver fatigue management measures
- measures to ensure safe access to existing properties during construction, or provision of suitable alternatives.

20.6.2. Avoidance and minimisation of impacts

Traffic impacts during construction of the project would be avoided and managed primarily through the establishment of regular communications with the relevant road and rail authorities, landowners, community, contractors of other projects and project stakeholders, regarding the planned movements of project construction traffic.

20.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

Table 20-4 summarises the mitigation measures that would be implemented to avoid or minimise potential impacts to traffic and transport.

Table 20-4 Summary of traffic and transport mitigation measures

Reference	Impact	Mitigation measure	Timing	Relevant locations
TT1	Road safety – design	Access tracks, access connections and road upgrades required to facilitate the movement of project related traffic will be designed according to relevant Austroads guides.	Detailed design	Access tracks and roads
TT2	Impact to road network during OSOM deliveries	Prior to commencement of transportation activities, the validity of the previously undertaken haulage route studies will be confirmed in consideration of final haulage route conditions and applicable route restrictions for the period during which transportation of such components is planned.	Detailed design	Transportation route
TT3	General construction impacts	Traffic controls will be aligned with *Traffic Control at Work Sites – Technical Manual Version 6.1* (TfNSW, 2022b). Traffic controls will be confirmed in consultation with the relevant road authority.	Detailed design and construction	All locations
TT4	Road maintenance	Prior to construction, road dilapidation surveys will be carried out for all local roads to be used during construction. The surveys will assess the current condition of the road surface. At the completion of project construction, a subsequent road condition assessment will be prepared to assess the damage to roads accessed by project related traffic. Damage caused by the project will be rectified in consultation with the relevant road authority.	Detailed design and construction	Access routes
TT5	Impact on rail operation	All project activities in rail corridors will be undertaken in accordance with the permission granted by the appropriate rail authority. Stringing of transmission line over rail tracks will be scheduled during rail maintenance periods or in a duration which permits sufficient gap between scheduled freight or passenger services to undertake the work.	Construction and operation	All locations
TT6	Temporary lane/road closure	Road closures will be undertaken with the approval of the appropriate road authority and under the relevant road occupancy licence to be obtained prior to construction. Where feasible, road closures will be planned outside of the traffic peak to minimise the impact on the road network.	Construction	All locations
TT7	Road safety – driver related	A Code of Conduct applicable to all construction workers will be developed and implemented which will define acceptable driver behaviour. The purpose of the Code of Conduct is to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised. The Code of Conduct will be developed as part of a wider suite of documents under work health and safety requirements.	Construction	Roads providing access to project
TT8	Community and stakeholder consultation	Community and stakeholder communication strategies will be established and implemented to notify the affected communities, visitors, emergency services and relevant road and rail authorities in advance of any disruptions to traffic, anticipated delays, disruptions to property access and changes to travel routes. The strategies will be developed including details on communication channels, frequency of communication and response measures in relaying information to the community and stakeholders.	Detailed design and construction	All locations

20.6.4. Managing residual impacts or uncertainties

The access routes assessed for construction and operation of the project were identified through GIS analysis. The access routes are made up of a combination of roads and access tracks to connect to proposed transmission line structures, construction compounds, substations and accommodation locations of the project that form the traffic study area. The access routes are therefore considered indicative for the purposes of the traffic and transport impact assessment. It is probable that the access routes may change during further design development, or due to changes to the construction methodology, or due to other external factors such as road damage caused by severe weather events. However, should alternative access routes be used in nearby areas, impacts are expected to be comparable due to the roads in the vicinity of the project having similar characteristics. The final access routes would be confirmed in the TTMP.

Through the implementation of the mitigation measures detailed in Section 20.6.3, residual impacts of the project resulting from the identified traffic, transport and access impacts are anticipated to be appropriately managed without any residual impacts or uncertainties. In particular, the continued engagement with local councils would identify the required strategies to manage the predicted minor increase in vehicle movements on the local road networks and the appropriate measures to manage road condition (in particular on unsealed roads).

21. Air quality

This chapter provides a detailed summary of the assessment of potential air quality impacts of the project. The full assessment is provided in *Technical Report 17 – Air Quality Impact Assessment* (SLR, 2023b).

21.1. Environmental Assessment Requirements

21.1.1. Secretary's Environmental Assessment Requirements

Table 21-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to the air quality impacts of the project and where these requirements are addressed in this EIS.

Table 21-1 Secretary's Environmental Assessment Requirements – air quality

Reference	SEARs	Where principally addressed in the EIS
Air		
Key issues	The EIS must address the following matters: • an assessment of the air quality impacts of the project.	Section 21.4 provides information on potential construction air quality impacts. Section 21.5 provides information on potential operational air quality impacts.

21.2. Assessment approach

21.2.1. Legislative and policy context

Key legislation, policies and guidelines considered as part of the air quality assessment included:

- *National Environment Protection Council Act 1994*
- National Environment Protection Council (Ambient Air Quality) Measure (NEPC, 2021)
- *Protection of the Environment Operations Act 1997*
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2022c)
- *Technical Framework: Assessment and management of odour from stationary sources in NSW* (NSW Department of Environment and Conservation, 2006b)
- *NSW Clean Air Strategy 2021 – 2030* (DPE, 2022l)
- *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management (IAQM), 2014) (IAQM Guidance)
- National Pollutant Inventory *Emission Estimation Technique Manual for Combustion Engines* (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008).

21.2.2. Methodology

The approach to the air quality assessment for the project included:

- identifying relevant air pollutants (refer to Section 21.2.2.1)
- defining the air quality study area and identifying sensitive receptors
- reviewing local topography, existing air quality and meteorology for the air quality study area
- qualitatively assessing dust emissions due to construction activities (refer to Section 21.2.2.2)
- carrying out a risk-based assessment of potential operational dust emissions and emissions from products of combustion during construction and operation (refer to Section 21.2.2.3)
- identifying mitigation measures to address air quality risks identified.

In accordance with the IAQM Guidance, sensitive receptors within 350 metres of the project footprint were identified. The IAQM Guidance also recommends consideration of sensitive receptors within 500 metres of access tracks, and therefore a 500 metre buffer on either side of the project footprint was also assessed. Therefore, the air quality study area is all land within the 350 metre and 500 metre buffer around the project footprint as illustrated in Figure 21-2.

No significant quantities of odorous chemicals or volatile organic compounds (VOCs) (which can be potentially odorous) would be stored or used on site during either construction or operation of the project. The Tumbarumba accommodation facility (AC1) would be connected to the sewerage system and no onsite septic system is proposed. As such, no detailed assessment of odour was considered to be required for the project.

21.2.2.1. Air pollutants of concern

The relevant air pollutants of concern that have been considered as part of the air quality assessment include:

- particulate matter (PM) of varying size fractions (including nuisance dust)
- products of fuel combustion (including particulates) from equipment and vehicles.

The term PM refers to a category of airborne particles, which is classified in relation to its size as either:

- PM_{10} particles which are sufficiently small enough (10 microns or less) to penetrate the large airways of the lungs
- $PM_{2.5}$ particles which are generally small enough (2.5 microns or less) to be drawn in and deposited into the deepest portions of the lungs.

Gaseous emissions associated with construction and operation from the combustion of fossil fuels (eg diesel and petrol, LPG etc) in vehicles, helicopters and generators include carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO_2) and VOCs.

21.2.2.2. Construction dust assessment

Potential air quality impacts associated with dust emissions from construction of the project have been conservatively assessed in accordance with the IAQM Guidance. The IAQM Guidance uses a qualitative process for assessing the risk of adverse effects due to dust emissions from construction activities.

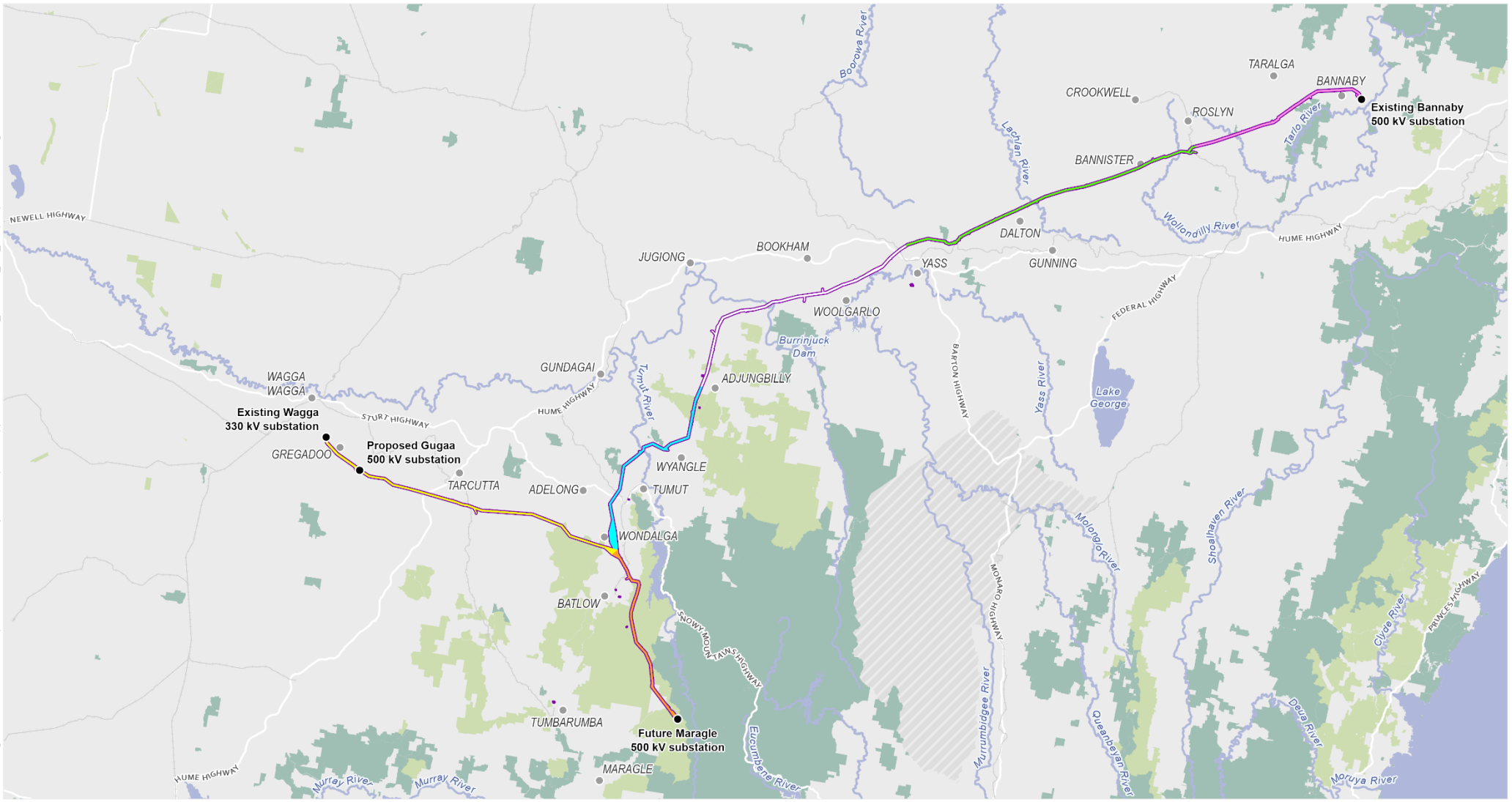
Key steps in the assessment included:

- an initial screening to identify whether there is a risk of construction dust impacts based on the proximity of sensitive receptors
- a risk assessment to determine which construction activities with no mitigation applied have the potential to generate a dust impact based on the scale and nature of the construction activities, and the sensitivity of nearby sensitive receptors
- identification of appropriate dust mitigation measures depending on the level of assessed risk of impact.

Due to the length of the project and the need to consider impacts of construction activities at a local level, the potential impact on air quality during construction was considered in the following six sections and illustrated on Figure 21-1:

- Transmission line section 1: Wagga 330 kV substation to Wondalga
- Transmission line section 2: Wondalga to future Maragle 500 kV substation
- Transmission line section 3: Wondalga to Adjungbilly
- Transmission line section 4: Adjungbilly to Yass
- Transmission line section 5: Yass to Roslyn
- Transmission line section 6: Roslyn to Bannaby.

In accordance with the IAQM Guidance, the risk of dust arising in sufficient quantities to cause annoyance and/or health impacts is assessed using the following four risk categories: negligible, low, medium and high. Refer to *Technical Report 17 – Air Quality Impact Assessment* for further detail on the construction dust assessment methodology including definitions and how sensitivity categories are applied.



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

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 21-1: Transmission line sections assessed in air quality assessment

21.2.2.3. Operational dust assessment

Operational dust emissions were assessed qualitatively using a risk-based approach, based on International Organization for Standardization (ISO) 31000 risk management principles (ISO, 2018). These consider a range of impact descriptors to derive the risk, namely:

- nature of impact
- receptor sensitivity
- magnitude of impact.

The risk-based matrix provided in *Technical Report 17 – Air Quality Impact Assessment* illustrates how the receptor sensitivity and magnitude of impact interact to determine the impact significance for the assessment of operational dust emissions.

21.2.3. Products of combustion assessment

The risk-based matrix was also used to determine emissions from products of combustion from mobile equipment during construction and operation.

The diesel and petrol emission factors for miscellaneous industrial vehicles were sourced from the *National Pollutant Inventory Emission Estimation Technique Manual for Combustion Engines* (DEWHA, 2008) to estimate the emissions from products of combustion.

During construction only, up to six of the construction compounds are expected to use diesel-fuelled generators for electrical power. As such, consideration has also been given to the recommended separation distance of 500 metres for fuel burning. Recommended separation distances are detailed in *Technical Report 17 – Air Quality Impact Assessment.*

21.3. Existing environment

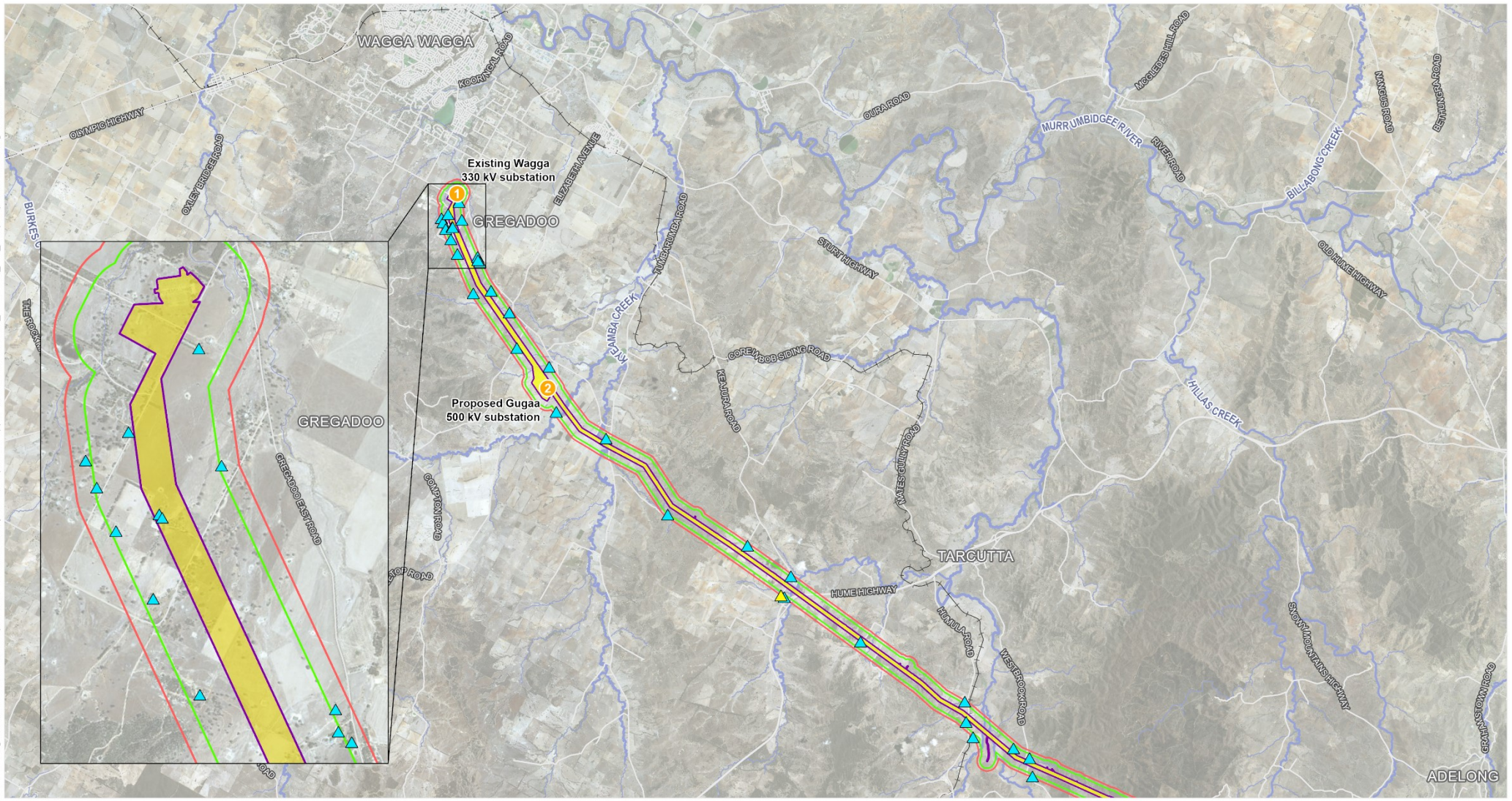
21.3.1. Sensitive receptors

A sensitive receptor is defined as a location where people are likely to work or reside. This may include a dwelling, school, hospital, office or public recreational area. However, the main type of sensitive receptor within the air quality study area are dwellings.

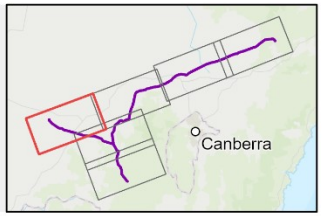
The locations along the transmission line route that have the highest number of dwellings within 500 metres of the air quality study area include the section between Wondalga to the future Maragle 500 kV substation, followed by the section between Yass and Roslyn, which also includes one place of worship. There is one uninhabited dwelling within 350 metres of the project footprint near the existing Wagga 330 kV substation and adjacent construction compound (C01) and no sensitive receptors within the air quality study area around the Bannaby 500 kV, proposed Gugaa 500 kV and future Maragle 500 kV substations.

The Memorial Avenue compound (C14) and Bowmans Lane compound (C15) have the highest number of sensitive receptors (dwellings) within 500 metres of the project footprint due to their proximity to the residential areas of Batlow. Multiple dwellings are also located just within the air quality study area at the Tumbarumba accommodation facility (AC1) and the Snowy Mountains Highway compound (C02). There are no sensitive receptors near the other construction compounds.

The identified sensitive receptors in the air quality study area are shown in Figure 21-2, together with the 350 metre and 500 metre buffers detailed in Section 21.2.2.



Project footprint
350m buffer
500m buffer
Waterway
Railway
Sensitive receiver within 500m buffer
Residential
Possible residence
Transmission line sections
Section 1: Wagga 330 kV substation to Wondalga
Construction ancillary facilities
1 Wagga 330 kV substation compound (C01)
2 Gregadoo Road compound (C06)



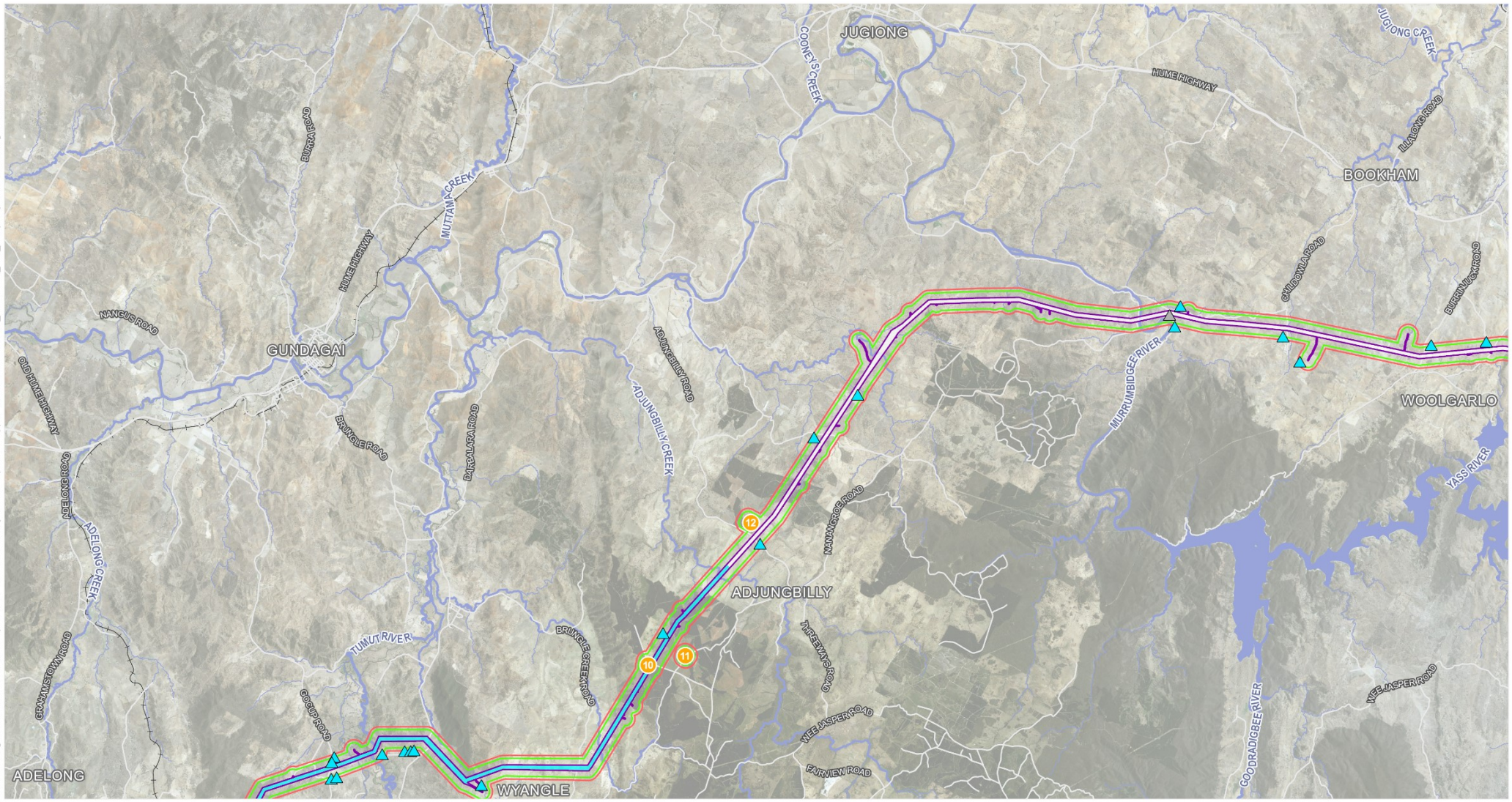
Source: *Aurecon, Transgrid, ALA, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 21-2a: Sensitive receiver location within and surrounding the air quality study area



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Project footprint
350m buffer
500m buffer
Waterbody
Waterway
Railway

Sensitive receiver within 500m buffer

Dilapidated dwelling
Residential

Transmission line sections

Section 3: Wondalga to Adjungbilly
Section 4: Adjungbilly to Yass

Construction ancillary facilities

10 Honeysuckle Road compound (C07)
11 Red Hill Road compound (C08)
12 Adjungbilly Road compound (C09)

Canberra

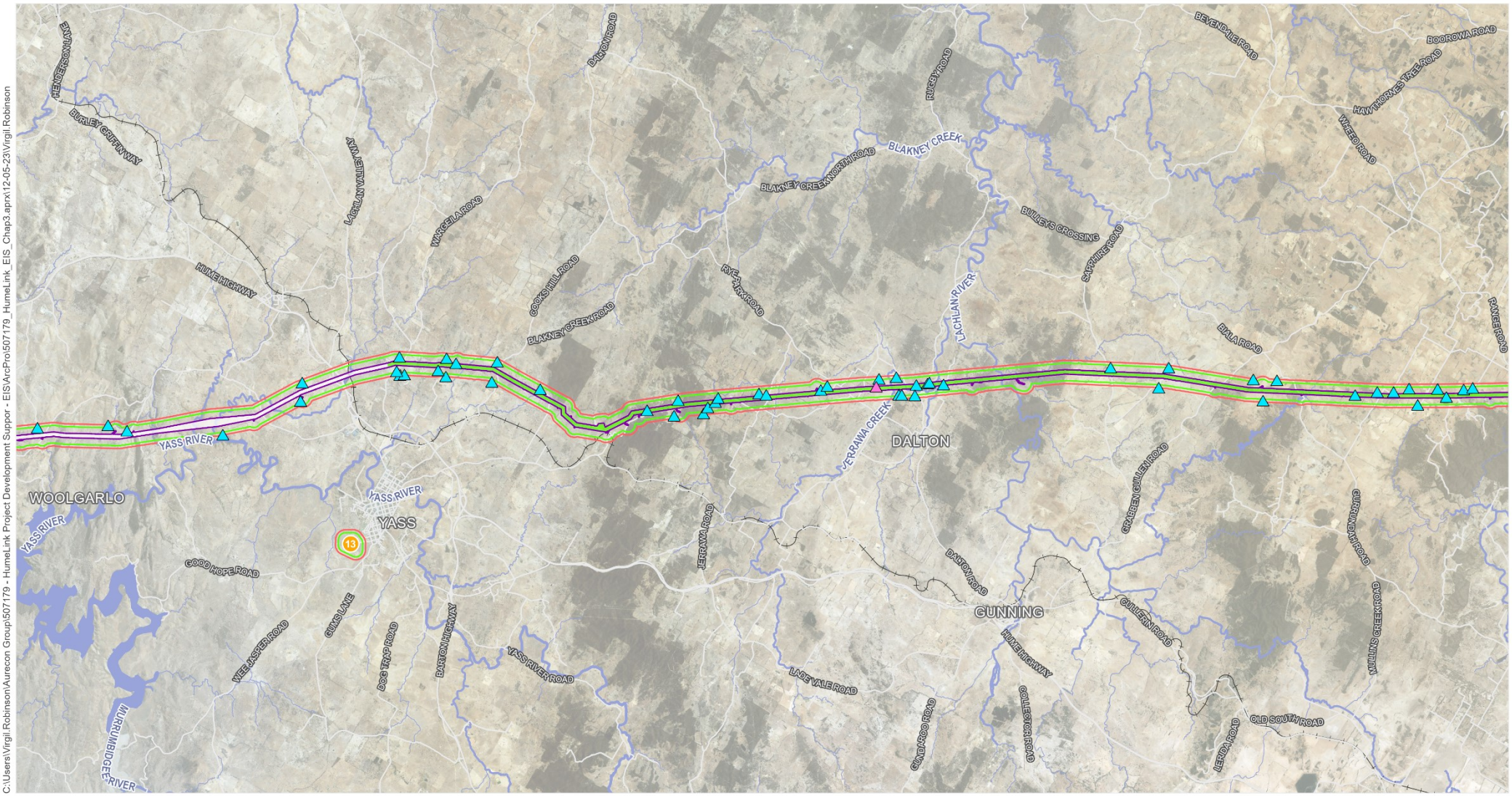
Source: *Aurecon, Transgrid, ALA, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 21-2b: Sensitive receiver location within and surrounding the air quality study area

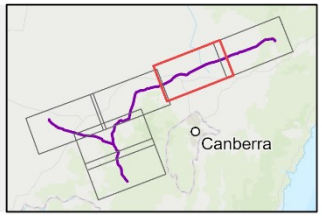


Project footprint
350m buffer
500m buffer
Waterbody
Waterway
Railway

Sensitive receiver within 500m buffer
Residential
Place of Worship

Transmission line sections
Section 4: Adjungbilly to Yass
Section 5: Yass to Roslyn

Construction ancillary facilities
13 Yass substation compound (C10)



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

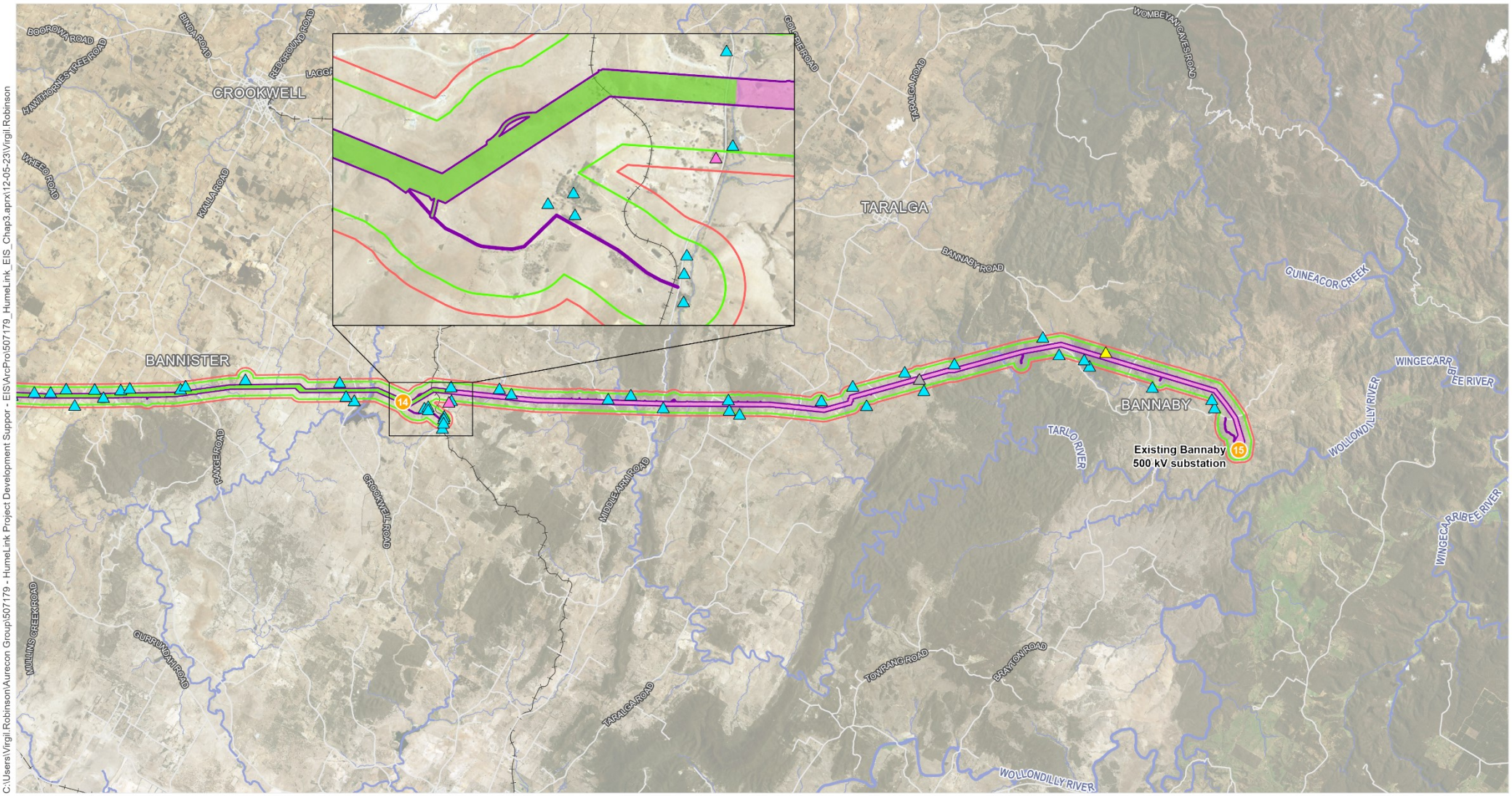
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Projection: GDA 1994 MGA Zone 55

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Figure 21-2c: Sensitive receiver location within and surrounding the air quality study area

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Project footprint
350m buffer
500m buffer
Waterway
Railway

Sensitive receiver within 500m buffer

Dilapidated dwelling
Residential
Place of Worship
Possible residence

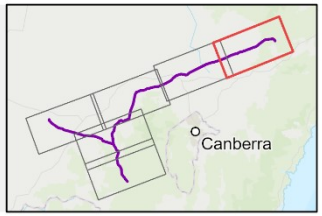
Transmission line sections

Section 5: Yass to Roslyn
Section 6: Roslyn to Bannaby

Construction ancillary facilities

14 Woodhouselee Road compound (C11)

15 Bannaby 500 kV substation compound (C12)



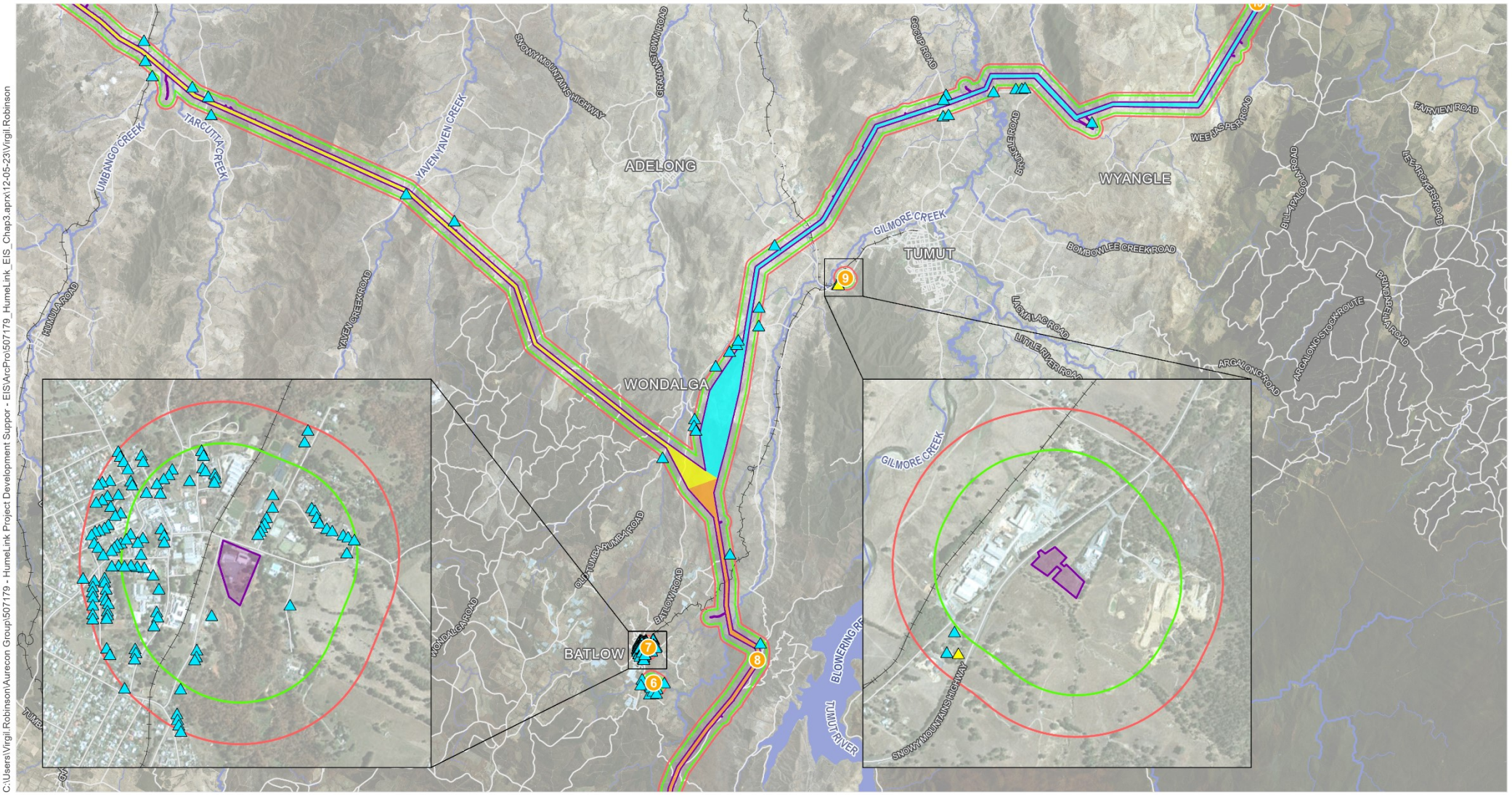
Source: *Aurecon, Transgrid, ALA, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 21-2d: Sensitive receiver location within and surrounding the air quality study area

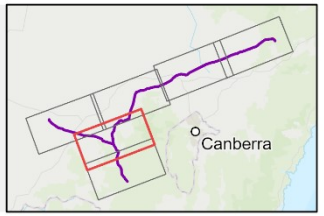


Project footprint
350m buffer
500m buffer
Waterbody
Waterway
Railway

Sensitive receiver within 500m buffer
Residential
Possible residence

Transmission line sections
Section 1: Wagga 330 kV substation to Wondalga
Section 2: Wondalga to future Maragle 500 kV substation
Section 3: Wondalga to Adjungbilly

Construction ancillary facilities
6 Bowmans Lane compound (C15)
7 Memorial Avenue compound (C14)
8 Snubba Road compound (C03)
9 Snowy Mountains Highway compound (C02)
10 Honeysuckle Road compound (C07)



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

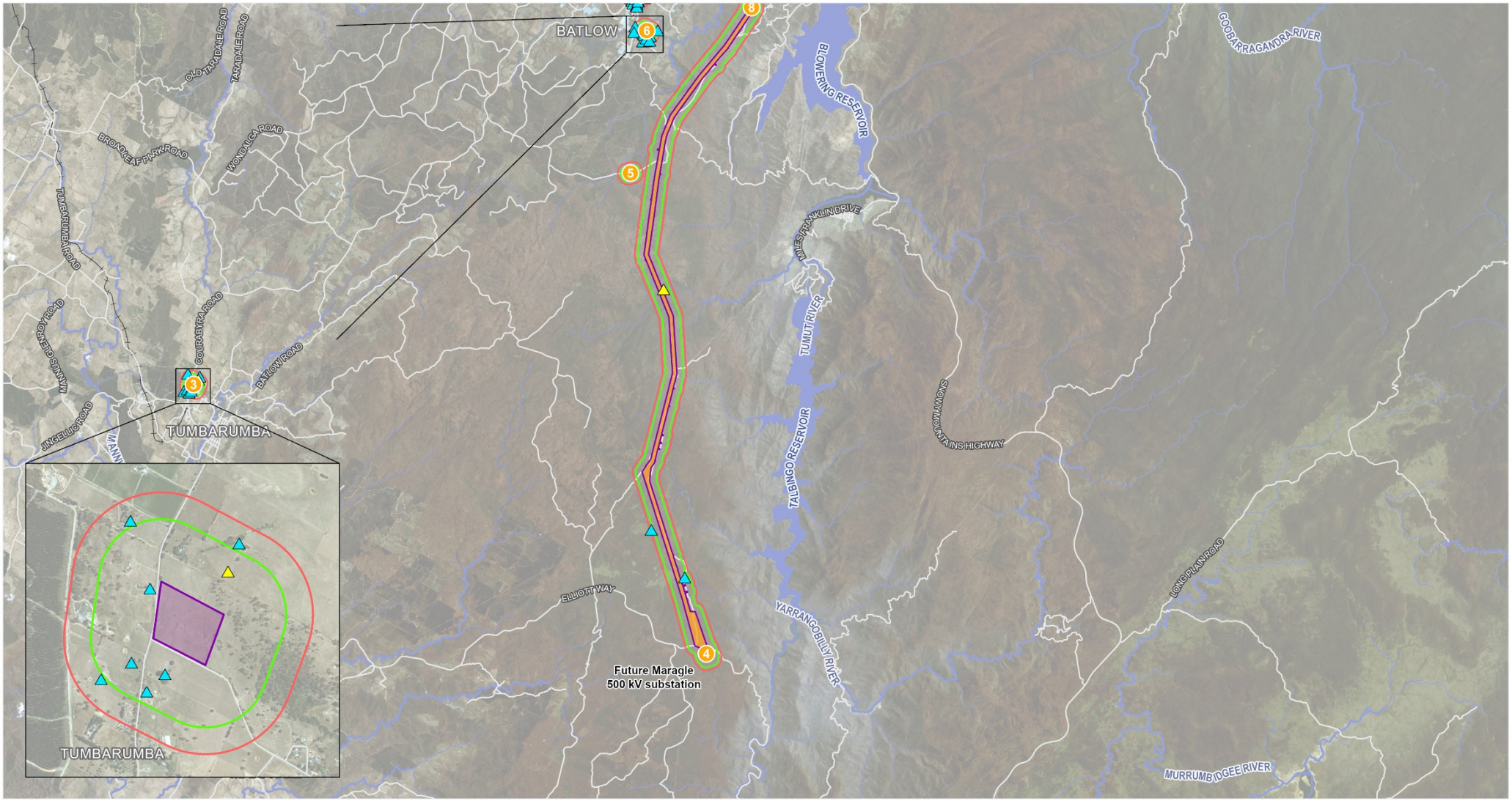
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Projection: GDA 1994 MGA Zone 55

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Figure 21-2e: Sensitive receiver location within and surrounding the air quality study area

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Project footprint
350m buffer
500m buffer
Waterbody
Waterway
Railway

Sensitive receiver within 500m buffer

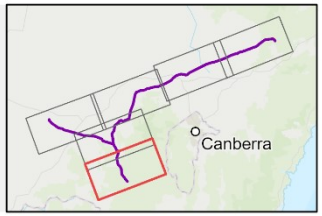
Residential
Possible residence

Transmission line sections

Section 2: Wondalga to future Maragle 500 kV substation

Construction ancillary facilities

3 Tumbarumba accommodation facility (AC1)
4 Maragle 500 kV substation compound (C05)
5 Snubba Road compound (C16)
6 Bowmans Lane compound (C15)
8 Snubba Road compound (C03)



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

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Projection: GDA 1994 MGA Zone 55

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Figure 21-2f: Sensitive receiver location within and surrounding the air quality study area

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21.3.2. Topography

The topography of the air quality study area is widely variable, with elevation ranging from about 220 metres above the Australian height datum (mAHD) to 1,232 mAHD.

21.3.3. Local meteorology

Meteorological considerations are important for determining the direction and rate at which emissions from a source disperses. The key meteorological parameters include wind speed and direction and, to a lesser extent, temperature, rainfall and relative humidity.

The following four Bureau of Meteorology (BoM) automatic weather stations are located near the air quality study area:

- Moss Vale – about 30 kilometres south-east of Bannaby 500 kV substation
- Goulburn – about 50 kilometres south-west of Bannaby 500 kV substation and approximately 30 kilometres south of the project footprint
- Cabramurra – about 15 kilometres south-east of the future Maragle 500 kV substation
- Wagga Wagga – about seven kilometres to the north-east of Wagga 330 kV substation.

Table 21-2 provides a summary of key climate statistics and wind conditions reported at each of these weather stations. Detailed findings are described in *Technical Report 17 – Air Quality Impact Assessment*.

Table 21-2 Key climate statistics and wind conditions near the project footprint

Parameter	Bureau of Meteorology automatic weather stations			
	Moss Vale	Goulburn	Cabramurra	Wagga Wagga
Predominant wind direction	West and north-north-east	West-north-west and north-west	West-north-west and north-west	North-east and east
Calm wind speed (0-0.5 m/s) frequency	4.3%	13.5%	4.1%	6.7%
Mean temperatures	23.6 °C (max) 2.5 ˚C (min)	28.2 ˚C (max) 0.3 ˚C (min)	21.6 ˚C (max) -0.8 ˚C (min)	31.9 ˚C (max) 2.8 ˚C (min)
Annual average rainfall	712.9 mm	558.4 mm	1225 mm	571.4 mm
Mean humidity range	83% (max at 9am) 51% (min at 3pm)	88% (max at 9am) 39% (min at 3pm)	84% (max at 9am) 52% (min at 3pm)	88% (max at 9am) 29% (min at 3pm)

21.3.4. Ambient air quality

21.3.4.1. Background air quality and existing emission sources

The primary land uses within the air quality study area are grazing modified pastures, grazing native vegetation and cropping; refer to Chapter 11 (Land use and property) for more detail. Emissions from existing activities within these land uses influence the air quality within the air quality study area. The primary contributions from these land uses to local air quality are expected to be:

- particulates (dust) from cultivating and harvesting activities
- dust from livestock
- products of fuel combustion (including particulates) from agricultural equipment, local road and air traffic.

Around the towns of Goulburn, Yass, Tumut, Batlow and Wagga Wagga, it is expected that background air quality conditions would also be impacted by marginally greater levels of vehicle use and commercial activities. However, given the project footprint is generally a considerable distance from urban areas (refer to Figure 21-2), the background air quality within the air quality study area is expected to contain low concentrations of pollutants (outside of events including dust storms or bushfires) due to the rural and agricultural nature of the area.

The NSW Government monitors air quality using Air Quality Monitoring Stations (AQMS) across NSW. The following three AQMS are closest to and most representative of the air quality study area:

- Bargo AQMS – about 47 kilometres north-east of the Bannaby 500 kV substation
- Goulburn AQMS – about 43 kilometres south-west of the Bannaby 500 kV substation
- Wagga Wagga North AQMS – about 10.5 kilometres to the north of the Wagga 330 kV substation.

Air pollutant data was reviewed for the Bargo and Wagga Wagga North AQMS for a five-year period between 2017 to 2021 (inclusive). Goulburn AQMS was commissioned in 2019 with data for this AQMS accordingly reviewed for the years 2019 to 2021 (inclusive). The review identified the following:

- exceedances of the maximum 24-hour average PM_{10} criterion of 50 micrograms per cubic metre were recorded at the Bargo and Wagga Wagga North AQMS in all five years investigated and at the Goulburn AQMS in two of the three years investigated
- exceedances of the maximum 24-hour average $PM_{2.5}$ criterion of 25 micrograms per cubic metre were recorded at the Bargo AQMS and Wagga Wagga North AQMS for four of the five years investigated and Goulburn AQMS for all three years investigated
- for annual average PM_{10} criterion of 25 micrograms per cubic metre there were:
    - no exceedances of the annual average PM_{10} criterion at Bargo AQMS
    - exceedances at Goulburn AQMS for one of the three years investigated
    - exceedances at Wagga Wagga AQMS for two of three years investigated
- exceedances of the annual average $PM_{2.5}$ criterion of eight micrograms per cubic metre were recorded at the Bargo AQMS in one of the five years investigated, Goulburn AWMS in two of the three years investigated and at the Wagga Wagga North AQMS for four of the five years investigated
- ambient concentrations of nitrogen dioxide (NO_2) were below the maximum one-hour average and annual average criterion of 0.08 and 0.015 parts per million respectively for Bargo AQMS for all five years investigated, ambient concentrations of NO_2 exceeded the maximum one-hour average at Goulburn AQMS for two of the three years investigated and there was no data available for Wagga Wagga North AQMS.

The exceedances recorded at all stations were primarily due to exceptional events, such as bushfire emergencies, dust storms and hazard reduction burns. In particular, the exceedances recorded in 2019 and 2020 were due to bushfire smoke that impacted much of NSW for a significant period during November 2019 and January 2020.

Based on the above background air quality data review and removal of the data between November 2019 and January 2020, the assumed annual average background PM_{10} concentrations for each AQMS are:

- Bargo AQMS – 14.3 micrograms per cubic metre
- Goulburn AQMS – 10.0 micrograms per cubic metre
- Wagga Wagga North – 22.7 micrograms per cubic metre.

Further detail on the background air quality data review is provided in *Technical Report 17 – Air Quality Impact Assessment*.

21.4. Potential impacts – construction

21.4.1. Dust emissions

During construction, dust emissions can be caused by:

- demolition
- earthworks
- construction
- track-out (the movement of site material onto public roads by vehicles).

The generation of emissions and their effect can vary substantially from day-to-day, depending on:

- activities undertaken
- duration of the activities
- size of the work site
- meteorological conditions
- proximity of sensitive receptors to the activities
- adequacy of mitigation measures applied to reduce or eliminate dust
- sensitivity of sensitive receptors to dust.

A large proportion of the dust emissions during construction would result from construction plant and vehicles moving over temporary roads or access tracks and open ground. If mud is tracked onto local roads, dust emissions can occur at some distance from the originating site. Helicopters may be used during construction to deliver materials and equipment, particularly within the more elevated sections of the project footprint. Where a helipad is proposed, the potential air quality impacts have been considered in the risk assessment for dust emissions.

Crushing and screening activities may occur at some construction compounds during construction, which would also be a potential source of dust. The scale of these impacts would depend on the dust suppression and other mitigation measures applied. Dust impact from construction activities mainly relates to deposited dust. Deposited dust can cause nuisance by settling on surfaces and possessions, affecting visibility, and contaminating tank water supplies. High rates of dust deposition can also adversely affect vegetation by blanketing leaf surfaces.

Table 21-3 summarises the potential dust risks at sensitive receptors without the application of mitigation measures. The sensitivity of each section to dust deposition effects is based on the receptor sensitivity and the number of sensitive receptors within 20 metres, 50 metres, 100 metres and 350 metres of the project footprint (refer to Figure 21-2 for sensitive receptor locations relevant to the project footprint).

Table 21-3 Summary of dust risk with and without mitigation measures

Activity	Dust risk		Location
	No mitigation	With mitigation	
Construction of the transmission line	Low to high	Negligible	Referring to the following transmission line sections: High: • Section 1: Wagga 330 kV substation to Wondalga • Section 4: Adjungbilly to Yass • Section 5: Yass to Roslyn Medium: • Section 3: Wondalga to Adjungbilly • Section 6: Roslyn to Bannaby Low: • Section 2: Wondalga to future Maragle 500 kV substation
Substation work	Low	Negligible	All
Establishment and use of construction compounds	Negligible	N/A	• Snubba Road compound (C16) • Honeysuckle Road compound (C07) • Red Hill Road compound (C08) • Maragle 500 kV compound (C05)
	Low	Negligible	All (with the exception of Snubba Road compound (C16), Honeysuckle Road compound (C07), Red Hill Road compound (C08) and Maragle 500 kV compound (C05))
Establishment and use of worker accommodation facility	Low	Negligible	Tumbarumba accommodation facility (AC1)

Notes:

The establishment and use of access tracks has been considered where relevant in the construction activities
The telecommunications hut has been considered in Transmission Line Section 3: Wondalga to Adjungbilly

As shown in Table 21-3, the risk assessment indicates that without mitigation, there is a medium to high risk of adverse dust deposition and human health impacts from construction activities at most of the transmission line sections. However, the risk assessment is considered to be conservative as the main source of dust emissions would be concentrated where the transmission line structures are installed. These impacts would be temporary in any one location (as the work moves along the transmission line). Within each transmission line section, there are many locations where minimal (if any) dust generating activities would occur and/or there are no sensitive receptors identified.

The dust risk for most construction compounds and the Tumbarumba accommodation facility (AC1) was assessed to be low without mitigation based on a combination of the sensitivity of the areas and magnitude of dust emissions expected during construction activities. The Snubba Road compound (C16), Honeysuckle Road compound (C07), Red Hill Road compound (C08) and Maragle 500 kV compound (C05) were assessed as having a negligible dust risk without mitigation (refer to Table 21-3). While a helipad may be constructed at Snubba Road compound (C16), all sensitive receptors are at least five kilometres from the project footprint and as such are considered unlikely to be impacted. *Technical Report 17 – Air Quality Impact Assessment* provides further information on the risk assessment approach.

During construction or modification of the substations, there is predicted to be a low risk of dust impacts occurring at sensitive receptors. This is mainly due to the limited number of sensitive receptors within the

air quality study area surrounding the majority of substation locations. As noted in Section 21.3.1, there is only one sensitive receptor located within 350 metres of the Wagga 330 kV substation.

It is expected that with the implementation of mitigation measures detailed in Section 21.6.3, residual dust impacts for construction activities would be managed to acceptable levels such that there is negligible risk of adverse air quality effects at the sensitive receptors.

21.4.2. Gaseous emissions

Emissions due to products of combustion (including particulate matter) during construction of the project predominantly relate to the use of trucks and other vehicles, including where relevant, helicopters accessing and idling within the project footprint. Diesel and petrol fuel combustion from vehicle movements and onsite plant and machinery operation would generate CO, NO_x, SO_2 and trace amounts of non-combustible hydrocarbons. The emission rates and potential impact on surrounding areas would depend on the number and power output of the combustion engines, the quality of fuel used, the condition of the engines and the intensity of use.

While some of the emissions would be localised (eg use of generators at the construction compounds), the majority would occur over large areas for relatively short periods of time. As such, the magnitude of the impact from gaseous emissions is anticipated to be negligible.

21.5. Potential impacts – operation

During operation of the project, the potential for air quality impacts would primarily be associated with vehicle use from inspections, maintenance and minor repairs to the substations, transmission lines and other supporting infrastructure as described in Chapter 3 (Project description – infrastructure and operation). Due to the type of activities and the low frequency of vehicles that are anticipated during operation, dust and gaseous emissions are anticipated to be negligible and the impacts on the nearby sensitive receptors are anticipated to be short-term, minor and localised.

21.6. Management of impacts

21.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). Impacts on air quality are primarily anticipated during construction and would be associated with dust emissions. A range of mitigation measures and monitoring requirements would be specified in an Air Quality Management Plan to manage potential impacts. The Air Quality Management Plan would be prepared as part of the Construction Environmental Management Plan (CEMP).

Given the anticipated negligible air quality impacts during operation, no project-specific mitigation is proposed. Nevertheless, Transgrid's *Environmental Handbook* (Transgrid, 2021d) would guide operational and maintenance workers in minimising risks to air quality during operation.

21.6.2. Avoidance and minimisation of impacts

To avoid and minimise air quality impacts, the following approaches were considered in developing the project footprint and construction methodology:

- locating the project footprint including construction compounds, construction equipment and the worker accommodation facility away from sensitive receptors where practicable
- using already established sealed hardstand areas for construction compounds where available – such as areas within the Wagga 330 kV substation compound (C01), Yass substation compound (C10), Bannaby 500 kV substation compound (C12) and Memorial Avenue compound (C14) – which would reduce dust risk.

21.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential impacts on air quality are presented in Table 20-4.

Table 21-4 Summary of air quality mitigation measures

Reference	Impact	Mitigation measure	Timing	Relevant locations
AQ1	Dust emissions	The following measures will be considered and implemented where practicable and appropriate to manage dust: • use water sprays or surfactants as required for dust suppression • provide adequate water supply on site for dust suppression • locate dust generating activities away from receptors • protect stockpiled materials from wind erosion to minimise dust generation and position stockpiles as far as practicable away from any nearby receptors • implement measures to minimise the tracking of dust generating material onto paved roads • cover the loads of potential dust producing materials • minimise the extent of ground disturbance as far as practicable • stabilise disturbed areas as soon as practicable • plan and schedule vegetation clearance and grubbing activities to minimise areas of open and exposed soil. The effectiveness of the installed controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	All locations
AQ2	Vehicles and machinery emissions	All vehicles and machinery will be maintained in accordance with manufacturer's specifications.	Construction	All locations
AQ3	Vehicle movements	Dust generation from project-related traffic movements on unsealed roads and access tracks (routes) in proximity to sensitive receivers will be visually monitored. Where dust from project-related traffic movements is impacting or has the potential to impact the sensitive receivers, measures to minimise dust emissions and potential associated amenity impacts will be implemented where practicable and appropriate.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant locations
AQ4	Operation of concrete batching plant(s)	Measures will be implemented at concrete batching plants to minimise emissions to air as far as possible, and will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air may include: • all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay • cement silos and hoppers will be fitted with dust filters • all inspection points and hatches will be fully sealed • all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor • the cement silo will be fitted with emergency pressure alert and automatic cut off overfill protection • transfer of cement from storage to batching will occur via sealed steel augers • regularly inspect monitoring of dust emissions and apply additional controls as required.	Construction	Concrete batching plant(s)
AQ5	Crushing/screening activities	To minimise dust emissions during crushing/screening activities, the following measures (as a minimum) will be considered and implemented where practicable and appropriate: • fit screen covers will be fitted to the crushing/screening equipment • control dust emissions from screening activities using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis and maintain as required to ensure operational efficiency • where practicable, install wind breaks in appropriate locations adjacent to the dust generating equipment and processes • prior to screening, dampen the rocks during dry weather conditions. The effectiveness of the implemented controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	Crushing/screening plant(s)

21.6.4. Managing residual impacts or uncertainties

Air quality experienced at any location is a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional, and global). With the implementation of site-specific mitigation measures detailed in Section 21.6.3, the residual dust impacts as a result of the project are anticipated to be managed to acceptable levels such that there is negligible risk of adverse air quality effects at the sensitive receptors.

Due to the low-risk nature of the project with respect to air quality, data collected by the NSW Government has been used to characterise the existing air quality. As the data has been collected predominantly in locations with higher populations (and thus higher emissions to air) than the majority of the project footprint, the assessment is considered to be conservative.

22. Climate change and greenhouse gas

This chapter provides a detailed summary of the assessment of potential climate change and greenhouse gas (GHG) impacts of the project and identifies measures to address these impacts. The full GHG assessment is provided in *Technical Report 18 – Greenhouse Gas Assessment* (SLR, 2023c).

22.1. Environmental Assessment Requirements

22.1.1. Secretary's Environmental Assessment Requirements

The NSW DPE issued project specific Planning Secretary's Environmental Assessment Requirements (SEARs) on 14 March 2022 setting out matters to be addressed in the EIS. Requirements to consider impacts associated with climate change and GHGs were not included as one of the "Key Issues" in the SEARs. However, the "General Requirements" of the SEARs require an assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any Government legislation, policies and guidelines.

22.2. Assessment approach

22.2.1. Legislative and policy context

Climate change and GHG impacts associated with the project were assessed with consideration of:

- *Intergovernmental Panel on Climate Change* (IPCC) (1988)
- *National Climate Resilience and Adaptation Strategy 2021 – 2025* (Department of Agriculture, Water and the Environment, 2021)
- *Australian Standard AS 5334-2013 'Climate change adaptation for settlements and infrastructure'*
- *Climate Change Policy Framework* (State of NSW and Office of Environmental Heritage (OEH), 2016)
- *Climate Risk Ready NSW Guide* (NSW Government, 2021)
- *Climate Change Adaptation Strategy* (NSW Government, 2022)
- *Climate Change Act 2022* (Commonwealth)
- GHG Protocol Initiatives including *GHG Protocol Corporate Accounting and Reporting Standard* (World Resources Institute (WRI) / World Business Council for Sustainable Development (WBCSD), 2004)) and *GHG Protocol for Project Accounting* (WRI/WBCSD, 2004)
- International Organization for Standardization (ISO) standards including:
  - *14064-1:2018 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*
  - *14064-2:2019 Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements*
  - *16064-3:2019 Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements*
- *National Greenhouse and Energy Reporting Act 2007* (Commonwealth) (NGER Act) and the National Greenhouse and Energy Reporting Scheme (NGERS)
- *National Greenhouse Accounts Factors* (Department of Industry, Science, Energy and Resources (DISER), 2021)
- *Estimating emissions and energy in the electricity generation, transmission, and distribution sectors guideline* (Clean Energy Regulator, 2021).

Section 2.3.1 describes the NSW Government's Net Zero Plan and Paris Agreement commitments and how the project aligns with these plans to minimise the future impacts of climate change and GHG emissions. Australia aims to reduce its net GHG emissions to 43 per cent below 2005 levels by 2030 and to zero by 2050 (DISER, 2022b). These reduction targets have now been put into legislation in the *Climate Change Act 2022*.

22.2.2. Methodology

22.2.2.1. Overview of approach

The methodology to assess the impacts from climate change and GHG involved:

- identifying and assessing relevant hazards and risks, using available climate mapping and projections, to provide an indication of the changing likelihood or consequence of risk over the asset lifetime
- reviewing relevant electricity industry climate change risk assessments
- reviewing other HumeLink technical reports to identify relevant climate change inclusions and gaps
- identifying climate change risks for the project
- identifying emission sources within the project footprint associated with construction and operation in accordance with the *Estimating emissions and energy in the electricity generation, transmission, and distribution sectors guideline* (CER, 2021), which considered:
    - Scope 1 emissions - direct GHG emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level
    - Scope 2 emissions - indirect GHG emissions released to the atmosphere from the indirect consumption of an energy commodity
    - Scope 3 emissions - indirect GHG emissions other than Scope 2 emissions that are generated in the wider economy that occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business
- identifying emission calculation methods and emission factors for each source
- identifying the activity data for each emission source based on estimates and projections of likely consumption rates and activity levels during construction and operation
- calculating estimated GHG emissions for the project and comparing these against NSW and national GHG emissions
- identifying mitigation measures.

Risks from climate change were based on the *IPCC 6th Assessment Report* (IPCC, 2021) and *Climate Change in Australia* website (CSIRO and BoM, 2015), which use representative concentration pathways (RCPs) to establish atmospheric carbon levels and subsequent physical impacts on climate. Two RCPs were used in the assessment: RCP 4.5 which provides a moderate scenario and RCP 8.5 which provides the highest baseline emissions scenario. Aligned with the 50 year transmission line structure design life, the years 2030, 2050 and 2070 were selected for the assessment. Given projected climate change impacts for 2030 and 2050 are similar under all RCP scenarios, a single emissions scenario (RCP 8.5) was used. For future emissions in 2070, two scenarios (RCP 4.5 and RCP 8.5) were used to provide feasible upper and lower bounds of impacts.

22.3. Existing environment

Human activities, such as the production and burning of fossil fuels, leakage of refrigerants, clearing of forest and other vegetation, and the use of fertilisers, can cause an increase in GHG emissions. Climate change can be caused by increases in GHG emissions to the atmosphere. Climate change refers to a

change in the state of the climate that can be identified by changes to its properties that persists for an extended period of time.

As per the *IPCC 6th Assessment Report* (IPCC, 2021), climate change has already caused observable changes to the climate in Australia as follows:

- Australian land areas have warmed by around 1.4 degrees Celsius between 1910 and 2020
- heat extremes have increased and cold extremes have decreased
- relative sea levels have risen around Australia
- snow cover and depth have decreased
- the intensity, frequency of extreme fire weather and duration of the fire season have increased
- increased aridity and droughts are projected
- maximum one-day rainfall is projected to increase.

In particular, in the Eastern Australia region (which is most applicable to the project footprint), the following changes are projected (IPCC, 2021):

- mean cool season rainfall is projected to decrease
- extreme rainfall events are projected to increase
- agricultural droughts – related to plant stress from a combination of evaporation and low soil moisture– are projected to increase.

Changes in the climate are anticipated to result in chronic and acute risks, defined as:

- acute risks represent short-term extreme events, such as storm surges, flooding or cyclones
- chronic risks represent longer-term risks due to a shift in climate patterns such as rising temperatures or decreasing average rainfall.

In Wagga Wagga, the average, minimum and maximum temperatures are expected to increase up to about three degrees Celsius in the case of average maximum temperature by 2070 (under a high emissions scenario RCP 8.5). Maximum temperatures above 35 degrees Celsius have been experienced in summer (December to February). Although the mean annual rainfall is projected to decrease, extreme daily rainfall is projected to increase by about 17 millimetres.

Wagga Wagga has been used as an example to show observed recent changes in local climate. The number of days per year with temperature above 35 degrees Celsius has increased over the past decade from an average of 14 days per year in the 1940s to more than 25 days per year in the 2010s. Figure 22-1 depicts the maximum temperatures above 35 degrees Celsius have been experienced in summer (December to February), which is important when considering the following risks:

- overheating of components
- potential construction delays due to extreme heat
- reduction of transmission capacity due to high temperatures (derating), particularly during the summer months.

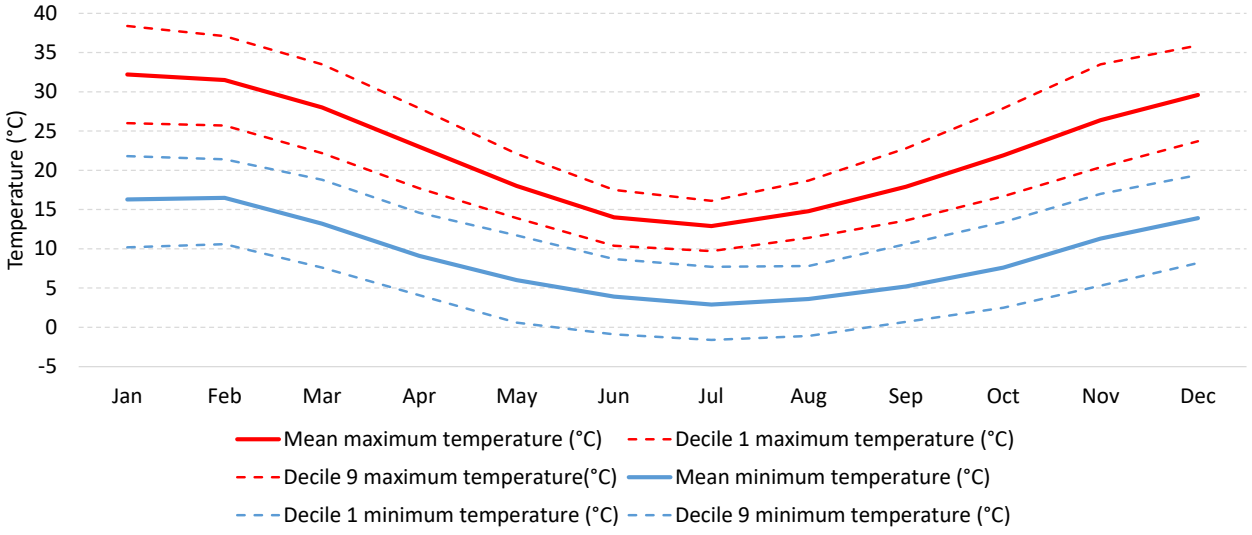


Figure 22-1 Variations of maximum and minimum monthly temperatures observations for Wagga Wagga for 1981-2010

Historical and projected climate change data were compared at four weather stations within the project footprint: Wagga Wagga (station number 072150), Tumbarumba (station number 072043), Burrinjuck (station number 073007) and Taralga (station number 070080).

A review of the climate change variables at these four locations indicated the following key predictions:

- increase in the annual average daily mean, minimum and maximum temperatures at each location (up to three degrees Celsius (°C) for RCP 8.5 by 2070)
- increase in the number of days above 35 degrees Celsius:
  - almost 65 days per year by 2070(RCP 8.5) in Wagga Wagga
  - almost 49 days per year by 2070(RCP 8.5) in Burrinjuck
- maximum one-day rainfall projected to be 186 millimetres in Burrinjuck by 2070 (RCP 8.5) which is the highest amongst the four locations
- decrease in mean annual rainfall, but increase in extreme daily rainfall which will increase the existing flooding risk level
- increase in evapotranspiration in all seasons
- reduced rainfall coupled with an increase in temperature, radiation and evapotranspiration may cause drought and reduction in soil moisture
- increase in risk of thunderstorms and lightning due to increase in temperatures
- increase in extreme low-pressure systems in the warmer months, and decrease in small or moderate low-pressure systems in the cooler months
- increase in Forest Fire Danger Index from ‘high’ to ‘very high' risk in the Murray Basin cluster which includes Wagga Wagga, Tumbarumba and Burrinjuck.

The available annual National and State emissions data reported by the former Department of Industry, Science and Resources (now DISER) from 2016 to 2021 is summarised in Table 22-1. Values are presented in million tonnes carbon dioxide equivalent (Mt CO_2-e), which is a metric used to measure and compare emissions from GHGs based on their contributions to global warming.

Table 22-1 Annual GHG emissions data – Australia and NSW

Reporting year	2016	2017	2018	2019	2020	2021
Annual emissions: Australia (Mt CO_2-e)						
All sectors [1]	530.0	526.7	538.4	529.3	505.5	501.5
Public electricity and heat production [1]	194.7	189.8	183.6	179.4	N/A	N/A
Electricity sector [2]	194.2	187.3	182.5	177.5	170.4	162.3
Annual emissions: NSW (Mt CO_2-e)						
All sectors [1, 2]	137.5	139.2	144.3	136.6	N/A	N/A
Public electricity and heat production [1]	51.8	51.1	52.1	51.9	N/A	N/A

Notes:
1 *Australian Greenhouse Emissions Information System* (DISER, 2022b)
2 *National Greenhouse Accounts Factors. Australian National Greenhouse Accounts* (DISER, 2021)

22.4. Potential impacts – construction

22.4.1. Impacts on the project from climate change

Construction of the project is anticipated to occur from 2024 to 2026.

The following recent changes in climate have already been observed:

- The number of days with extreme high temperatures (above 35 degrees Celsius) has been increasing and is projected to continue to increase, as stated in Section 21.3. This increase in days with extreme temperatures and heat waves may cause heat stress to construction workers during construction.
- Worsening bushfire conditions may cause disruptions or health and safety risks during construction.
- Excessive and intense rainfall events might cause flooding, which may limit access to work sites and result in construction delays.

22.4.2. Impacts on climate change from the project

The GHG emissions estimated for the project were compared against the most recent publicly available State and national GHG emissions to assess their potential contribution to Australia's emissions inventory and thus their potential impact on Australia's ability to meet GHG reduction targets and policies. Examples of GHG emissions sources relevant to the project are potential use of sulfur hexafluoride (SF_6), which are embodied emissions in materials used in the project components and emissions related to the construction activities.

The impact on climate change from estimated GHG emissions for construction of the project is shown in Table 22-2 and a summary of the calculation methods are detailed in *Technical Report 18 – Greenhouse Gas Assessment*.

The estimated total direct Scope 1 emissions over the construction period equate to 56,593 tonnes CO_2-e. The estimated total Scope 2 emissions associated with electricity consumption at the construction compounds, worker accommodation facility, telecommunications hut and substation construction equate to 4,189 tonnes CO_2-e per year. This results in a total combined Scope 1 and Scope 2 emission estimate of 60,782 tonnes CO_2-e for project construction. The main source of Scope 1 and Scope 2 emissions is diesel consumption, which accounts for 86 per cent of the total emissions. The estimated total Scope 3 emissions

over the construction period equate to 312,961 tonnes CO_2-e per year; these emissions predominantly relate to the energy embodied in construction materials.

Table 22-2 Estimated GHG emissions - construction

Scope	Activity / source	Estimated emissions (t CO_2-e)	
		Total 2.5 year construction period	Annual average
1	Diesel consumption - off-road and stationary	52,535	21,014
	Diesel consumption - mobile/on-road	1,480	592
	Unleaded fuel consumption	2,584	1,019
	Consumption of oils (lubricants)	27.7	11.1
	Consumption of greases	3.2	1.3
Total Scope 1		**56,593**	**22,637**
2	Electricity consumption	4,189	1,676
Total Scope 2		**4,189**	**1,676**
3	Extraction and production of diesel consumed	2,770	1,108
	Extraction and production of petrol consumed	132	53
	Extraction and production of purchased materials - steel	68,893	27,557
	Extraction and production of purchased materials - concrete	155,279	62,112
	Extraction and production of purchased materials - copper	994	398
	Extraction and production of purchased materials - aluminium	82,750	33,100
	Employee commuting	297	119
	Disposal of solid waste generated	1,847	739
Total Scope 3		**312,961**	**125,184**

Table 22-3 outlines the estimated annual average construction GHG emissions from the project and its contribution to the overall emissions from NSW and Australia. The impact of project construction on the NSW and national GHG emission loads is estimated to be negligible, with the annual average emissions representing less than 0.1 per cent of NSW's annual emissions (refer to Section 22.6.3).

Table 22-3 Potential contributions of the project to state and national GHG emissions

Phase	Estimated Scope 1 and Scope 2 project emissions (t CO_2-e/year)	Percentage of NSW emissions	Percentage of Australia's emissions
Construction	24,313	0.018	0.005

22.5. Potential impacts – operation

22.5.1. Impacts on the project from climate change

The project would operate in an environment where the climate is changing, and historic weather conditions may no longer represent the conditions within which the project would operate over its lifetime. The project has a design life of 50 years, which can be extended to more than 70 years for some infrastructure components and plant items (refer to Section 3.2). However, the project would be exposed to a number of climate change risks, as identified in Table 22-4.

Table 22-4 Climate change vulnerabilities relevant to the project

Changing climate risks	Resulting vulnerability / implications
Rising temperatures and increasing duration of heatwaves	• reduced network capacity, increased demand, potential for increased maintenance costs.
Damage to transmission lines due to exposure to climate events (temperatures, bushfires, smoke, wind, flooding)	• decreased asset lifetimes / maintenance or replacement costs • threats to integrity of transmission lines • service disruptions.
Reduction of transmission capacity due to higher temperatures (derating)	• worsened performance • power outages and customer impacts • cascading failures – impacting transport, water supply, communications, medical services.
Exacerbated bushfire risk	• worsened impacts of bushfire, legal, reputational, and financial implications for electricity utilities • smoke and particulates can reduce effectiveness of high voltage insulators at substations and on transmission lines.
Compounding events (eg infrastructure failure, staff fatigue or disrupted access to sites)	• service disruptions • staff illness or injury • inability to complete essential works • customer disruptions – which would affect downstream transport, water, medical and communication services.

Climate change is also anticipated to have a range of impacts on materials such as concrete and steel. The Institute of Public Works Engineering Australasia (Asset Management and Financial Management Guidelines Practice Note 12.1 2018 – Climate Change Impacts on the Useful Life of Infrastructure, 2018) provides a summary of climate change risks on the useful life of infrastructure. The impacts on materials from various climate conditions are described in Table 22-5.

Table 22-5 Summary of relevant climate change risks on the useful life of infrastructure

Climate hazards	Concrete	Steel
Higher temperature / heat wave	• accelerate carbonation, chloride penetration and corrosion rate of steel reinforcement • heat related expansion, cracking and lifting of slabs.	• expansion and possible buckling • increased corrosion rates if steel remains warmer and wetter for longer.
Higher rainfall	• elevated humidity increases carbonation and chloride penetration • erosion from high speed water • damage from flood debris • loss of calcium ions from increased contact with soft water.	• increased corrosion if steel remains warmer and wetter for longer • damage from flood debris.
Lower rainfall / droughts	• possible damage from soil drying and movement • lowered relative humidity may reduce or even stop carbonation and chloride penetration.	• reduced chemical deterioration.
Increased bushfire intensity	• expansion and possible cracking.	• softening, loss of strength and possible failure during a bushfire.
Increased wind events	• N/A	• wind loading damage or bending.

22.5.2. Impacts on climate change from the project

The project is consistent with the Commonwealth Government's climate change initiatives and would be an enabler for the continued expansion of renewable energy generation by facilitating the longer-term transition of the energy sector to low-emission energy sources.

The annual GHG emissions estimated for operation of the project are shown in Table 22-6. The main source of emissions associated with the ongoing operation of the project are Scope 2 emissions related to unavoidable transmission losses. For the Scope 1 emissions, the main source is associated with leakage of SF_6, due to its potency as a GHG.

Table 22-6 Estimated GHG emissions - operation

Scope	Activity/Source	Estimated emissions (t CO_2-e/year)
1	Diesel consumption	61.8
	Petrol consumption	20.5
	Aviation gasoline (avgas) consumption	6.2
	SF_6 leakage	1,922
Total Scope 1		**2,010**
2	Transmission losses	127,980
Total Scope 2		**127,980**
3	Production and supply of fuels used	4.54
Total Scope 3		**4.54**

Table 22-7 presents a comparison of the operation phase GHG emissions with the existing national and state emissions. The impact of project operation on NSW and national GHG emission loads is estimated to be negligible, with the annual emission estimate representing less than 0.1 per cent of NSW's annual emissions. While the actual annual emissions may be higher in some years than others, depending on the staging of activities, the project would still be a very minor contributor to Australia's GHG emissions. Refer to Section 22.6.3 and Table 22-8 for the management of operation impacts.

Table 22-7 Comparison of operational GHG impacts against national and state emissions

Phase	Estimated Scope 1 and Scope 2 project emissions (t CO_2-e/year)	Percentage of NSW emissions	Percentage of Australia's emissions
Operation[1]	129,990	0.095	0.026

Note:
1 The design life of the project is 50 years, which can be extended to more than 70 years for some assets.

22.6. Management of impacts

22.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management) of this EIS. For construction, mitigation measures would be consolidated in a Construction Environmental Management Plan (CEMP).

Transgrid measures and reports Scope 1 and 2 emissions in accordance with the NGER Act. Transgrid's annual NGER energy and emissions report includes all GHG emissions (both direct (Scope 1) and indirect (Scope 2)). This is above a minimal reporting threshold generated from its activities ie construction, operation and maintenance. Scope 3 emissions measurement and reporting is undertaken as part of voluntary corporate commitment. The monitoring and reporting of GHG emissions by Transgrid would provide information that can be used to identify the main emission sources and related activities so that mitigation measures can be identified to minimise key emissions where possible.

To assist in this process, a GHG Management Plan would be prepared for the project to develop strategies to reduce GHG emissions as part of the sustainability strategy and Infrastructure Sustainability Rating Scheme pathway, and in line with Transgrid's Science Based Targets initiative GHG emission reduction targets as well as Australia's international commitments and the State and Commonwealth aspirations during construction and operation.

22.6.2. Avoidance and minimisation of impacts

GHG emissions from the project would potentially be countered to some extent by its role enabling the introduction of new renewable energy generation in the declared South West Renewable Energy Zone (REZ) and candidate Wagga Wagga and Tumut REZs.

22.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

Table 22-8 summarises the mitigation measures that would be implemented to avoid or minimise potential impacts on climate change and GHG.

Table 22-8 Mitigation measures – climate change and GHG

Reference	Impact	Mitigation measure	Timing	Relevant locations
CC1	GHG emissions	The use of SF_6 will be minimised where possible, including through the investigation of alternatives.	Detailed design and operation	Substations
CC2	GHG emissions	Options that will be considered during ISC rating design review include energy efficient and passive design features for substation and worker accommodation facility buildings including air conditioning, lighting, low-flow fittings and solar power.	Detailed design	Substations and worker accommodation facility
CC3	GHG emissions	Options to minimise transport distances between construction compounds, accommodation facilities and work sites will be considered, for example utilising vehicle pooling / mini buses and sourcing equipment and materials locally where practicable.	Detailed design	All locations
CC4	GHG emissions	GHG emissions and associated activity data will be tracked and recorded to assist in identifying key emission sources and appropriate targeting of mitigation measures, as well as to provide learnings for other projects and demonstration of IS Rating compliance.	Construction and operation	All locations
CC5	GHG emissions	SF_6 emissions will be minimised through leakage detection monitoring programs, maintenance and end of life dismantling procedures.	Operation	Substations

22.6.4. Managing residual impacts or uncertainties

The activity data used in the emission calculations are based on projections of likely consumption rates and activity levels during construction and operation. The actual emissions would be influenced by the detailed design of the proposed infrastructure, materials specifications and sourcing decisions, and the final construction methodology and schedule. Given this, a conservative approach has been adopted in the calculations to reduce the likelihood that emissions are underestimated. Although the GHG assessment has been based on estimates, the key sources of GHG emissions associated with the project have been identified and would be managed in accordance with a GHG Management Plan.

23. Waste

This chapter provides an assessment of waste impacts of the project and identifies mitigation measures to address these impacts.

23.1. Environmental Assessment Requirements

23.1.1. Secretary's Environmental Assessment Requirements

Table 23-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to waste implications of the project and where these requirements are addressed in this chapter.

Table 23-1 Secretary's Environmental Assessment Requirements – waste

Reference	SEARs	Where principally addressed in the EIS
Waste		
Key issues	The EIS must address the following matters: • identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Section 23.4.1 identifies, quantifies and classifies the likely waste streams during construction and operation. Measures to be implemented to manage, reuse, recycle and safely dispose of this waste are detailed in Sections 23.4.2 and 23.6.

23.2. Assessment approach

23.2.1. Legislation and policy context

Key legislation, policies and guidelines considered relevant to the management of waste include:

- *Protection of the Environment Operations Act 1997* (POEO Act) – sets the process and procedures for environmental control and for issuing environmental protection licences covering issues such waste
- Waste Regulation – regulates obligations of consignors (producers and agents), transporters, and receivers of waste, in relation to waste transport licensing and tracking requirements
- Waste Avoidance and Resource *Recovery Act 2007* (WARR Act) – ensures waste management options are considered using the waste management hierarchy of avoid, resource recovery and disposal as a last resort
- *NSW Waste and Sustainable Materials Strategy 2041 Stage 1: 2021-2027* (Department of Planning, Industry, and the Environment (DPIE), 2021) – outlines the steps the NSW Government will take over the next six years to transition to a circular economy
- *National Environment Protection Council Act 1994* (Commonwealth) and National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998 – regulates the movement of controlled waste between states and territories
- *Waste Classification Guidelines* (NSW Environment Protection Authority (EPA), 2014) – assists waste generators to classify waste via a step-by-step guide. Part 1 of the guidelines provides advice and directions on classifying waste as well as relevant waste management measures.

23.2.2. Methodology

A qualitative desktop assessment was carried out to estimate the waste streams, quantities, potential impacts of waste and appropriate waste management measures for the project. This involved:

- reviewing relevant legislation and guidelines in relation to waste management
- identifying potential waste generating activities during construction and operation of the project
- estimating the likely waste streams and quantities, including wastewater and demolition materials where possible
- classifying the identified waste streams in accordance with the relevant legislation and guidelines
- describing the proposed management and handling techniques for key waste streams
- identifying licensed waste management facilities that can lawfully accept particular waste streams/types within the Local Government Area (LGAs) of Wagga Wagga City, Cootamundra-Gundagai Regional, Snowy Valleys, Yass Valley, Upper Lachlan Shire, Hilltops and Goulburn-Mulwaree.

Waste types and volumes identified in the EIS are indicative and were identified for the purpose of determining potential waste management measures. The management of contaminated soils and hazardous materials are considered in Chapter 16 (Soils, geology and contamination) and Chapter 19 (Hazards and risks). The management of contaminated surface water and groundwater are addressed in Chapter 17 (Surface water and groundwater quality).

23.3. Existing environment

Operation of the existing Wagga 330 kV and Bannaby 500 kV substations and existing sections of transmission line within the project footprint generate waste that is removed as required by an authorised waste contractor. Waste includes:

- waste oil from substation transformers
- waste conductors and insulator materials from maintenance activities when elements are required to be replaced or serviced
- green waste from vegetation management within easements, overgrown access tracks and substation property boundaries
- sewage waste from facilities
- general domestic non-putrescible waste generated by maintenance workers.

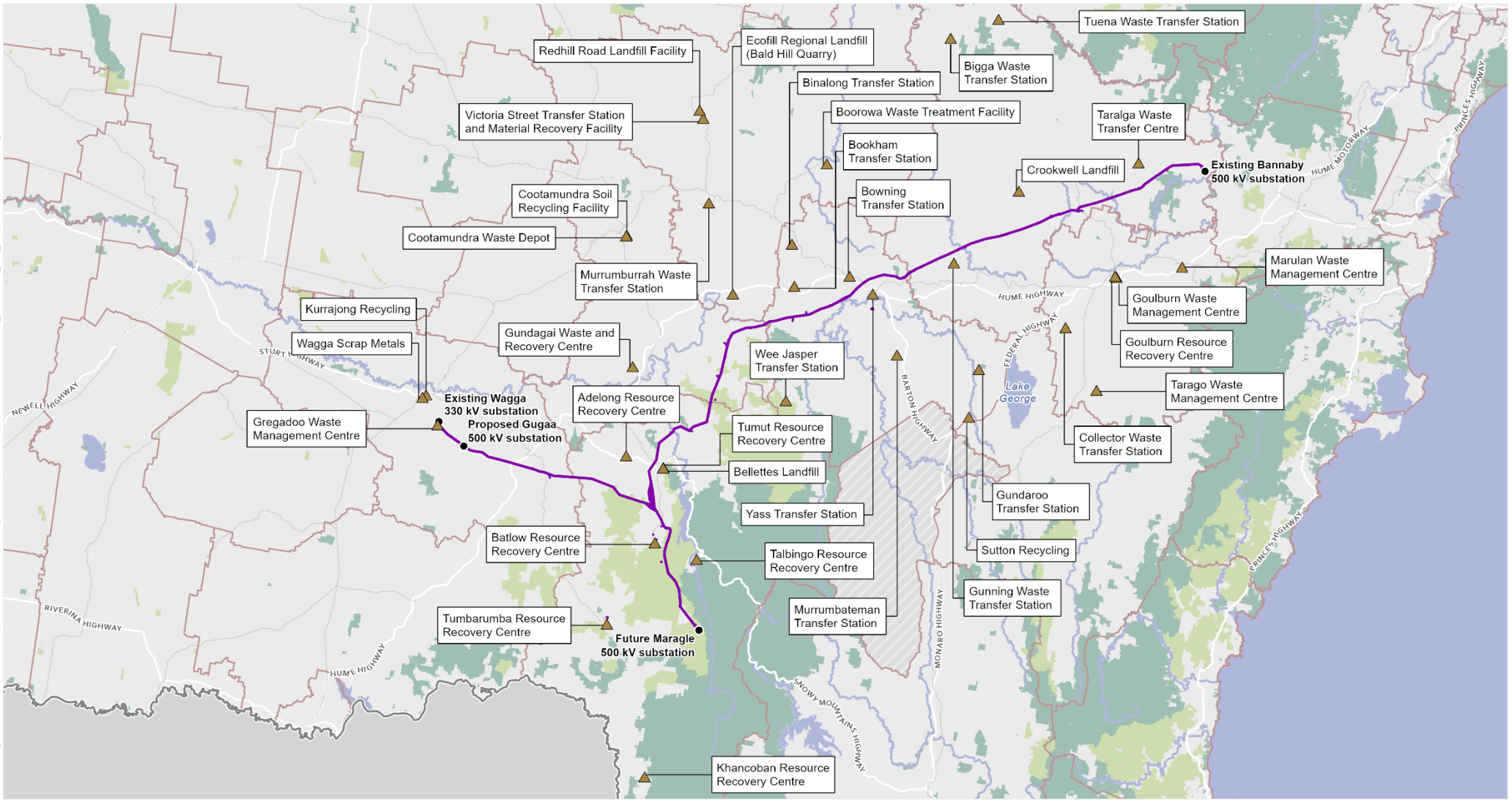
The existing licensed waste management facilities within the LGAs of Wagga Wagga City, Cootamundra-Gundagai Regional, Snowy Valleys, Yass Valley, Upper Lachlan Shire, Hilltops and Goulburn-Mulwaree are listed in Table 23-2 and shown in Figure 23-1. The majority of these facilities provide waste recovery services and may be considered for the disposal of waste from the project.

Table 23-2 Existing suitably licensed waste management facilities

Facility name	Location	LGA	Accepted waste	Approximate distance from project footprint
Gregadoo Waste Management Centre	132 Ashfords Road, Gregadoo	Wagga Wagga City	Cardboard, paper, bottles, cans, motor oil, paint, gas bottles, fluoro globes and tubes, clean and separated rubble, scrap steel or recyclable materials, general putrescible waste, green waste, unsorted construction and demolition waste, medical and industrial asbestos waste, scrap metal	less than 1 km
Kurrajong Recycling	54 Chaston Street	Wagga Wagga City	Rigid plastic containers, steel cans, aluminium cans trays and foil, paper, cardboard, glass bottles and jars	10 km
Wagga Scrap Metals	163-165 Fernleigh Road	Wagga Wagga City	Recycle all kinds of ferrous and non-ferrous scrap metals	10 km
Gundagai Waste and Recovery Centre	Burra Rd, Gundagai	Cootamundra -Gundagai Regional	Paints and solvents, gas bottles, fire extinguishers, motor and grease oil, batteries (lead, acid and single use), smoke detectors, fluoro globes and tubes	24 km
Cootamundra Waste Depot	35 Turners Lane, Cootamundra	Cootamundra -Gundagai Regional	Putrescible waste	46 km
Cootamundra Soil Recycling Facility	17 Turners Lane, Cootamundra	Cootamundra -Gundagai Regional	All soil classifications including hazardous soil	46 km
Adelong Resource Recovery Centre	183 Grahams Town Road, Adelong	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, green waste, mixed recycled, motor oil, scrap metals bulk loads	9 km
Batlow Resource Recovery Centre	Forest Road, Batlow	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, green waste, mixed recycled, motor oil, scrap metals bulk loads	less than 1 km
Khancoban Resource Recovery Centre	Off the Alpine Way, Khancoban	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, green waste, mixed recycled, motor oil, scrap metals bulk loads	50 km
Talbingo Resource Recovery Centre	Off Grove Street, Talbingo	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, green waste, mixed recycled, motor oil, scrap metals bulk loads	10 km
Tumbarumba Resource Recovery Centre	Sleyards Road, off Mason's Hill Road, Tumbarumba	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, green waste, mixed recycled, motor oil, scrap metals bulk loads, fluorescent tubes and bulbs, gas bottles	2 km
Bellette Landfill	10 Killarney Road, Gilmore	Snowy Valleys	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	less than 1 km
Tumut Resource Recovery Centre	Killarney Drive, Gilmore	Snowy Valleys	Agvet chemical drums (DrumMuster), batteries, mixed recycled, motor oil, scrap metals bulk loads, fluorescent tubes and bulbs, gas bottles	less than 1 km

Facility name	Location	LGA	Accepted waste	Approximate distance from project footprint
Murrumbateman Transfer Station	246 Isabel Drive, Murrumbateman	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	16 km
Binalong Transfer Station	Cemetery Road (off Sykes Road), Binalong	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	22 km
Bookham Transfer Station	Illalong Road (800 m from Hume Highway), Binalong	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	9 km
Bowning Transfer Station	Silver Street (off Montem Street), Bowning	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	5 km
Gundaroo Transfer Station	100 Dairy Creek Road, Gundaroo	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	37 km
Sutton Recycling	West Street, Sutton	Yass Valley	Green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch	45 km
Wee Jasper Transfer Station	Wee Jasper Road, Wee Jasper	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	23 km
Yass Transfer Station	Faulder Ave, Yass	Yass Valley	Mixed waste, green organic/natural timber waste, scrap metal, sorted building timber waste, timber furniture, particle board, tree branches and stumps, concrete, bricks, tiles, concrete including steel reinforcement, mulch, earth moving tyres, paper, cardboard, glass	5 km
Crookwell Landfill	3848 Grabben Gullen Road, Crookwell	Upper Lachlan Shire	Bulk demolition waste, bricks and concrete, timber, asbestos, cardboard, paper, plastic, glass, all scrap metal, batteries	11 km
Gunning Waste Transfer Station	Dalton Road, Gunning	Upper Lachlan Shire	Glass, batteries, scrap metals, plastic, paper and cardboard	3 km

Facility name	Location	LGA	Accepted waste	Approximate distance from project footprint
Collector Waste Transfer Station	Currawang Road, Collector	Upper Lachlan Shire	Glass (clear, green and brown), batteries, plastic, paper and cardboard, scrap metals	34 km
Taralga Waste Transfer Station	Old Showground Road, Taralga	Upper Lachlan Shire	Glass (clear, green and brown), batteries, plastic, paper and cardboard, scrap metals	7 km
Bigga Waste Transfer Station	Mulgowrie Street, Bigga	Upper Lachlan Shire	Glass (clear, green and brown), plastic, paper and cardboard, scrap metals	65 km
Tuena Waste Transfer Station	Tuena Cemetery Road, Tuena	Upper Lachlan Shire	Glass (clear, green and brown), plastic, paper and cardboard	65 km
Ecofill Regional Landfill (Bald Hill Quarry)	5423 Hume Highway, Berremangra	Hilltops	Asbestos, putrescible solid waste from Yass, Hilltops, Cootamundra Gundagai and Snowy Valley Councils	12 km
Victoria Street Transfer Station and Material Recovery Facility	Victoria Street, Young	Hilltops	Mixed solid waste, whitegoods, tyres and green waste, as well as facilities for recycling (including scrap metal, paper, plastics, glass, aluminium, e-waste, waste oils and agvet chemical drums to DrumMuster). The Victoria Street Facility accepts asbestos by appointment only with 48 hours' notice	71 km
Redhill Road Landfill Facility	31 Redhill Road, Young	Hilltops	Inert and non-organic materials only, including concrete and rubble, building materials, furniture, plastics and fabrics (mattresses, lounges etc) No green waste, food items, hazardous wastes will be accepted at this site	71 km
Boorowa Waste Treatment Facility	Tip Road, Boorowa	Hilltops	Mixed solid waste, whitegoods, tyres and green waste, as well as recycling facilities (including scrap metal, paper, plastics, glass, aluminium, e-waste, waste oils, and agvet chemical drums to DrumMuster)	40 km
Murrumburrah Waste Transfer Station	Araluen Road, Murrumburrah	Hilltops	Mixed solid waste, whitegoods, tyres and green waste, as well as recycling facilities (including scrap metal, paper, plastics, glass, aluminium, e-waste, waste oils, and agvet chemical drums to DrumMuster)	42 km
Goulburn Waste Management Centre	100 Sinclair Street, Goulburn	Goulburn Mulwaree	Mixed waste, clean metal, recyclable metal, asbestos, food and garden organics, truck tyres, clean fill	24 km
Goulburn Resource Recovery Centre	54 Sinclair Street, Goulburn	Goulburn Mulwaree	Aluminium, cardboard, chemical drums, containers and packaging, paper, soft plastics, glass containers, iron and steel	23 km
Marulan Waste Management Centre	Wilson Drive, Marulan	Goulburn Mulwaree	Sorted mixed waste, clean metal, food organics and garden organics, truck tyres, clean fill, mixed waste	28 km
Tarago Waste Management Centre	Lumley Road, Tarago	Goulburn Mulwaree	Sorted mixed waste, clean metal, food and garden organics	57 km



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

1:1,250,000

0 25 50 km

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 23-1: Waste facilities

23.4. Potential impacts – construction

23.4.1. Waste generation

Key activities with the potential to generate waste during construction are summarised in Table 23-3. The opportunity to reuse waste as part of the project should be considered where a relevant NSW Environment Protection Authority (EPA) Resource Recovery Order exists for a specific waste type.

The types and quantities of waste generated by the project would vary throughout construction and the quantities included in Table 23-3 are indicative only. These estimates were derived from assumed typical waste generation quantities from experience on similar projects (Including Project EnergyConnect (NSW – Eastern Section), Project EnergyConnect (NSW – Western Section) and Snowy 2.0 Transmission Connection Project). Final quantities and classifications of all waste streams would be confirmed during construction.

To achieve positive waste and resource management outcomes, the project would adopt waste management strategies in accordance with the waste management hierarchy and avoidance and management of impacts as identified in Section 23.6.2.

Table 23-3 Indicative types of waste generated during construction

Activities	Waste streams that may be produced	Estimated quantities	NSW EPA Resource Recovery Order which may apply	Likely classification of waste stream
• clearing and removal of vegetation.	Green waste, mulch	1,115 ha[1]	Compost order, mulch order	General solid waste (non-putrescible)
• earthwork and establishment of construction benches and brake and winch sites for each transmission line structure • earthwork for substation construction • bulk earthwork and excavation to form the pad for the telecommunications hut, concrete foundations, electrical conduits, trenches and drainage • construction of new access tracks and waterway crossings and/or upgrade of existing access tracks • road improvement work.	Spoil comprising of virgin excavated natural material (VENM) (uncontaminated soil and crushed rock), aggregate, fines and road material eg asphalt	200,000 to 300,000 m^3	Excavated natural material (ENM) order, recovered aggregate order, recovered fines order, reclaimed asphalt pavement order, excavated public road material order	General solid waste (non-putrescible)
	Contaminated spoil including asbestos	Unknown	N/A	Special waste (including non-friable asbestos contaminated waste)
	Contaminated spoil including heavy metals, pesticides, herbicides, polychlorinated biphenyls (PCBs), hydrocarbons, per- and poly-fluoroalkyl substances (PFAS), nutrients, solvents	Unknown	N/A	Hazardous waste or restricted solid waste
• construction of footings and foundation work for the new transmission line structures including either concrete or steel piles (driven and/or screw), steel fabrication works and concrete pours • construction of new access tracks and waterway crossings and/or upgrade of existing access tracks • installation of reinforced concrete and piled foundations • establishment of hardstand areas for storage, laydown and car parking at construction compounds and other ancillary facilities • establishment and operation of concrete batching plant	Concrete, bricks, timber, steel electrical and plumbing fittings	300 to 400 tonnes	Cement fibre board waste order, recovered aggregate order, recovered fines order	General solid waste (non-putrescible)

Activities	Waste streams that may be produced	Estimated quantities	NSW EPA Resource Recovery Order which may apply	Likely classification of waste stream
• removal and/or replacement of empty overhead optical ground wire and conductor drums along transmission lines • removal of redundant equipment at substations.				
• field portable toilets for transmission line work • staff amenities eg toilets, ablution blocks at construction compounds and worker accommodation facility.	Wastewater	9 ML per year	N/A	Liquid waste
• disposal of hazardous materials and chemicals stored within construction compounds and other ancillary facilities.	Hazardous materials and chemicals such as: • acetylene, oxygen, liquid petroleum gas • adhesives, glues and epoxies • contact cleaners • cold-galvanising spray • pesticides and/or herbicides • paints and other paint markers.	Minimal quantity	N/A	Hazardous waste or restricted waste (non-putrescible)
• general construction activities • construction of transmission lines and substations • operation of temporary buildings, structures including workshops at construction compounds.	General construction waste such as off-cuts and excess material (such as concrete, timber, plastic and metal)	1,500 to 2,000 tonnes	Cement fibreboard order, recovered aggregate order, recovered fines order	General solid waste (non-putrescible)
	Waste oils, greases and lubricants from maintenance of construction plant and equipment	20 kL	N/A	Hazardous waste or restricted waste (non-putrescible)
• domestic waste generated by workers • operation of offices and worker accommodation facility • packaging/deliveries.	Food scraps, organics, glass and plastic bottles, paper and cardboard	1,500 to 2,000 tonnes	Compost order	General solid waste (putrescible)

Note:

The estimated quantity is based on the indicative area of vegetation that is likely to be disturbed by the project. Clean green waste would be reused on site (refer to Table 23-4), where possible.

23.4.2. Waste management

Table 23-4 summarises the likely waste streams produced with the proposed site waste management approaches. All waste generated would be removed from site as required by appropriately licensed contractors, in order to avoid potential issues associated with odour generation, decreased visual amenity and animal/pest issues.

Table 23-4 Construction waste management

Waste streams that may be produced	Management
Green waste, mulch	Usable timber would be reused within the easement for fauna habitat or offered to directly affected landowners, where practicable. Following this, clean green waste (ie free of weeds and weed seeds) would be chipped, mulched and reused on site for landscaping or other suitable uses (in accordance with the relevant NSW EPA Resource Recovery Order), where possible. Clean green waste and weed contaminated green waste would be kept segregated onsite. Tree stumps and native vegetation would be assessed for weeds or other contaminants prior to reuse. Offsite beneficial reuse would be in accordance with the EPA mulch exemption, must pose minimal risk of the presence of physical and chemical contaminants and be in compliance with the *Biosecurity Act 2015*. Weed contaminated green waste would be disposed of and taken to a licensed waste facility (refer to Section 23.3).
Spoil comprising of VENM (uncontaminated soil)	Topsoil would be segregated and preserved to be reused for rehabilitation purposes where possible. Spoil comprising VENM (uncontaminated) would be managed in accordance with the waste hierarchy and the ENM resource recovery order. Spoil would be stockpiled and used for backfilling around the areas on site from which it was excavated (where practicable and suitable). Offsite beneficial reuse would be in accordance with the EPA ENM exemption which requires soil samples to be taken and tested prior to offsite reuse. Where spoil cannot be reused onsite, it would be disposed of offsite at an appropriately licensed waste facility (refer to Section 23.3).
Contaminated spoil	Where contamination is suspected, in situ testing and assessment of soils would be undertaken to determine the correct waste classification. Contaminated spoil would need to be appropriately contained, sampled, tested and disposed of at a suitable licensed waste management facility (in accordance with the *Waste Classification Guidelines* (EPA 2014b) or managed in situ, only where there is no unacceptable risk to human health or ecological values. In addition to the above, asbestos containing materials (ACMs) (including naturally occurring asbestos) would be managed in accordance with the implementation of proven management techniques that would be outlined in an Asbestos Management Plan for the project.
Recyclable construction waste such as, concrete, aggregate, gravel and hardstand materials, bricks, timber, steel, electrical and plumbing fittings General construction waste such as off-cuts and excess material (such as concrete, timber, plastic and metal)	Where feasible, some construction waste materials such as aggregate would be reused under the appropriate NSW EPA Resource Recovery Order listed in Table 23-3. If materials cannot be reused onsite or as part of the project, demolition waste would be segregated/sorted on site and processed at a materials recycling facility, if practicable (refer to Section 23.3). Electrical waste would be stored for collection by an authorised contractor for processing and offsite recycling. All demolition wastes associated with the work would be assessed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).

Waste streams that may be produced	Management
Wastewater	At Gregadoo Road compound (C06) and Bannaby 500 kV substation compound (C12), wastewater treatment facilities would be used to treat wastewater from construction activities on site. Any onsite systems would be designed, installed and maintained to the requirement of the relevant council standards. The volume of wastewater to be processed would depend on the construction compound occupancies and associated water use at any one time throughout the construction period. It is anticipated that some servicing of the first tank (or section) would be required (eg once a year, depending on system load) as not all solids are expected to breakdown and would be required to be collected. Any wastewater would be taken to an appropriately licensed facility for disposal. At all other construction compounds, wastewater would be temporarily stored in suitably sized tanks prior to transport by a competent wastewater contractor to an appropriately licensed facility for treatment and disposal at regular intervals during construction. The Tumbarumba accommodation facility (AC1) would connect to the local wastewater network of Tumbarumba.
Hazardous materials and chemicals	Waste classified as hazardous waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for offsite disposal in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).
Waste oils, greases and lubricants from maintenance of construction plant and equipment	Liquid wastes are to be stored in appropriate containers in bunded areas until transported off site. The capacity of any bunded area would be at least 130% of the largest volume contained. All waste would be disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).
General recyclable wastes from site offices such as putrescibles, glass, plastic bottles, paper, aluminium, printer cartridges, IT equipment, batteries and cardboard, earth moving tyres, scrap metals	Recyclable materials such as glass, certain plastics, paper and carboard would be segregated and temporarily stored at the accommodation location and/or the construction compounds before being collected and taken to a licensed waste facility, which provides waste recovery services (refer to Section 23.3). Where recycling is not feasible, waste would be collected and stored in designated waste areas for collection by an authorised contractor and taken to an appropriately licensed waste facility.
Food scraps, organics	General waste would be collected in designated waste collection bins at the worker accommodation facility, construction compounds and ancillary facilities regularly and taken to a licensed waste facility for disposal (refer to Section 23.3).

23.5. Potential impacts – operation

Minimal operational waste is anticipated to be generated during the operation of the project. The key activities with the potential to generate waste during operation include:

- transmission line and substation maintenance
- substation operation.

Table 23-5 details the types of waste that could be generated from the above activities, its likely classification and how it would be managed. These estimates were derived from assumed typical waste generation quantities from experience on similar projects (including Project EnergyConnect (NSW – Eastern Section), Project EnergyConnect (NSW – Western Section) and Snowy 2.0 Transmission Connection Project).

Table 23-5 Indicative types of waste generated during operation

Activity	Waste type	Estimated quantities	Likely classification of waste stream	Onsite management
Transmission line and substation maintenance	Waste conductors and insulator materials	30 to 40 tonnes per 50 years	General solid waste (non-putrescible)	Collected and recycled by an authorised contractor for offsite disposal in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).
	Waste oil from substation transformers and reactors	8,500 to 9,000 kL per 30 years	Hazardous waste or restricted waste (non-putrescible)	Collected by an authorised contractor for offsite disposal in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).
	Green waste from vegetation management activities	No estimate available –as required to maintain vegetation clearances limits along the proposed easement	General solid waste (non-putrescible)	Clean green waste would be chipped, mulched and reused for on site for landscaping (in accordance with the relevant NSW EPA Resource Recovery Order), where possible. Weed contaminated green waste would be disposed of and taken to a licensed waste facility (refer to Section 23.2).
Substation operations	General waste from workers	Less than 5 tonne per year	General solid waste (non-putrescible)	General waste would be removed from site by an authorised contractor and disposed of at a licensed waste facility (refer to Section 23.2).
	Wastewater	0.1 ML per year	Liquid waste	Wastewater would be disposed of via connection to the local network or via a suitable disposal system such as a septic tank or a treatment plant with the treated water pumped to a suitable landscaped area. Any wastewater required to be removed from site would be taken to an appropriately licensed facility for disposal.

During operation, waste would be collected as required. Waste management measures to be implemented during the operation of the project are summarised in Table 23-6. These mitigation measures are based on the waste management hierarchy for the identified types of waste likely to be produced during operation.

23.6. Management of impacts

23.6.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management). During construction of the project, a range of management measures and procedures would be specified in the Waste Management Plan prepared as part of the Construction Environmental Management Plan (CEMP). The management measures and procedures would be based on applying the policies and guidelines outlined in Section 23.2.1. In addition, the Waste Management Plan would include waste monitoring, reporting procedures for storage, transportation, disposal and management of waste, in addition to compliance tracking of construction waste generated by the project. Waste generated during operation would be managed in accordance with Transgrid's existing Environmental Management System (EMS) and processes for the handling and management of waste.

Suitably licensed waste contractors would be used for the collection and transport of all non-domestic, retail and commercial wastes for off-site processing and/or disposal to an appropriately licensed facility. Prior to disposal, arrangements would be made with the licensed facility to ensure the quantity and type of waste can be disposed of at the facility.

23.6.2. Avoidance and minimisation of impacts

Approaches to avoid and minimise waste were considered during development of the project footprint and construction methodology. This included but was not limited to locating construction compounds on relatively level ground to avoid unnecessary earthwork and generation of spoil. The amount of green waste likely to be generated has been decreased through design refinements to minimise vegetation clearance such as use of a double-circuit transmission line (which reduced the overall transmission line length from over 500 kilometres to 360 kilometres) and co-locating the transmission line route with existing areas of disturbance where possible. The project has also adopted a partial clearing methodology for the management of the transmission line easement instead of full continuous clearance of the easement. This methodology would minimise direct impacts on native vegetation along the length of the transmission line route.

Further impact avoidance measures would be considered during detailed design and ongoing construction planning, which would consider the principles of the resource management hierarchy as defined in the WARR Act.

Where feasible and reasonable, resources would be managed according to the following hierarchy:

- avoiding unnecessary resource consumption through design, efficient construction methodologies and management
- resource recovery, including reuse, reprocessing, recycling and energy recovery within the project
- resource recovery, including reuse, reprocessing, recycling and energy recovery outside the project
- where resource recovery is not feasible or reasonable, disposal would be the last resort.

23.6.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The mitigation measures that would be implemented to avoid or minimise potential waste related impacts are listed in Table 23-6.

Table 23-6 Summary of waste mitigation measures

Ref	Impact	Mitigation measure	Timing	Relevant location
W1	Resource management	The resource management hierarchy principles established under the WARR Act of avoid, reduce, reuse, or recycle with disposal as the last resort will be applied to further development, construction and operation of the project.	Detailed design, construction and operation	All locations
W2	Stockpiling of wastes	Stockpiled wastes, where required, will be: • appropriately segregated to avoid mixing and contamination • appropriately signposted • appropriately stored in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) • less than three metres in height with an appropriate height to length batter ratio • located as far away as reasonably practicable from sensitive receivers, ecological areas and waterways.	Construction	All locations
W3	Storage and transport of waste	All waste will be assessed, classified, managed, and disposed of in accordance with the Waste Classification Guidelines (NSW EPA 2014). Waste will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment. All waste related documentation such as waste classifications, transfer and disposal documentary evidence will be held by the proponent for a minimum of seven years from the date the waste is generated.	Construction and operation	All locations
W4	General waste management	The reuse of spoil and soils sourced from construction will be considered under an NSW EPA approved resource recovery order where the materials are sourced from within the project footprint and suitable from both a contamination and geotechnical perspective. Where a NSW EPA Resource Recovery Order exists for waste generated by the project, the opportunity to reuse that waste will be considered prior to disposal. The orders will need to be reviewed during construction and operation for validity and applicability.	Construction and operation	All locations
W5	Hazardous waste	Hazardous waste will be managed by appropriately qualified and licensed contractors, in accordance with the requirements of the *Environmentally Hazardous Chemicals Act 1985* and the EPA waste disposal guidelines.	Construction and operation	All locations

23.6.4. Managing residual impacts or uncertainties

Following the implementation of mitigation measures identified in Table 23-6 and the implementation of the Waste Management Plan, no residual impacts associated with the generation and management of waste are anticipated.

As noted in Section 23.2.2, the waste types and volumes identified in the EIS are indicative and have been identified for the purpose of determining potential waste management measures. However, any uncertainty associated with the final quantities of waste generated by the project during construction and operation would be appropriately managed with the implementation of the waste management measures in Table 23-6.

24. Sustainability

This chapter describes the overall approach to sustainability on the project and how specific objectives and initiatives are being incorporated into its design, construction and operation.

24.1. Sustainability context

Sustainable development consists of meeting the needs of the present, without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). In 1992, the Commonwealth Department of Environment defined Ecologically Sustainable Development (ESD) as “using, conserving and enhancing the community’s resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.”

In Australia, for the infrastructure sector, the Infrastructure Sustainability Council (ISC) defines IS as something which is designed, constructed and operated to optimise environmental, social and economic outcomes over the long-term. In 2021, Infrastructure Australia released its Sustainability Principles and outlined the role infrastructure networks play in promoting a sustainable community and how critical it is that infrastructure supports sustainability outcomes (Infrastructure Australia, 2021).

As a major infrastructure project, there are several national and NSW policy documents relevant to the sustainability outcomes for the project:

- *Sustainability Principles: Infrastructure Australia’s Approach to Sustainability* (Infrastructure Australia, 2021)
- *NSW Net Zero Plan Stage 1: 2020 – 2030* (Department of Industry and Environment (DPIE), 2020a)
- *NSW Electricity Infrastructure Roadmap* (DPIE, 2020a)
- *Electricity Strategy 2019* (DPIE, 2019)
- *NSW Circular Economy Policy* (State of NSW and NSW Environment Protection Authority (EPA), 2019)
- *NSW Climate Change Policy Framework* (Office of Environment and Heritage (OEH), 2016)
- *NSW Government’s Government Resource Efficiency Policy* (OEH, 2014).

As the operator and manager of Australia’s most critical high voltage network in the National Electricity Market, Transgrid is committed to leading the nation’s transition to a clean energy future. Operating within this broader government and policy framework, Transgrid has taken significant steps to increase the sophistication of its approach to managing Environmental, Social and Governance (ESG) issues. This ranges from corporate-level sustainability goals and priorities through to project-specific contractor requirements and individual project sustainability ratings.

Figure 24-1 provides an overview of the sustainability approach that has been taken for the project. Further discussion is provided below.

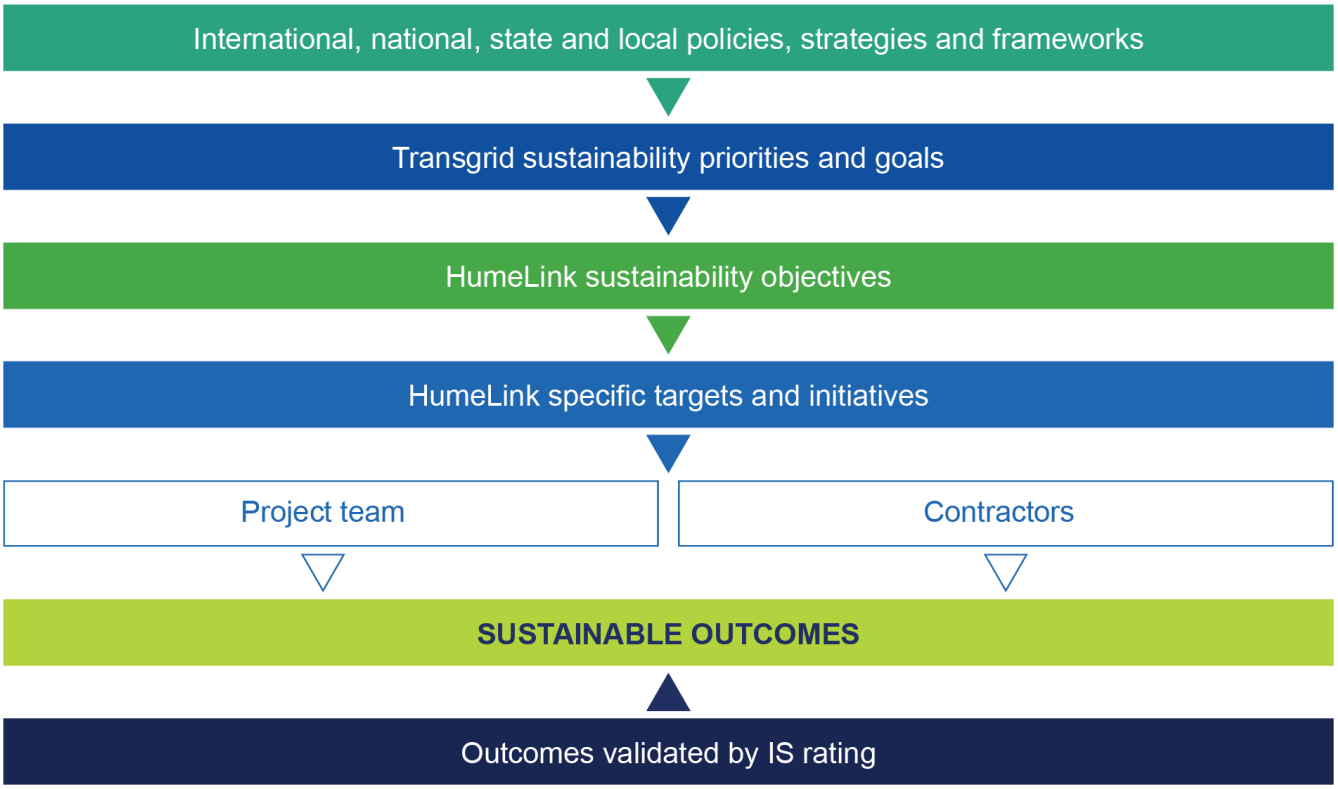


Figure 24-1 Sustainability context for the project

24.2. Transgrid sustainability priorities and goals

Transgrid's three sustainability goals and seven sustainability priorities to address the broader sustainability policy framework are shown on Figure 24-2.

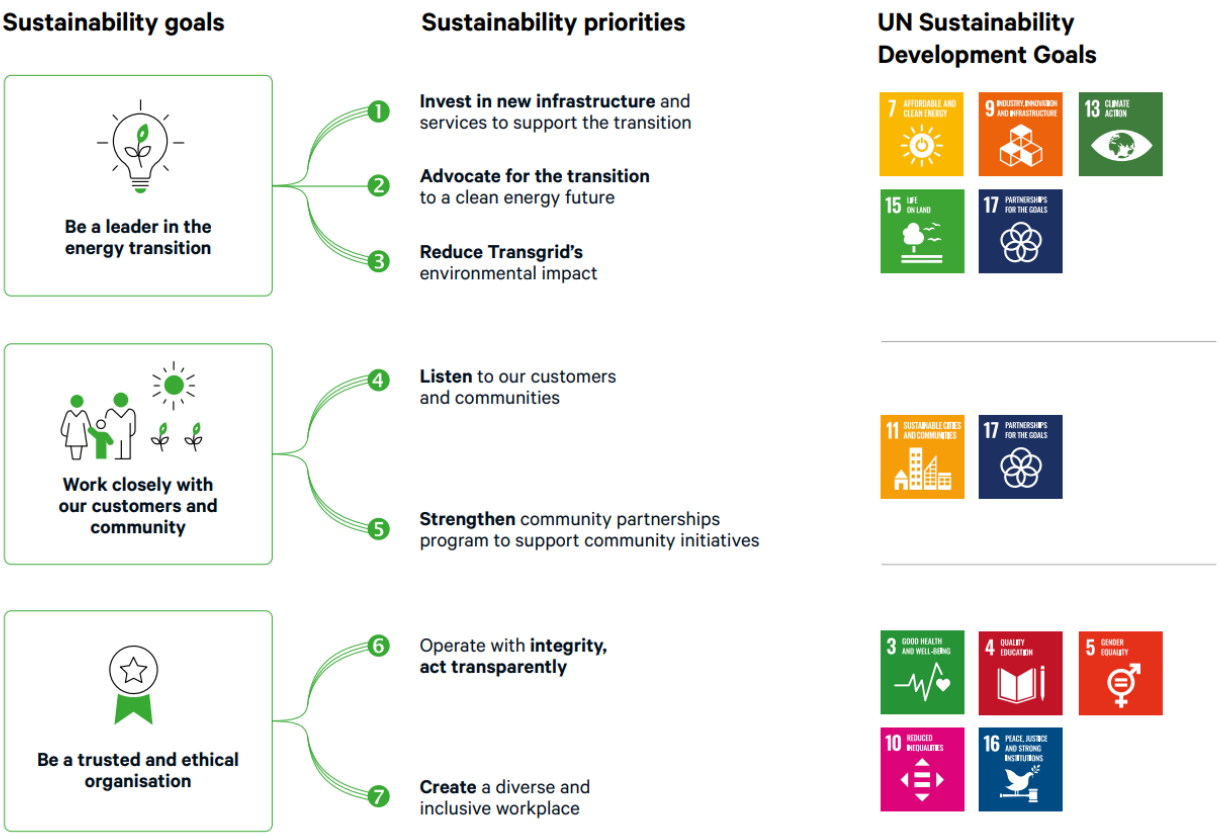


Figure 24-2 Sustainability goals and priorities (Transgrid, 2021)[19]

24.3. HumeLink sustainability strategy

A project-specific sustainability strategy has been developed for HumeLink – the *HumeLink Sustainability Strategy* (Transgrid, 2022). The strategy provides a targeted approach to sustainability outcomes for HumeLink through the development of eight project themes that align with Transgrid's sustainability goals and priorities (refer to Figure 24-2). These themes are as follows:

1. deliver infrastructure to accelerate the clean, decarbonised energy future
2. increased resilience to future climate
3. optimise resource efficiency
4. protect and enhance the natural environment and landscape
5. community at the heart of decision making
6. contribute to liveable communities
7. protect and enhance cultural heritage
8. demonstrate sustainability leadership and continual improvement.

The development of these themes also provides a pathway for use with the ISC IS rating scheme. In alignment with this, sustainability objectives have been set for each theme, with potential project-specific initiatives to be delivered between the project team and the successful delivery contractors and followed by the ISC rating process for assurance.

[19] https://www.Transgrid.com.au/media/cpqnbmn0/annual-review-2021.pdf, accessed 15/07/2022

The IS rating scheme includes ratings for the planning, design, as-built and operational stages of projects with a focus on improving sustainability outcomes. It evaluates the performance of a project against the quadruple bottom line (governance, economic, environmental and social) of infrastructure development.

Sustainability objectives and potential initiatives for HumeLink corresponding with the eight sustainability themes and the applicable ISC rating categories are shown in Table 24-1. These were developed through workshops with the project team and other relevant Transgrid personnel. Further engagement will be undertaken with the appointed delivery partners to test and refine these potential initiatives as the project moves into the next stage and specific deliverables will be established through the prescribed IS Rating process and associated allocation of credit points.

Table 24-1 HumeLink sustainability objectives and potential initiatives

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
Sustainability Theme 1: Deliver infrastructure to accelerate the clean, decarbonised energy future			
Increase the transfer capacity between southern NSW and major load centres within NSW (Sydney, Newcastle and Wollongong) Reinforce stability and reliability of the transmission network Facilitate transition of the network to new generation sources	Innovation (possible opportunities)	• ensure the delivery contractors make clear commitments to help Transgrid meet these objectives • early and ongoing engagement with key stakeholders • implement a program-wide approach to delivery of major projects to enable greater efficiencies and benefits.	• help to transition Australia to a low carbon future • enable more renewable energy generation to enter the market, supporting Australia's emissions reduction targets • provide NSW households with greater access to reliable and affordable energy.
Sustainability Theme 2: Increased resilience to future climate			
Design infrastructure and operations to be resilient to the impacts of climate change	Climate change adaptation	• conduct a Climate Change Risk Assessment in accordance with the Task Force On Climate-Related Financial Disclosure (TCFD) requirements (physical and transitional risks and opportunity identification) • use Indigenous knowledge to inform adaptation measures and resilience strategies • identify and implement adaptation measures to mitigate all extreme and high residual climate change risks • identify and implement adaptation measures to treat 25-50% of all medium residual climate change risks.	• flood impacts and extreme temperature risks would be reduced • reduction on time and cost to restore operations • improved asset durability • improved service reliability and maintenance schedules.
Sustainability Theme 3: Optimise resource efficiency			
Optimise energy use from renewable sources and reduce greenhouse gas (GHG) emissions across the infrastructure life cycle	Energy and carbon	• set targets for reductions in energy use and greenhouse gas (GHG) emissions during construction and operation • utilise and incorporate energy efficient construction plant and equipment, methods and practices • reduce materials in haulage through more efficient procurement and reduced transport-related emissions • prepare an Energy Efficiency and GHG Emissions Strategy detailing processes, methods and targets to improve energy efficiency and reduce GHG emissions	• reduced energy use during construction and operation • cost-effective and innovative approaches to energy efficiency, procurement and renewable sources are supported.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
		• undertake monitoring and modelling of energy use and GHG emissions and actions taken to reduce them • set targets for energy sourced from renewable energy generated onsite and/or accredited GreenPower.	
Optimise material use across the project	Materials	• set targets to maximise the re-use of materials • use local sources of materials where feasible • source materials that reduce the need for virgin material supply • identify and implement opportunities to reduce material use and maximise the use of materials with low embodied environmental impact • identify innovative approaches and opportunities during value engineering workshops with the delivery contractors • conduct an environment product declaration as per Project EnergyConnect.	• local materials are sourced and re-used • monitoring and modelling of materials lifecycle impacts is undertaken.
Optimise water use across the project	Water	• set targets for reductions in water use during construction and operation • undertake a Water Balance Study and identify opportunities to reduce water use (in particular potable water use) and reuse water (eg rainwater, stormwater, wastewater, and groundwater) during construction • implement water efficiency measures with a focus on achieving water savings and targeting water recycling and reuse • reuse, recycle or reclaim water (eg rainwater, stormwater, wastewater, groundwater) generated/collected • ensure water monitoring across project lifecycle is implemented.	• the need for potable water during the project lifecycle is minimised • water is reused and recycled during construction and operation • monitoring and modelling of water use is undertaken.
Reduce generation of waste and maximise diversion from landfill	Waste	• set targets for waste avoidance and reductions in waste to landfill • reuse/recycle usable spoil (uncontaminated surplus excavated material), construction and demolition waste (uncontaminated) • implement packaging take-back arrangements with suppliers (delivery contractors to pass target onto sub-contractors, where practicable).	• waste is minimised during construction • waste monitoring and management has been managed, reviewed or audited.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
Sustainability Theme 4: Protect and enhance the natural environment and landscape			
Optimise land use across the project	Land	• minimise the project's physical land footprint and the acquisition of properties • utilise disturbed land for project activities and infrastructure wherever possible instead of undisturbed or productive land.	• all subsoil and topsoil impacted by the project is separated and protected from degradation, erosion or mixing with fill or waste • sustainability appraisal of remediation options is undertaken • the run-off, flood risk, and potential increased flood risk elsewhere as a result of the project have all been assessed over their expected working life.
Minimise discharges to air, land and water	Discharges to air, land and water	• identify and implement measures to minimise adverse impacts to receiving water environmental values during construction and operation • monitoring of water discharges and receiving waters must be undertaken at appropriate intervals and at times of discharge during construction • identify and implement measures to mitigate noise during construction and operation • monitoring of noise is undertaken at appropriate intervals and in response to complaints during construction • identify and implement measures to minimise adverse impacts to local air quality during construction • monitoring of air emissions and/or air quality is undertaken at appropriate intervals and in response to complaints during construction • identify and implement measures to prevent light spill during construction. This must be shown through night audits of light spill.	• potential sources of pollution are reduced • control at the source of pollution is optimised to minimise harm to the environment.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
Improve biodiversity outcomes by avoiding, mitigating or offsetting the potential impacts of the project on plants, animals and their environments	Ecology	• invest in Indigenous regeneration opportunities • investigate opportunities to expand the distribution of threatened species (eg through propagation) • identify biodiversity custodian partnership opportunities with local landowners and community groups • work with private landowners to identify potential reuse opportunities for cleared vegetation and spoil and investigate opportunities for a shared value solution • reduce vegetation clearing to the smallest extent that is practical for the safe construction and operation of the project • promote a local landowner-based strategy for the establishment of biodiversity offset sites to offset vegetation clearing • investigate new and improved protocols for biosecurity management • help landowners and Forestry Corporation of NSW with feral pest management initiatives • retain connectivity corridors around new and existing transmission lines • partner with local wildlife organisations, government agencies or academic/research institutions to understand impacts of transmissions lines on threatened flora and fauna. This information could be shared across major projects to enhance uptake of preventative actions.	• protected and enhanced biodiversity values through appropriate planning and management • a biodiversity offset delivery strategy that creates opportunities for local landowner and community involvement.
Demonstrate best practice landscape design practices	Urban and landscape design	• identify innovative measures during design and construction to mitigate impacts to landscape character and visual amenity • use native plantings as long-term visual screening/mitigation in highly impacted vistas • incorporate Indigenous plants and meeting places (eg yarning circles) into design.	• enhanced landscapes that benefit the community and private landowners.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
Sustainability Theme 5: Community at the heart of decision making			
Engage and involve the community and local stakeholders in the development of the project	Stakeholder participation	• implement a Stakeholder Engagement Strategy, to be reviewed annually, for all stages of the project • seek input from the community and stakeholder representatives throughout the planning, design and delivery stages of the project • conduct regular stakeholder meetings across the broad range of project stakeholders and both internal and external • distribute community newsletters and stakeholder letters • adopt a collaborative approach with key stakeholders on the resolution of key issues.	• landowners and community groups are engaged throughout the project • engagement activities with stakeholders and the community to encourage and facilitate community participation in HumeLink's project planning.
Sustainability Theme 6: Contribute to liveable communities			
Make a positive contribution to community health and wellbeing Promote local and Aboriginal employment on the project Create opportunities for local business involvement during construction and operation	Community health, wellbeing and safety	• support Transgrid's "Look up and Live" safety awareness campaign including materials in local schools to ensure the community is prepared for the operation of a high voltage transmission line • work with the local community and NSW Rural Fire Services to address concerns in relation to bushfire response and risk management in and around transmission Lines Report on performance against targets set for Aboriginal participation in construction as described in Transgrid's Reconciliation Action Plan 2023 • form strategic partnerships with Charles Sturt University, the Clean Energy Training Centre and Regional Development Australia (RDA) – Riverine, to upskill the local community and create employment opportunities locally • build sustainable economic wealth in local communities through the implementation of an Aboriginal Participation Plan and Local Industry Participation Plan.	• contributed to economic activity in regional NSW, generating major benefits for local communities • jobs and opportunities: the project will create more than 1,000 construction jobs • zero harm to the workforce and community is achieved • crime prevention is implemented to maximise safety during construction and operation • Transgrid infrastructure is integrated with surrounding land uses.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
Sustainability Theme 7: Protect and enhance cultural heritage			
Manage and conserve cultural heritage and contribute to the awareness of the past	Heritage	• have all contractors undertake cultural awareness training where possible on-country and with community. • share local cultural stories collected as part of cultural values assessment (with permission and where appropriate) with the community • as part of the Indigenous Engagement Plan, identify and map indigenous stakeholders including indigenous communities, businesses, employment services, community advocates and agencies • continue to build relationships with local Indigenous communities prior to project commencement • as part of the Indigenous Engagement Plan engage and procure from Indigenous-owned businesses to meet targets set in Transgrid's Reconciliation Action Plan. This can promote supplier diversity, enable Indigenous business growth, and provide upskilling opportunities.	• protected and enhanced heritage through appropriate planning and management • impacts on Aboriginal and non-Aboriginal heritage significance have been minimised, avoided and mitigated where practicable, and management measures to be implemented throughout construction of the project have been provided.
Sustainability Theme 8: Demonstrate sustainability leadership and continual improvement			
Demonstrate sustainability leadership by embedding sustainability into decision making Demonstrate a high level of performance against objectives and appropriate benchmarks Establish governance arrangements which support continuous improvement of sustainability performance Be accountable and report publicly on performance	Management systems	• establish governance structures, processes and systems that ensure integration of sustainability considerations throughout all stages of the project • couple sustainability risk and opportunities with overall project risk processes to drive consistency and improve project outcomes • monitor project sustainability performance and report results into Transgrid's corporate reporting initiatives • ensure knowledge sharing is conducted across the HumeLink team, Transgrid's major projects program and wider industry covering lessons learnt, and environmental, social and economic aspects.	• approach to governance will be a senior management team that is engaged with sustainability performance • performance will be driven by corporate requirements and reporting commitments • high-impact decisions will be guided by multi-criteria analysis, cost-benefit analysis and risk and opportunity assessment where relevant.

Sustainability objectives	ISC rating category	Potential initiatives	Desired outcomes
To reduce the adverse environmental, social and economic impacts of purchased goods and services throughout their life and disposal. To integrate sustainability into procurement systems.	Procurement and purchasing	• ensure the decision-making framework includes sustainability criteria which considers the environment and community • build detailed briefs for design teams to assist/drive more sustainable decision making eg including carbon impacts on design options • nominate an internal design review process to include sustainability in design and associated design reports • partner with local suppliers where economically feasible and include social and environmental impacts in procurement strategies • develop and implement a sustainable procurement plan to apply to contractors, subcontractors and suppliers • increase engagement and purchasing from local and Indigenous companies.	• increased positive economic, environmental and social impacts from the project. • local skills development through the upskilling of local providers in the supply chain.

24.4. Ongoing approach to sustainability through contractual requirements and ISC rating

The strategy will continue to evolve in parallel with the planning and approvals process. Identified sustainability initiatives and targets would be further refined and relevant requirements included in the contract documents for all detailed design, construction and operations contracts.

Project delivery partners would be required to clearly identify how they would ensure that specific sustainability objectives, initiatives and targets are met. This approach would encourage industry to develop innovative value-for-money sustainability solutions. Following this process, the contractors would confirm the targeted ISC rating for the project.

25. Cumulative impacts

This chapter provides an assessment of the project's potential to generate cumulative impacts in the local and regional area. Cumulative impacts, as they relate to specific key issues, are addressed further in the relevant technical reports of the EIS.

25.1. Environmental Assessment Requirements

25.1.1. Secretary's Environmental Assessment Requirements

Table 25-1 outlines the Planning Secretary's Environmental Assessment Requirements (SEARs) relevant to cumulative impacts of the project and where these requirements are addressed in the EIS.

Table 25-1 Secretary's Environmental Assessment Requirements – cumulative impacts

Reference	SEARs	Where principally addressed in the EIS
General Requirements	In particular, the EIS must include:	
	• the relevant strategic context for the project, having regard to: - any other existing, approved or proposed projects that could result in cumulative impacts with the project;	Section 25.3 provides an overview of relevant future projects that could result in cumulative impacts with the project.
	• an assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any relevant Government legislation, 2 policies and guidelines (see below), including: - the predicted impacts of the project, including any cumulative impacts of the site and existing or proposed developments in the region taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice including Cumulative Impact Assessment Guideline (DPIE, November 2021);	Chapters 8 to 23 detail the predicted impacts of the project. Section 25.5 and Section 25.6 provide details on the potential cumulative impacts of the project and relevant future projects. The DPE's *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022m) has been applied in scoping the cumulative impact assessment of the project and assessing and evaluating the potential cumulative impacts.
	- actions proposed to deal with any uncertainties associated with the assessment;	Chapter 26 (Environmental management) provides actions to deal with key uncertainties associated with the assessment of the project. Section 25.7.4 provides steps that would be taken to address uncertainties associated with the cumulative impact assessment.

25.2. Assessment approach

25.2.1. Policy context

The *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022m) is the key NSW government guideline for assessing project-level cumulative impacts related to State significant projects such as HumeLink and sets clear expectations and requirements. Accordingly, the guideline has been applied in scoping the cumulative impact assessment of the project and assessing and evaluating the potential cumulative impacts.

25.2.2. Methodology

The cumulative impact assessment methodology involved:

- identifying relevant future projects to be included in the cumulative impact assessment (refer to Section 25.2.3)
- assessing and evaluating the potential cumulative impacts of the relevant future project, including identification of any issues likely to have material cumulative impacts during construction and/or operation of the project
- identifying suitable mitigation and management measures to manage potential cumulative impacts.

The assessment and evaluation of potential cumulative impacts has been based on issue-specific (refer to Section 25.5) and combined cumulative impact assessment (refer to Section 25.6) approaches as described in the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022m). Issue specific cumulative impact assessments include the cumulative impacts of the project on key matters, such as an increase in traffic, with other relevant future projects. Combined cumulative impact assessments include the effect of the different cumulative impacts (eg an increase in traffic, dust and noise in one area) of the project on key matters, sensitive receptors or important features with other relevant future projects. Due to the extent of information available at the time of the assessment and uncertainties associated with timing and determination of relevant future projects, the cumulative impact assessment was qualitative, in accordance with the guidelines.

The issue-specific assessment approach has considered the impacts of the project together with the impacts of other relevant future projects on the key matters assessed in the EIS. Full issue-specific assessments are provided in the technical reports prepared for the EIS and include further detail on the methodology applied. Key outcomes of the issue-specific cumulative impact assessments are summarised in Section 25.5.

The combined assessment approach has involved integrating the findings of each issue-specific assessment to determine whether there would be a combined effect of the different cumulative impacts of the project with other relevant future projects on key matters in an identified area (refer to Section 25.6).

No project-level cumulative impact assessment has been undertaken as part of the GHG assessment. This is because it is more appropriate to compare the potential construction and operational GHG emissions from the project with the most recent GHG emission estimates for NSW and Australia (refer to Chapter 22 (Climate change and greenhouse gas)) rather than nearby projects, as is it not a localised or regional cumulative issue.

25.2.3. Identifying relevant future projects

Initial scoping to identify relevant future projects was carried out as part of preparing the *HumeLink Scoping Report* (Transgrid, 2022f). Further review and investigation have been carried out as part of the EIS to confirm the relevant future projects for cumulative impact assessment. This included development of a cumulative impact study area to identify relevant future projects that aligned to the scoping assessment presented in the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022m) focusing on key matters that may be materially affected.

The size of the cumulative impact study area was identified based on the scale and nature of the potential impacts of the project, which may be combined with other relevant future projects. This conservatively included the Local Government Area (LGAs) of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional, Upper Lachlan Shire, Goulburn-Mulwaree and Hilltops.

Using the cumulative impact study area, potentially relevant future projects were then identified based on a search of the following data sources throughout preparation of the EIS (the most recent search was conducted in March 2023):

- DPE's Major Projects register
- NSW Government's Southern Regional Planning Panel project register
- NSW Independent Planning Commission project register
- EPBC Act Public Portal
- Transport for NSW Projects Map.

State and local government strategic and land use plans were also reviewed to identify potential areas or developments that may require consideration, eg Special Activation Precincts. Local council development approval tracking databases were not reviewed as they generally include developments that are not of the scale or relevance in terms of potentially contributing to or compounding material impacts in the cumulative impact study area.

Once potentially relevant projects were identified, the projects were screened against four criteria, as set out in Table 25-2, to determine whether a project could potentially cause a cumulative impact with HumeLink and should be considered in the cumulative impact assessment. Projects that satisfied at least one of the requirements in each of the four criteria were included in the cumulative impact assessment and are described in Section 25.3.

Table 25-2 Screening criteria for the cumulative impact assessment

Criteria	Requirement for consideration of cumulative impacts
Location	• project footprints intersect • projects are in proximity where there is the potential for impacts to spatially overlap.
Status	• approved projects, including approved projects that have not started construction, projects currently under construction, and recently completed projects • proposed projects where there is enough publicly available information to allow for analysis of potential cumulative impact issues.
Timeframe	• overlapping construction program with the project • consecutive construction program with the project.
Scale	• project is a large-scale major development or infrastructure project that could cause cumulative impacts with HumeLink.

25.3. Projects with potential for cumulative impacts

Relevant future projects that were considered to have the potential for cumulative impacts with the construction and operation of HumeLink are listed in Table 25-3 and are shown on Figure 25-1.As described in Chapter 4 (Project description - construction), construction of HumeLink is expected to commence in 2024 and the project is expected to be fully operational by 2026. It is anticipated that overall construction would take about 2.5 years.

Table 25-3 Projects with the potential for cumulative impacts

Relevant future project	Proponent	Scope	Location	Status/timeframe/overlap
EnergyConnect (NSW – Eastern Section)	Transgrid	New transmission line connecting the existing Buronga substation and existing Wagga 330 kV substation, and construction of the new Dinawan 330 kV substation (170 km west of Wagga Wagga). The existing Wagga 330 kV substation requires upgrade and expansion to accommodate the new transmission line connectors (DPE, 2022n).	EnergyConnect (NSW – Eastern Section) and the project footprint intersect at the existing Wagga 330 kV substation.	• approved in September 2022 • construction began in early 2023 • upgrade and expansion of the existing Wagga 330 kV substation as part of EnergyConnect (NSW – Eastern Section) to be complete by August 2024 • likely consecutive construction programs or minor overlap between the project and EnergyConnect (NSW – Eastern Section).
Gregadoo Solar Farm	Gregadoo Solar Farm Pty Ltd	New solar farm with a generating capacity of around 47 MW that would occupy around 96 ha (DPE, 2018b).	Gregadoo Solar Farm is located adjacent to the project footprint at the existing Wagga 330 kV substation.	• approved in December 2018 • construction proposed to begin mid-2023 and expected to take about 9 months • potential consecutive construction programs or minor overlap between the project and Gregadoo Solar Farm.
Inland Rail – Albury to Illabo*	Australian Rail Track Corporation Limited (ARTC)	Enhancement work to structures and sections of existing 185 km railway line between the Victoria/NSW border and Illabo, including adjustments to 44 km of track, upgrade and removal of bridge structures, adjustments to local road network, and drainage infrastructure upgrades (WSP & ARTC, 2022).	Work proposed for Wagga Wagga Station and surrounds, and at Uranquinty, as part of Inland Rail – Albury to Illabo, would be about 9 km north and 13 km west of the existing Wagga 330 kV substation respectively.	• EIS exhibited August–September 2022 • construction is proposed to begin in early 2024 and is expected to take about 16 months • likely overlapping construction programs between the project and Inland Rail – Albury to Illabo.
Victoria to NSW Interconnector West (VNI West)*	Transgrid	Transmission interconnector expansion between Victoria and NSW to address network limitations and improve supply reliability (Transgrid, 2023b).	Several options are under consideration for the proposed new interconnector corridor connecting to the existing Wagga 330 kV substation. There is potential for VNI West to intersect the project footprint between the existing Wagga 330 kV substation and proposed Gugaa 500 kV substation.	• regulatory Investment Test for Transmission process underway • construction proposed to begin in 2026 with commissioning by 2028 • potential consecutive construction programs between the project and VNI West.

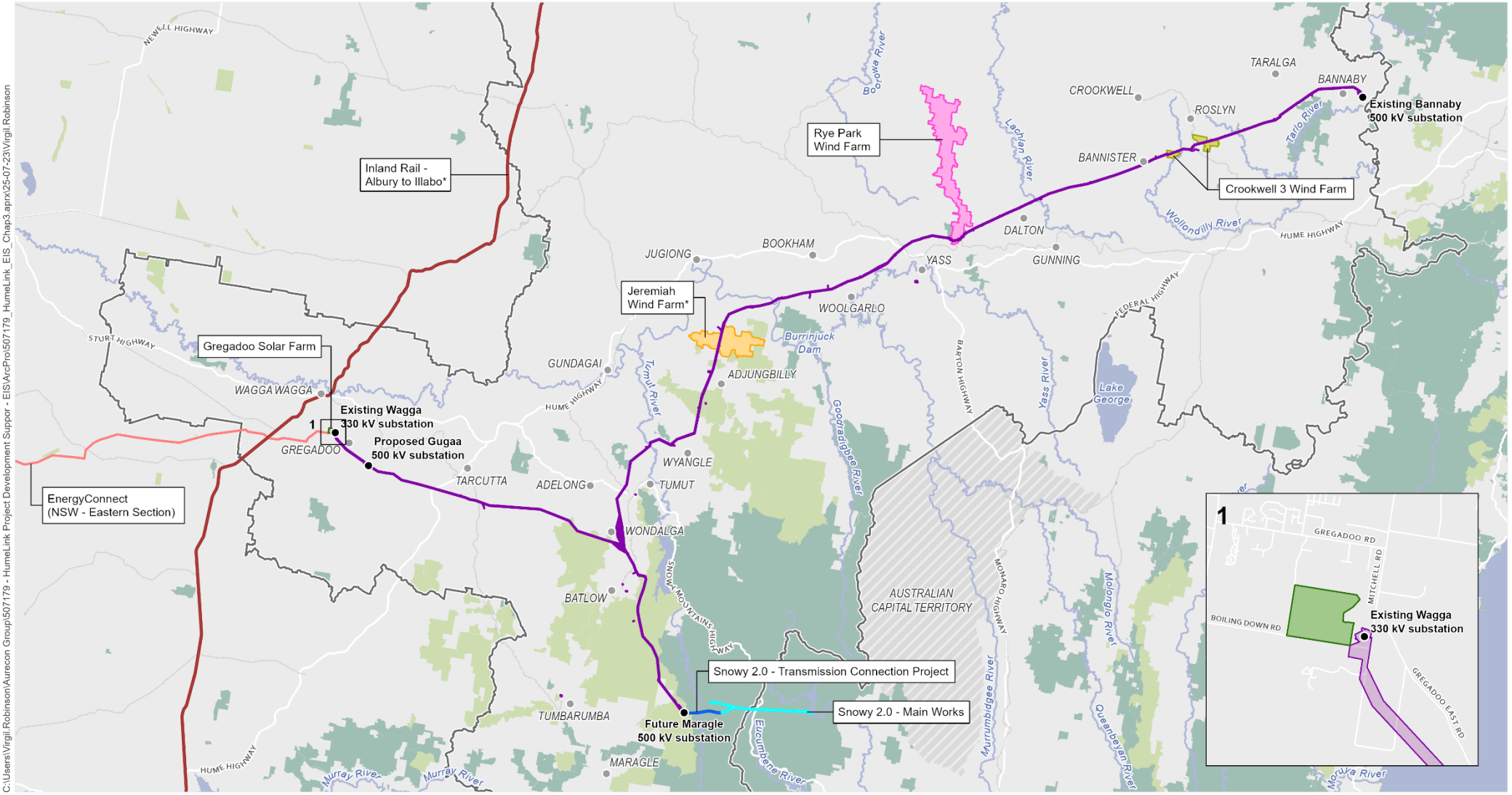
Relevant future project	Proponent	Scope	Location	Status/timeframe/overlap
Jeremiah Wind Farm*	Squadron Energy Pty Ltd	New 65 turbine wind farm with a maximum tip height of 300 m, battery energy storage system and associated ancillary infrastructure (Eco Logical Australia, 2021).	Jeremiah Wind Farm development area and the project footprint intersect around 29 km east of Gundagai around the Adjungbilly area.	• SEARs were issued in September 2021 and EIS is being prepared • determination anticipated in 2023 • construction expected to take about 24–30 months • likely overlapping construction programs between the project and Jeremiah Wind Farm.
Rye Park Wind Farm	Rye Park Renewable Energy Pty Ltd	New 80 turbine wind farm with a maximum tip height of 200 m, associated infrastructure (eg substation, and operation and maintenance facilities) and upgrades to local roads (DPE, 2017b).	Rye Park Wind Farm development area and the project footprint intersect at Bango (near Bango Nature Reserve). A telecommunications connection with the future Rye Park Wind Farm substation is proposed as part of HumeLink (refer to Chapter 3 (Project description – infrastructure and operation)).	• approved in May 2017 • construction began in December 2021 with expected completion in June 2023 • unlikely consecutive construction programs between the project and Rye Park Wind Farm[1].
Crookwell 3 Wind Farm	Global Power Generation Australia Pty Ltd	New 16 turbine wind farm with a maximum tip height of 157 m and associated infrastructure. The turbines would be developed in two clusters either side of the Crookwell 2 Wind Farm, which has been operating since 2018 and includes 28 turbines (DPE, 2019).	Crookwell 3 Wind Farm development area and the project footprint intersect at Woodhouselee, immediately west of Wollondilly River and immediately east of Woodhouselee Road.	• approved in October 2020 • detailed design and pre-construction activities are being carried out with main construction work expected to take about 18 months once commenced • likely consecutive construction programs or minor overlap between the project and Crookwell 3 Wind Farm.
Snowy 2.0 – Main Works	Snowy Hydro Limited	Expansion of the existing Snowy Mountains Hydro-electric Scheme by connecting the Talbingo and Tantangara reservoirs with 29.7 km of underground waterway tunnels and construction of a new underground power station and associated infrastructure (DPIE, 2020h).	The Talbingo Reservoir site of Snowy 2.0 – Main Works is around 5 km east of transmission lines between Wondalga and the future Maragle 500 kV substation.	• approved in May 2020 • construction began in October 2020 with expected completion by 2026 • likely overlapping construction programs between the project and Snowy 2.0 – Main Works.

Relevant future project	Proponent	Scope	Location	Status/timeframe/overlap
Snowy 2.0 – Transmission Connection Project	Transgrid	New transmission connection between the power station to be constructed as part of Snowy 2.0 Main Works and the existing high voltage transmission network, including two new 9 km long 330 kV transmissions lines and a new 500/330 kV substation at Maragle (i.e. the future Maragle 500 kV substation) (DPE, 2022o).	Snowy 2.0 Transmission Connection Project and the project footprint intersect at the future Maragle 500 kV substation.	• approved in September 2022 • construction expected to begin in late 2023 with expected completion by end of 2025 • likely consecutive construction programs or minor overlap between the project and Snowy 2.0 Transmission Connection Project given construction sequencing requirements with the future Maragle 500 kV substation.

Note:

1. While overlapping or consecutive construction programs are unlikely, given the project's proposed connection with Rye Park Wind Farm substation and scale of the wind farm project it was considered appropriate to include Rye Park Wind Farm as a relevant future project.

* Projects subject to approval



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

Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 25-1: Projects with potential for cumulative impacts

25.4. Other projects

In addition to the relevant future projects identified in Table 25-3 and Figure 25-1, multiple approved and proposed renewable energy projects were identified within the cumulative impact study area. These projects ranged from around 10 to 18 kilometres from the project footprint and include Maxwell Downs Solar Farm, Mates Gully Solar Farm, Yass Valley Wind Farm (renamed Coppabella Wind Farm), Bango Wind Farm, Gunning Solar Farm and Western Range Solar Farm. While there is the likelihood for overlapping or consecutive construction programs, impacts associated with the above approved and proposed renewable energy projects are expected to be localised and minimised with the implementation of mitigation measures. As such, these projects did not meet the location and scale criteria as detailed in Table 25-2 and were not considered further as relevant future projects.

The Royal Australian Air Force (RAAF) Base Wagga Redevelopment (part of Riverina Redevelopment Program) was also identified as a potentially relevant future project given its proximity to the existing Wagga 330 kV substation (about 7.5 kilometres). However, as there was limited publicly available information about the scope of the redevelopment and construction timing, it was not possible to determine the potential for a cumulative impact with the project.

Similarly, the *Tumut to Hume Highway (Snowy Mountains Highway and Gocup Road) Corridor Strategy* (Transport for NSW, 2016) proposes a number of priority projects that could intersect with the project footprint where it crosses the Snowy Mountains Highway. A number of priority projects identified under the corridor strategy have been delivered in recent years near the project, eg Gocup Road upgrade. However, given limited publicly available information about the scope or timing of other priority projects, it was not possible to determine the potential for a cumulative impact with the project.

Engagement with the Department of Defence and Transport for NSW would continue during detailed design and construction of the project as detailed in Chapter 6 (Engagement). This engagement would allow for the identification and consideration of any potential cumulative impacts from the RAAF Base Wagga Redevelopment and work associated with the *Tumut to Hume Highway (Snowy Mountains Highway and Gocup Road) Corridor Strategy* (Transport for NSW, 2016) as required (refer to Section 25.7.3).

25.5. Issue-specific cumulative impact assessment

The potential issue-specific cumulative impacts that may occur with each relevant future project are identified in Table 25-4 and discussed in the following sections. Full assessments are provided in the technical reports prepared for the EIS.

Table 25-4 Potential cumulative impacts for each relevant future project

Relevant future project	Type of cumulative impact with the project														
	Biodiversity	Aboriginal heritage	Non-Aboriginal heritage	Land use and property	Economic	Social	Landscape character and visual amenity	Noise and vibration	Soils, geology and contamination	Surface water and groundwater	Hydrology and flooding	Hazards and risks	Traffic, transport and access	Air quality	Waste
EnergyConnect (NSW – Eastern Section)					■	■	■	■					■	■	
Gregadoo Solar Farm				■	■	■	■							■	
Inland Rail – Albury to Illabo*					■	■									
VNI West*				■	■	■	■								
Jeremiah Wind Farm*	■			■	■	■	■	■					■	■	
Rye Park Wind Farm	■			■	■	■	■	■							
Crookwell 3 Wind Farm				■		■	■	■						■	
Snowy 2.0 – Main Works					■	■							■		
Snowy 2.0 – Transmission Connection Project	■			■	■	■	■						■	■	

Key:

■ Potential for cumulative impact, including positive and negative impacts

■ Negligible cumulative impact or unable to be determined at this stage due to limited publicly available information

* Projects subject to approval

25.5.1. Biodiversity

Relevant future projects identified as having potential cumulative biodiversity impacts with the project are Jeremiah Wind Farm, Rye Park Wind Farm and the Snowy 2.0 – Transmission Connection Project. These projects intersect the project footprint in areas where biodiversity impacts could be compounded.

Table 25-5 details threatened ecological communities (TEC) and species listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that have the potential to be impacted by the project and the Jeremiah Wind Farm development area, Rye Park Wind Farm and the Snowy 2.0 – Transmission Connection Project.

Table 25-5 TECs and threatened species with potential for cumulative biodiversity impacts

TEC or threatened species	Conservation status[1]	Jeremiah Wind Farm[2, 5]	Rye Park Wind Farm[3]	Snowy 2.0 – Transmission Connection Project[4]
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland TEC	BC Act - CE	Known to occur in development area	Identified as impacted	-
	EPBC Act - CE	-	Identified as impacted	-
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	BC Act - V EPBC Act - E	Known to occur in development area	-	Identified as impacted
Eastern Pygmy-possum (*Cercartetus nanus*)	BC Act - V	-	-	Identified as impacted
Striped Legless Lizard (*Delma impar*)	BC Act - V EPBC Act - V	-	Identified as impacted	-
Little Eagle (*Hieraaetus morphnoides*)	BC Act - V	-	Identified as impacted	-
Booroolong Frog (*Litoria booroolongensis*)	BC Act - E EPBC Act - E	Known to occur in development area	-	Identified as impacted
Large Bent-winged Bat (*Miniopterus orianae oceanensis*)	BC Act - V	Known to occur in development area	-	-
Southern Myotis (*Myotis Macropus*)	BC Act - V	-	Identified as impacted	-
Greater Glider (*Petauroides volans*)	BC Act - E EPBC Act - E	Known to occur in development area	-	-
Yellow-bellied Glider population on the Bago Plateau	BC Act - E	-	-	Identified as impacted
Squirrel Glider (*Petaurus norfolcensis*)	BC Act - V	-	Identified as impacted	-
Superb Parrot (*Polytelis swainsonii*)	BC Act - V EPBC Act - V	Known to occur in development area	Identified as impacted	-
Golden Sun Moth (*Synemon plana*)	BC Act - V EPBC Act - V	-	Identified as impacted	-
Masked Owl (*Tyto novaehollandiae*)	BC Act - V	-	-	Identified as impacted

TEC or threatened species	Conservation status[1]	Jeremiah Wind Farm[2, 5]	Rye Park Wind Farm[3]	Snowy 2.0 – Transmission Connection Project[4]
Yass Daisy (*Ammobium craspedioides*)	BC Act - V EPBC Act - V	Known to occur in development area	-	-

Note:

2. Conservation status listings: CE - critically endangered; E - endangered; V – vulnerable
3. Sourced from *Jeremiah Wind Farm Scoping Report* (Eco Logical Australia 2021)
4. Sourced from *Rye Park Wind Farm Modification Application 2 Report* (Rye Park Renewable Energy Pty Ltd, 2022) and *Rye Park Wind Farm Biodiversity Assessment Addendum* (ngh environmental, 2016)
5. Sourced from *Snowy 2.0 Transmission Connection Project Revised Biodiversity Development Assessment Report* (Jacobs 2021)
6. Project subject to approval.

Given the overlap with the projects in Table 25-5 and project footprint, there is the potential for biodiversity impacts within the locality to be compounded by the projects.

The avoidance and minimisation measures, along with the offset requirements and mitigation measures for residual impacts detailed in *Technical Report 1 – Biodiversity Development Assessment Report*, along with similar provisions in each individual project specific assessment are considered likely to control the risk of potentially significant cumulative biodiversity impacts in the locality.

25.5.2. Aboriginal heritage

There is potential for cumulative Aboriginal heritage impacts with the project and Crookwell 3 Wind Farm. An Aboriginal heritage site identified as part of the investigations for Crookwell 3 Windfarm is located within the project footprint of HumeLink. However, the Crookwell 3 Wind Farm project is proposing to avoid the site. With the implementation of mitigation measures detailed in Chapter 9 (Aboriginal heritage), there is unlikely to be a substantial increased impact on the Aboriginal heritage. In particular, impacts on Aboriginal heritage sites would be avoided or minimised in detailed design and construction planning for the project, which would involve refining the design and location of the transmission line structures and refining the design of proposed infrastructure and construction methodology.

25.5.3. Land use and property

Relevant future projects identified as having potential cumulative land use and property impacts with the project include Gregadoo Solar Farm, VNI West, Jeremiah Wind Farm, Rye Park Wind Farm, Crookwell 3 Wind Farm and the Snowy 2.0 – Transmission Connection Project.

Gregadoo Solar Farm and the project have the potential to result in localised cumulative agricultural land use impacts near the existing Wagga 330 kV substation during operation. Gregadoo Solar Farm would permanently change 96 hectares of cropping and grazing land uses to utilities and require the removal of farm infrastructure. These impacts would be compounded with impacts on agricultural land uses from the project in the locality. However, given the relatively small area of impact in this location associated with the Gregadoo Solar Farm and the project compared to the large scale of regional agricultural activity, the overall cumulative impact is minor.

As noted earlier, there is the potential that the VNI West project may intersect HumeLink. Should VNI West intersect with the project footprint between the existing Wagga 330 kV substation and the proposed Gugaa 500 kV substation, there is potential for cumulative land use and property impacts during operation. Based on existing land use in this area, cumulative land use impacts would largely be limited to agricultural land uses, including cropping and grazing. However, the impacts of both projects on agricultural land would be expected to be minor compared to the large scale of regional agricultural activity and the cumulative

impacts would also be minor. Cumulative property impacts would occur during operation if a landowner's land were affected by both projects. Should this occur, potential cumulative impacts would be localised and any additional impacts to land use and property would be considered during the acquisition process detailed in Chapter 3 (Project description – infrastructure and operation).

Due to the potential overlapping construction programs between the project and Jeremiah Wind Farm, it is likely there would be cumulative land use and property impacts during construction. These impacts would mainly relate to access restrictions and land use disruption at the work sites during construction. However, cumulative impacts are expected to be minor due to the relatively small area where the project and Jeremiah Wind Farm intersect and the low density of residents.

Potential cumulative land use and property impacts during operation from Jeremiah Wind Farm, Rye Park Wind Farm, Crookwell 3 Wind Farm and the project would be similar. The predominant land use where these projects intersect the project footprint of HumeLink is grazing land. Wind turbines and associated access tracks for the wind farm projects are spread out across a large area and would generally allow for continued grazing land use around these assets. Similarly, the transmission lines and access tracks associated with the project would generally allow for continued grazing land use. As such, cumulative impacts on land use and agricultural production during operation would be minor. Cumulative impacts on property during operation would include changes to landowner access regimes and establishment of easements; these impacts on property would be minor.

In addition to the above, the wind farm projects and HumeLink could have potential localised cumulative impacts on aerial agriculture operations in the areas where these projects intersect. However, the areas where these projects intersect is not in the area where extensive aerial agricultural operations are undertaken, i.e. near Wagga Wagga and Tarcutta, as discussed in Chapter 11 (Land use and property). Despite this, there may be potential cumulative impacts depending on the reliance of aerial agriculture operations in the area. Given that alternative methods of fertiliser and chemical application are available, the overall cumulative impact on agricultural productivity is considered minor.

The construction and operation of the project and the Snowy 2.0 – Transmission Connection Project would contribute to cumulative impacts on forestry land use and property in the Snowy Valleys LGA. Cumulative impacts would be limited to Bago State Forest, where there would be a combined impact on about 262 hectares (i.e. about 218 hectares impacted by the project based on the indicative concept design and construction methodology and about 44 hectares by the Snowy 2.0 – Transmission Connection Project). The combined area of impact equates to around 0.5 per cent of the total area of Bago State Forest. Cumulative land use impacts would be associated with the loss of forestry through vegetation clearing and operational restrictions for the projects. The cumulative impacts on land use from the combination of the projects would be moderate as the two projects would reduce the area of land available for forestry. Cumulative impacts on property would be associated with the establishment of easements. The cumulative impacts on property would be minor.

The potential cumulative land use and property impacts identified above would be minimised by implementing the mitigation measures detailed in Chapter 11 (Land use and property) and equivalent mitigation measures included for the approved relevant future projects and those expected for Jeremiah Wind Farm.

25.5.4. Economic

The construction of the project and majority of the relevant future projects would result in positive economic cumulative impacts at a local, regional and State level. The positive impacts would be associated with local employment opportunities, wage expenditure and increased economic activity. The timeframe for the positive cumulative impacts could be for several years in some areas depending on the timing of consecutive construction programs of the project and relevant future projects.

However, there is potential for negative economic cumulative impacts from the project and large-scale relevant future projects, which have overlapping construction programs. These projects include Inland Rail – Albury to Illabo, Snowy 2.0 – Main Works, the Snowy 2.0 – Transmission Connection Project and, to a lesser extent, EnergyConnect (NSW – Eastern Section). The negative cumulative impacts would be associated with demand for local workers, which may result in temporary labour shortages that would need to be met with commuter workers or internal migration. The migration of outside workers could then increase the demand for rental housing and accommodation, which could result in accommodation shortages during peak tourist periods. Locations that are likely to experience the cumulative increase in demand for rental housing and accommodation include Wagga Wagga City LGA and Tumbarumba and Batlow regions of Snowy Valleys LGA. The cumulative increase in demand for rental housing and accommodation would be addressed and minimised by implementing the Worker Accommodation Strategy for the project as detailed in Chapter 4 (Project description – construction) and Chapter 13 (Social).

There would also be overlapping construction programs with the project and Jeremiah Wind Farm, with a subsequent increase in demand for services and accommodation in and around the Gundagai and Tumut region. However, associated negative cumulative impacts are not anticipated as existing accommodation facilities near Gundagai and Tumut should be sufficient to accommodate the combined workers of both projects.

25.5.5. Social

The construction and operation of the project and relevant future projects would potentially result in both positive and negative cumulative social impacts. The timing and scale of impact would depend on the overlap of construction programs, proximity of the project to the relevant future project and surrounding community.

Potential positive cumulative social impacts from the project and relevant future projects relate to construction and would be experienced concurrently or consecutively depending on the timing of construction of the relevant future projects. The positive cumulative social impacts would be associated with improved livelihoods for business operators and workers in the surrounding region due to increased patronage and access to employment and training. The positive cumulative social impacts would be largely contained to the social locality as defined in Chapter 13 (Social). The magnitude of the impact would be minor.

Table 25-6 provides details on the potential negative cumulative social impacts from the project and relevant future projects. The identified impacts would be managed by implementing the mitigation measures detailed for other environmental matters, including noise and vibration; and traffic, transport and access, as well as the implementation of equivalent mitigation measures as part of the delivery of the relevant future projects. Also, as noted in Section 25.5.4, the cumulative increase in demand for accommodation and housing during construction would be addressed and minimised by implementing the Worker Accommodation Strategy for the project as detailed in Chapter 4 (Project description – construction) and Chapter 13 (Social).

Table 25-6 Potential negative cumulative social impacts from the project and relevant future projects

Relevant future project	Potential negative cumulative social impact	Affected locality	Magnitude of impact(s)
EnergyConnect (NSW – Eastern Section)	Impacts during construction would be associated with: • demand for accommodation and housing • changes to accessibility due to increased construction traffic.	Wagga Wagga	Minor
Gregadoo Solar Farm	Impacts during construction would be associated with changes to accessibility (eg related to construction traffic), health and wellbeing, and the surroundings from the continuation of construction work.	Wagga Wagga	Minor
Inland Rail – Albury to Illabo*	Impacts during construction would be associated with: • demand for accommodation and housing • changes to accessibility due to increased construction traffic • reduced amenity and health and wellbeing due to increased construction noise, vibration and dust.	Limited to any shared construction access routes	Minor
VNI West*	Impacts would be unlikely and details on the project are limited.	Not applicable	Not applicable
Jeremiah Wind Farm* Rye Park Wind Farm Crookwell 3 Wind Farm	Impacts during construction would be limited to the project and Jeremiah Wind Farm and Crookwell 3 Wind Farm and would be associated with: • changes to accessibility due to increased construction traffic • reduced amenity and health and wellbeing due to increased construction noise, vibration and dust. Impacts during operation of the project and identified wind farm projects would be associated with changes to the surroundings, health and wellbeing, and amenity due to permanent infrastructure impacting the landscape. There would also be potential for increased operational noise.	Limited to the vicinity of where the wind farms intersect with the project footprint	Minor
Snowy 2.0 – Main Works	Impacts during construction would be associated with changes to way of life and accessibility due to reduced access to recreation areas such as Kosciuszko National Park, Bago State Forest and Talbingo Reservoir.	Tumut, Batlow and Tumbarumba	Minor
Snowy 2.0 – Transmission Connection Project	Impacts during construction would be associated with: • demand for accommodation and housing • increased non-resident worker population • increased construction vehicle movements. Increased construction vehicle movements may also impact community environmental values, amenity, and the surroundings. Impacts during operation would be associated visual impacts from permanent infrastructure, which would have impacts on community environmental values, amenity, and the surroundings.	Tumut, Batlow and Tumbarumba	Minor

Note:
* Project subject to approval

25.5.6. Landscape character and visual amenity

Potential cumulative landscape character and visual impacts from the project and relevant future projects (excluding Inland Rail – Albury to Illabo and Snowy 2.0 – Main Works) are expected to occur during construction and/or operation. The impacts would generally be associated with landform changes, removal of vegetation and/or the introduction of new or additional electricity infrastructure. Some cumulative impacts, such as those associated with the project and EnergyConnect (NSW – Eastern Section) and the project and Gregadoo Solar Farm, would occur in landscapes where there is existing electricity infrastructure. As such, impacts associated with additional transmission lines and new energy generation infrastructure would be minimal. Other landscapes, would have a higher visual absorption capacity for the introduction of new electricity infrastructure due to the presence of surrounding vegetation, which would minimise views to the projects, such as near the Snowy 2.0 – Transmission Connection Project.

Cumulative landscape character and visual impacts associated with the project and VNI West, Jeremiah Wind Farm, Rye Park Wind Farm and Crookwell 3 Wind Farm, would be predominantly located in a rural landscape. The relevant future projects would introduce new or additional energy generation infrastructure or additional transmission lines into the landscape. These changes, in addition to HumeLink, would result in electricity infrastructure that is larger in scale and more prevalent.

Table 25-7 provides further details on the location and timing of the potential cumulative landscape character and visual impacts from the project and relevant future projects. The identified impacts would be managed by implementing the mitigation measures detailed in Chapter 14 (Landscape character and visual amenity) as well as equivalent mitigation measures as part of the delivery of the relevant future projects.

Table 25-7 Potential cumulative landscape character and visual impacts from the project and relevant future projects

Relevant future project	Landscape subject to cumulative impacts	Views subject to cumulative impacts	Timing of cumulative impact
EnergyConnect (NSW – Eastern Section)	Rural fringe landscape	Views from Ashfords Road, Gregadoo East Road and Boiling Down Road	Construction and operation
Gregadoo Solar Farm	Rural fringe landscape	Views from Boiling Down Road	Construction and operation
VNI West*	Rural fringe landscape Great Dividing Range foothills landscape	Views from Ashfords Road, Gregadoo East Road, Boiling Down Road, Big Springs Road and Livingstone Gully Road	Construction and operation
Jeremiah Wind Farm*	Rural valleys landscape	Views from Parsons Creek Road and Nanangroe Road, and from surrounding rural properties	Construction and operation
Rye Park Wind Farm	Undulating rural hills and ridges landscape	Views from Bushs Road and Coolalie Road, and from nearby rural properties	Construction and operation
Crookwell 3 Wind Farm	Rural tablelands landscape	Views from Crookwell Road, Woodhouselee Roads, and from nearby rural properties	Construction and operation
Snowy 2.0 – Transmission Connection Project	Upland forest landscape	Views from Elliot Way and some locations in Bago State Forest	Construction and operation

Note:

* Project subject to approval

25.5.7. Noise and vibration

Potential cumulative noise impacts could occur from the construction of the project and construction of EnergyConnect (NSW – Eastern Section), Jeremiah Wind Farm, Rye Park Wind Farm and Crookwell 3 Wind Farm. The extent of impact would depend on the overlap of construction programs, the work being undertaken and the level of noise impacts that are experienced. Where there is no overlap or only a brief overlap in construction programs, impacts have been characterised as 'consecutive noise impacts' as impacts would be from successive projects in an area for an extended period.

For EnergyConnect (NSW – Eastern Section), the overlap of the construction program with the project is likely to be minimal and during this time construction noise associated with EnergyConnect (NSW – Eastern Section) would largely be associated with demobilisation and site rehabilitation work. While, nearby receivers could experience both cumulative construction noise impacts and consecutive construction noise impacts, the cumulative noise impacts would likely only be experienced for a short duration (i.e. around eight weeks) and limited to the local area around the Wagga 330 kV substation.

Construction of the project, Rye Park Wind Farm and Crookwell 3 Wind Farm would result in consecutive construction noise impacts. However, any impact would be limited to two receivers where the project intersects with Rye Park Wind Farm, and three receivers where it intersects with Crookwell 3 Wind Farm.

In addition, the project and Jeremiah Wind Farm could potentially result in cumulative construction noise impacts. Where Jeremiah Wind Farm intersects with the project footprint, work associated with the project would be limited to transmission line construction, which would be for a period of up to 12 weeks for each structure. As such, cumulative noise impacts would likely be intermittent over the overlapping construction program and would be limited to one receiver.

The potential cumulative construction noise impacts and consecutive construction noise impacts identified above would be minimised by implementing the mitigation measures in Chapter 15 (Noise and vibration).

Potential cumulative operational noise impacts could occur from the operation of the project, Jeremiah Wind Farm, Rye Park Wind Farm and Crookwell 3 Wind Farm. Impacts would be associated with potential worst-case equivalent noise emissions from operation of the proposed transmission line and nearby wind turbines. A total of six receivers could be affected by cumulative operational noise impacts. However, worst-case operational noise impacts from transmission lines require relatively still weather conditions whereas worst-case impacts from wind farms require higher wind speeds. Therefore, the likelihood of a noticeable cumulative operational noise impact between such projects is considered minor. Notwithstanding, operational noise impacts from the project would be minimised by implementing the mitigation measures in Chapter 15 (Noise and vibration), which would also help to minimise any cumulative operational noise impacts that may arise.

25.5.8. Traffic, transport and access

Relevant future projects identified as having potential cumulative traffic impacts with the project include EnergyConnect (NSW – Eastern Section), Jeremiah Wind Farm, Snowy 2.0 – Main Works and the Snowy 2.0 – Transmission Connection Project. These projects all have at least a minor overlap in construction program, are of a relatively large scale, and are likely to utilise similar construction access routes proposed for HumeLink. Potential cumulative traffic impacts would be limited to the overlapping construction phases and would be associated with increased additional construction traffic on the surrounding road network.

The potential cumulative traffic impacts between the project and EnergyConnect (NSW – Eastern Section) and the Snowy 2.0 – Transmission Connection Project are expected to be minor. This is because the majority of work associated with EnergyConnect (NSW – Eastern Section) and the Snowy 2.0 – Transmission Connection Project is likely to have been completed before the project begins. As such, it expected that construction traffic associated with these projects would generally be related to demobilisation and site rehabilitation work.

Potential cumulative traffic impacts associated with Jeremiah Wind Farm and the project are likely to extend over a longer timeframe compared to EnergyConnect (NSW – Eastern Section) and the Snowy 2.0 – Transmission Connection Project. Due to the wind farm's development area, impacts would be generally localised in the Adjungbilly area. Both projects are likely to use similar local roads for construction access routes in this area, including Adjungbilly Road, Red Hill Road and Parsons Creek Road. However, given the substantial residual capacity available on the local roads in the Adjungbilly area (refer to *Technical Report 16 – Traffic and Transport Impact Assessment*), should the peak construction work of both projects coincide, the traffic is unlikely to affect the capacity and performance of the surrounding road network.

Similarly, potential cumulative traffic impacts associated with Snowy 2.0 – Main Works and the project are likely to extend over a longer timeframe and be localised. Potential impacts are expected to be limited to local roads in the Bago State Forest. However, the local roads providing access to the project footprint in this area have substantial residual capacity (refer to *Technical Report 16 – Traffic and Transport Impact Assessment*). As such, the cumulative impact of Snowy 2.0 – Main Works and the project would be unlikely to affect the capacity and performance of the surrounding road network.

25.5.9. Air quality

Relevant future projects identified as having potential cumulative air quality impacts with the project include EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm, Jeremiah Wind Farm, Crookwell 3 Wind Farm and the Snowy 2.0 – Transmission Connection Project. These projects all have at least a minor overlap in construction program and are located adjacent to, or are intersected by, the project footprint.

Potential cumulative air quality impacts would be limited to the overlapping construction phases and would mainly be associated with dust generation. However, it is expected that potential cumulative impacts would be minimised by implementing the mitigation measures in Chapter 21 (Air quality).

25.6. Combined cumulative impact assessment

Based on the outcomes of the above issue-specific cumulative impact assessment, there is the potential for combined cumulative impacts to occur within the Wagga Wagga City LGA. The potential combined cumulative impacts would be due to the construction and operation of HumeLink and relevant future projects such as EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm, Inland Rail – Albury to Illabo and VNI West. The potential combined cumulative impacts would be both positive and negative.

Positive cumulative impacts from HumeLink as a part of the National Electricity Market's (NEM) transition to diverse renewable and distributed energy generation, supported by energy storage and network solutions include the contribution it would make to:

- addressing climate change, and to meet the Commonwealth and State government commitments to reduce carbon emissions and greenhouse gases
- reinforcing stability and reliability in the network
- facilitating development of new renewable energy generation in the declared South West renewable energy zone (REZ), and candidate Wagga Wagga and Tumut REZs.

HumeLink is expected to deliver $491 million in net benefits to electricity customers (Transgrid, 2021b), contributing to the overall $28 billion in net market benefits that the network investments would deliver for the NEM's consumers (AEMO, 2022).

The positive combined cumulative impacts would likely be associated with improved livelihoods for business operators and workers in the surrounding region due to increased patronage and access to employment. The impacts would potentially accrue in the Wagga Wagga City LGA with multiple major infrastructure projects being constructed over several years. The presence of major electricity infrastructure projects being delivered by Transgrid such as HumeLink and EnergyConnect (NSW – Eastern Section) and VNI West, could also support growth in a specialist industry for the region.

The negative combined cumulative impacts would likely be associated with:

- increased impacts on agricultural land use and property during operation due to impacts associated with the project and Gregadoo Solar Farm and VNI West
- changes to accessibility due to increased construction traffic from the project and EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm, and Inland Rail – Albury to Illabo
- increased demand for accommodation and housing during construction of the project and EnergyConnect (NSW – Eastern Section) and Inland Rail – Albury to Illabo
- increased impacts on landscape character and visual amenity during construction and operation due to impacts associated with the project and EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm and VNI West
- increased impacts on amenity due to increased noise and/or dust impacts during construction associated with the project and EnergyConnect (NSW – Eastern Section) and Gregadoo Solar Farm.

Due to the location of HumeLink, EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm and VNI West, a number of the potential negative combined cumulative impacts would be relatively localised to the Gregadoo area.

In addition, given the types of combined cumulative impacts that could occur during construction, there is potential for construction fatigue to be experienced by receivers near the project and EnergyConnect (NSW – Eastern Section) and Gregadoo Solar Farm. However, with the implementation of mitigation and management measures for the project (refer to Section 25.7.3) and the implementation of similar measures described for EnergyConnect (NSW – Eastern Section) and Gregadoo Solar Farm, it is expected that the combined impacts that could potentially result in construction fatigue would be managed.

The combined cumulative increase in demand for rental housing and accommodation in the Wagga Wagga City LGA would be addressed and minimised by implementing the Worker Accommodation Strategy for the project as detailed in Chapter 4 (Project description – construction) and Chapter 13 (Social).

As noted in Chapter 6 (Engagement), Wagga Wagga City Council also raised concerns about potential community consultation fatigue as a result of the multiple major projects taking place in the Wagga Wagga City LGA. The Community and Stakeholder Engagement Management Plan (CSEMP) for the project will consider potential concerns associated with concurrent engagement on multiple major projects.

25.7. Management of impacts

25.7.1. Environmental management

Environmental management for the project would be carried out in accordance with the approach detailed in Chapter 26 (Environmental management).

25.7.2. Avoidance and minimisation of impacts

Avoidance and minimisation of issue-specific impacts detailed in Chapters 8 to 23 would avoid and minimise potential cumulative impacts between the project and relevant future projects. Detailed design and further construction planning would aim to further avoid and minimise environmental impacts where possible, including impacts from the project contributing to potential cumulative impacts, as described in Sections 25.5 and 25.6.

25.7.3. Mitigation measures

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.

Chapter 26 (Environmental management) provides further information on Transgrid's EMS.

The following chapters provide mitigation measures that would help to mitigate potential cumulative impacts:

- Chapter 8 (Biodiversity)
- Chapter 9 (Aboriginal heritage)
- Chapter 11 (Land use and property)
- Chapter 12 (Economic)
- Chapter 13 (Social)
- Chapter 14 (Landscape character and visual amenity)
- Chapter 15 (Noise and vibration)
- Chapter 20 (Traffic, transport and access)
- Chapter 21 (Air quality).

As the mitigation measures in the above chapters have been developed to reduce potential impacts to acceptable levels, the cumulative mitigation measures included in Table 25-8 focus on coordinating and engaging with the proponents and/or construction contractors of relevant future projects. Chapter 6 (Engagement) provides further information on the ongoing opportunities for engagement with stakeholders during future stages of the project, which would assist in identifying and mitigating any cumulative impacts.

Table 25-8 Mitigation measures – cumulative impacts

Reference	Impact	Mitigation measure	Timing	Relevant location
CI1	Occurrence of cumulative impacts	Coordination and engagement with proponents and/or construction contractors of relevant future projects will occur during detailed design and construction to confirm the potential cumulative impacts and timing of activities that have potential cumulative impacts. Coordination and engagement will include: • providing regular construction program updates • identifying potential conflict points with other relevant future projects, eg proximity of work sites, or shared construction access routes and traffic management requirements • developing mitigation strategies in order to manage conflicts that may arise.	Detailed design and construction	All locations
CI2	Occurrence of cumulative impacts	Engagement with the Department of Defence and Transport for NSW will be carried out during detailed design and construction to confirm the potential for cumulative impacts from the RAAF Base Wagga Redevelopment and work associated with the *Tumut to Hume Highway (Snowy Mountains Highway and Gocup Road) Corridor Strat*egy (Transport for NSW, 2016). Mitigation strategies will be developed if potential cumulative impacts are identified.	Detailed design and construction	All locations

25.7.4. Managing residual impacts and uncertainties

Through the implementation of the mitigation measures included in Table 25-8 and from the chapters identified above, and implementation of equivalent mitigation measures as part of the delivery of the relevant future projects, residual cumulative impacts are expected to be appropriately managed. Additionally, the CSEMP that would be developed and implemented for the project would assist in coordinating with the proponents of the relevant future projects.

The main uncertainty associated with the assessment of potential cumulative impacts is due to limitations on data availability for relevant future projects, which affects predicting cumulative impacts. To address this uncertainty, qualitative assessments have mainly been carried out including the consideration of worst-case impacts, eg potential cumulative noise impacts have considered worst-case noise emissions.

Part C – Environmental management and conclusion

26. Environmental management

This chapter describes the environmental management approach for the project during detailed design, construction and operation, and identifies the process for inspections, monitoring, auditing and reporting of environmental compliance. It also provides an overview of the process to manage design refinements and changes that may arise during detailed design and construction of the project.

26.1. Approach to environmental management

26.1.1. Overall approach

The approach to environmental management for the project would be consistent with:

- the objective of avoiding and minimising impacts throughout all stages of the project
- the relevant conditions of approval for the project (if approved)
- mitigation measures and management plans proposed in this EIS or as otherwise updated in the Submissions Report (or an Amendment Report or Preferred Infrastructure Report, if prepared)
- the environmental management system (EMS) of the construction contractors (during pre-construction and main construction work) and of Transgrid (during operation and decommissioning).

Figure 26-1 illustrates the overall environmental management approach for the project. Additional discussion on the environmental management approach is provided in the following sections.

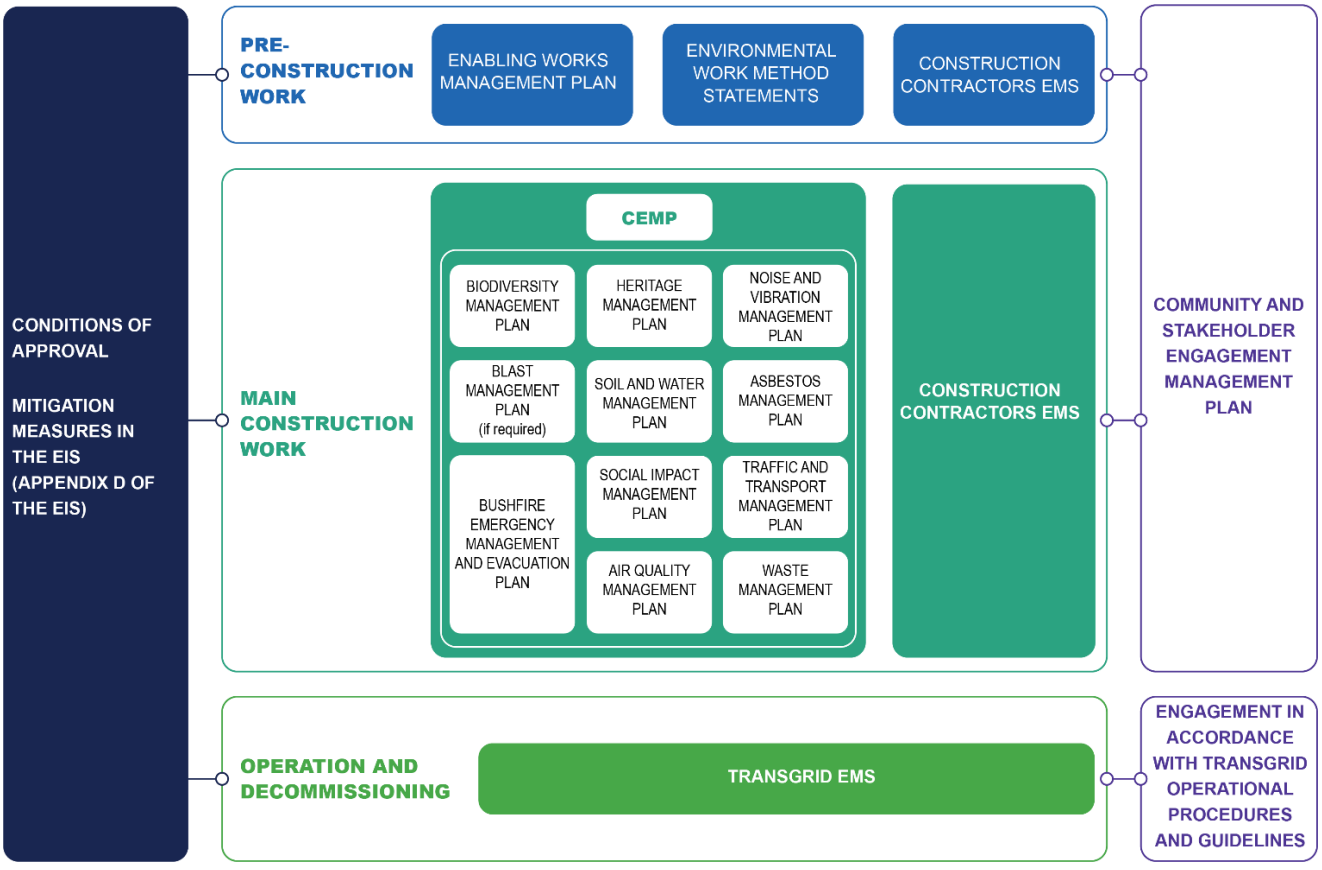


Figure 26-1 Overall environmental management approach for the project

A Community and Stakeholder Engagement Management Plan (CSEMP) would be prepared before construction work begins and would be developed in consultation with the relevant stakeholders. The CSEMP would detail the approach to communication between Transgrid, the construction contractors, the community, community groups, other stakeholders and government authorities during pre-construction and main construction work. The CSEMP would:

- identify people, organisations and government authorities to be consulted during construction
- set out procedures and mechanisms for the regular distribution of accessible information to keep the community and stakeholders informed of the project
- set out the procedures and mechanisms for consulting with relevant councils and government authorities including procedures for nil responses
- describe the method for advertising the telephone line and email address for enquiries relating to the project
- set out procedures and mechanisms for response to enquiries and feedback
- include a complaints management system that outlines parameters for recording information on all complaints received during the main construction work
- set out procedures and mechanisms to resolve any issues and disputes that might arise in relation to environmental and stakeholder management associated with the project.

Engagement during operation and decommissioning would be carried out in accordance with Transgrid's operational procedures and guidelines.

26.1.1 Pre-construction work

Pre-construction work would need to be carried out before the start of the main construction work. It would involve finalising the design and construction methodology and preparing the work sites for construction commencement. Typical and expected pre-construction work proposed for the project is described below.

26.1.1.1 Pre-construction minor impact work

The conditions of approval for Critical State Significant Infrastructure (CSSI) projects typically require that all construction activities occur in accordance with an approved Construction Environmental Management Plan (CEMP). Typical conditions of approval, however, often exclude certain pre-construction minor work and activities with low potential for environmental and community impacts (minor/low impact activities) from the definition of construction. When this occurs, the minor impact activities can occur prior to approval of a CEMP.

Pre-construction minor impact work may include:

- demolition and/or relocation of any structures (such as sheds or residences) within the transmission line easement
- minor clearance of vegetation, including bushfire hazard reduction (excluding threatened flora species, vegetation that is part of a threatened ecological community or is critical habitat for a threatened fauna species)
- investigations that are required to finalise the design and construction methodology, including:
    - geotechnical and contamination investigations, including drilling and excavation
    - heritage investigations, including test excavations, salvage and archival recording
    - biodiversity surveys
    - other survey work, such as road and building dilapidation surveys, and surveys of the general alignment and existing/future utilities, and installation of survey controls (such as global positioning systems)
- establishment of water supply points
- maintenance of existing buildings and structures
- installation of communication infrastructure
- property adjustment work, including adjustments to property fencing, barricades, gates and access
- installation of mitigation measures, including but not limited to erosion and sediment controls, temporary exclusion fencing for sensitive areas, monitoring equipment and operational noise treatments as required
- other activities determined by the Environmental Representative to have minor impacts on the environment and the community. These activities must:
    - not generate noise levels at any sensitive receiver above relevant noise management levels developed in accordance with *Interim Construction Noise Guideline* (DECC, 2009)
    - not result in dust leaving the site
    - not affect threatened flora species, vegetation that is part of a threatened ecological community or is critical habitat for a threatened fauna species
    - not involve excavations in potential archaeological deposits (PADs) (other than the test excavations and salvage referred to above) prior to the completion of required archaeological test excavations at that location
    - not impact on heritage items on the State heritage register, unless otherwise approved by DPE
    - not cause soil disturbance within 40 metres of a waterway (excluding the installation of sediment and erosion controls in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1, 4th Edition* (Landcom 2004) and Volumes 2A and 2C (DECC, 2008a))
    - be carried out (where required) in accordance with any road occupancy licence(s) granted by the relevant road authority.

The pre-construction minor impact work would be carried out in accordance with the construction contractors' certified EMS and would be subject to the relevant mitigation measures detailed in Appendix D (Mitigation measures). The contractors would prepare Environmental Work Method Statements or similar environmental management documents for these activities.

Any work that is not considered to be of minor/low environmental impact, pre-construction enabling work (refer to Section 26.1.1.2) or otherwise provided for in the conditions of approval would be carried out in accordance with an approved CEMP as part of the main construction work.

26.1.1.2 Pre-construction enabling work

The following pre-construction enabling work is proposed to occur ahead of the main construction work:

- site establishment and operation of construction compounds, including excavations, surface preparation, access roads and utility connections
- site establishment and operation of worker accommodation facilities, including excavations, surface preparation, access roads and utility connections
- establishment of new access tracks
- minor adjustments to existing access tracks and road improvement work as defined in Chapter 4 (Project description - construction)
- utility relocations and adjustments.

Pre-construction enabling work would be managed in accordance with an Enabling Works Management Plan, which will be submitted to the Department of Planning and Environment (DPE) for approval as part of the planning approval.

26.1.2. Main construction work

Main construction work would be carried out in accordance with an approved CEMP that has been prepared in accordance with *Environmental Management Plan Guideline for Infrastructure Projects* (Department of Planning, Industry and Environment (DPIE), 2020i) and the conditions of approval.

26.1.1.3 Construction Environmental Management Plan

The CEMP would include:

- a description of the construction contractor's environmental policy and objectives for construction
- a description of the activities to be carried out during construction
- reference to all relevant statutory and other obligations, including consents, licences, approvals and voluntary agreements required
- environmental targets and measurable performance indicators against which compliance would be monitored
- the roles and responsibilities of all workers to be employed on site with regards to the planning, implementation, maintenance, and monitoring of environmental controls
- specific mitigation measures and controls that would be applied to avoid and minimise environmental impacts
- required sub-plans (as detailed later in this section), which clearly set out the objectives of the sub-plan, relevant conditions of approval and mitigation measures
- processes for managing non-compliance (including corrective and preventative actions)
- procedures for complaints handling and ongoing communication with the community
- inspection, monitoring and auditing requirements, including procedures for regular environmental inspections and monitoring, auditing and review of the performance of environmental controls, and compliance tracking and reporting
- incident and contingency management requirements
- procedures for the control of environmental records
- induction and training requirements for all workers
- any other requirements as specified in the conditions of approval.

The CEMP would be adaptive, establishing a continuous cycle of monitoring, assessment, investigation and corrective actions. This process would be used to continuously evaluate and monitor the effectiveness

of the environmental management measures proposed in the relevant environmental assessment documents and identify any corrective actions to be carried out if required. Throughout the life of the project, the latest version of the approved CEMP (as annotated from time to time), would be available for all workers and, on request, for inspection/audit personnel.

A compliance tracking and reporting program would be developed as part of the CEMP and implemented by the construction contractors. It would aim to monitor compliance with the relevant environmental assessment documents, conditions of approval, licences and permits.

Compliance monitoring would be undertaken in the form of audits, including site audits undertaken by the construction contractors, the Environmental Representative, Transgrid and independent auditors. The frequency and reporting parameters would be identified in the CEMP. Independent audits would be carried out in accordance with the *Independent Audit Post Approval Requirements* (DPIE, 2020j).

26.1.1.4 Construction Environmental Management Sub-plans

Chapters 8 to 25 outline the specific environmental management approach proposed for each environmental aspect during construction, which includes detail on any sub-plans that would be contained within the CEMP. These sub-plans may include:

- Biodiversity Management Plan
- Heritage Management Plan
- Noise and Vibration Management Plan
- Blast Management Plan (if blasting is required)
- Soil and Water Management Plan
- Asbestos Management Plan
- Bush Fire Emergency Management and Evacuation Plan
- Social Impact Management Plan
- Traffic and Transport Management Plan
- Air Quality Management Plan
- Waste Management Plan.

Sub-plans may be replaced by a procedure where appropriate (ie when considering the scale and scope of the work), or merged with another sub-plan to streamline the CEMP. The conditions of approval for the project may require different and/or additional plans and strategies to be prepared for the project.

26.1.3. Operation and decommissioning

Operation of the project would be managed through Transgrid's existing EMS, which is accredited to the international standard ISO 14001 requirements. Transgrid's EMS has been designed to meet the commitments of its *Environment Policy* by identifying and assessing environmental risks and, where reasonable and practicable, implementing controls to avoid or limit these risks.

No operational environmental management plans will be developed for the project. 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.

Details of Transgrid's approach to environmental management during operation and relevant documents are available at https://www.transgrid.com.au/community-engagement/environment.

In addition, details of the environmental constraints identified as part of this EIS and throughout construction of the project that are relevant to the ongoing operation and maintenance of the assets, would be included in the appropriate Transgrid Geographical Information Systems (GIS), accessible to operational and maintenance workers.

Due diligence environmental checks, including review of environmental information generated from GIS where relevant, would be carried out during operation with required protection measures identified and confirmed before any maintenance work is carried out.

The design life of the transmission lines is 50 years, which can be extended to more than 70 years for some infrastructure components and plant items. Maintenance activities would be regularly undertaken for all project infrastructure components and plant items. These components would be replaced or refurbished towards the end of their serviceable life, allowing the service life of the transmission lines to be maximised. Should any project infrastructure need to be fully decommissioned in future, this would be managed in accordance with Transgrid's EMS. Relevant stakeholders would be notified of the work in accordance with Transgrid's operational procedures and guidelines.

26.2. Summary of mitigation measures

The measures proposed to mitigate and manage the potential impacts of the project are provided in Appendix D (Mitigation measures). The measures identified may be revised in response to submissions received during public exhibition of the EIS and/or any design refinements and construction methodology changes made following exhibition.

If the project is approved, the project would be carried out in accordance with the conditions of approval and the final list of mitigation measures.

26.3. Effectiveness and costs of mitigation measures

The mitigation and management measures proposed have been developed based on experience on other major transmission line projects similar in nature and location, and with consideration of mitigation and management measures adopted on other linear infrastructure projects (such as roads, rail and pipelines). This includes the implementation of risk assessment processes guided by experienced construction environment professionals.

Government and industry policies, guidelines and procedures have been developed to address potential impacts from major infrastructure projects. Mitigation measures carried out in accordance with these guidelines and procedures have proven to be effective on similar projects.

Monitoring programs, inspections and independent auditing would confirm the effectiveness of these measures. Further measures would be developed and undertaken if required, including implementation of corrective and preventative actions for any actual or potential non-compliant activities. The estimated costs of the environmental mitigation measures provided in this EIS are considered an integral component to the project and as a result have been largely captured in the project capital costs.

26.4. Managing project changes

As outlined in Chapter 7 (Approach to assessment of impacts), the project footprint has been developed to achieve a level of flexibility for future design refinement while undertaking a rigorous level of impact assessment. Refinements to the project design and construction method would be carried out to:

- avoid and minimise impacts identified in this EIS and during ongoing stakeholder and community engagement, including in response to submissions received following the exhibition of this EIS
- consider design innovation and/or alternative construction techniques
- respond to improved technologies or materials
- improve value for money.

As such, the final project design may vary from the description provided in Chapter 3 (Project description - infrastructure and operation) and Chapter 4 (Project description - construction). If approval is granted, any changes to the project would be reviewed for consistency with the conditions of the approval. This would also include reviewing the changes against the assessment contained in the EIS and relevant mitigation measures. Changes which are assessed to be consistent would be undertaken without any further planning approval being required. If changes are not consistent with the conditions of approval, Transgrid would submit a request to DPE to modify the project in accordance with Section 5.25 of the EP&A Act.

27. Project justification and evaluation

This chapter provides the justification and evaluation of the project as a whole, having regard to its economic, environmental and social impacts and the principles of Ecologically Sustainable Development (ESD).

27.1. Project objectives and need

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, like wind, solar and pumped hydro. The key factors driving this transition are:

- government commitments to reduce carbon emissions
- the potential for renewable generation to lower energy prices
- the closure of coal-fired power stations
- demand for a more secure and reliable energy supply.

The National Electricity Market (NEM), which connects the southern and eastern states in Australia, accounts for around 80 per cent of Australia's electricity consumption and has a system dominated by coal-fired generation. As coal-fired generators get older, they become more fragile and susceptible to outages, making the electricity system less reliable. With four of NSW's five remaining coal-fired generators set to reach the end of their technical lives and close by 2035, the retirement of coal generation is predicted to be particularly rapid in NSW.

In response, and to facilitate a strategic transition, the NSW Government developed the *NSW Electricity Strategy* (DPIE, 2019) and the *NSW Electricity Infrastructure Roadmap* (DPIE, 2020a*)*. These documents set out the plan to help replace the State's aging power stations with Renewable Energy Zones (REZs) leveraging locations with high renewable energy potential. REZs play a vital role in connecting multiple renewable energy generators and storage in the same location, capitalising on economies of scale to deliver cheap, reliable, and clean electricity for homes and businesses in NSW. The *Electricity Strategy* and *NSW Electricity Infrastructure Roadmap* support the implementation of the Australian Energy Market Operator's (AEMO) *2022 Integrated System Plan* (ISP)*.*

HumeLink would be a key component of the energy market transition. HumeLink would involve around 360 kilometres of new 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. It would open up additional capacity for new generation, primarily renewable wind and solar generation in southern NSW, and improve wholesale market competition. It would also help unlock the full capacity of the Snowy 2.0 project by increasing transmission capacity and enable greater sharing of energy across the eastern states. It would also enable greater access for consumers to more reliable and affordable electricity.

HumeLink has been identified in the 2022 ISP as a nationally strategic project and an *actionable project* to be *progressed urgently* with a target delivery date of July 2026. The 2022 ISP indicates that if HumeLink is not delivered on time, more long-duration storage than is anticipated under the *NSW Electricity Infrastructure Roadmap,* and/or additional gas-fired generation, would be needed to maintain power system reliability in NSW (AEMO, 2022).

HumeLink has been developed to satisfy the following three objectives:

- increase the transfer capacity between southern NSW and major load centres within NSW (Sydney, Newcastle and Wollongong)
- reinforce stability and reliability in the network
- facilitate transition of the network to new generation sources.

Details on the strategic context, including project need, are provided in Chapter 2 (Strategic context and project need).

27.2. Consistency with the strategic context

The project has been developed in the strategic context of a changing Australian energy environment and the need to develop infrastructure required to respond to these changes. In particular, this includes the influence of global changes and the transition to low-emission energy generation as well as relevant government and other regulatory and industry strategies, policies and plans.

The project would be consistent with key strategic policies and plans including:

- **Global need for emissions reduction** – including Australia's global commitment to reduce its net greenhouse gas emissions to 43 per cent below 2005 levels by 2030 and to zero by 2050
- **The shift towards renewable energy** – including strategically placed large-scale transmission lines to balance resources and unlock REZs in new regions
- **Responding to the 2022 ISP** – to deliver a strategic infrastructure development plan, based on sound engineering and economics, which can facilitate an orderly energy system transition under a range of scenarios
- **Commonwealth Government's *Priority transmission projects*** – to ensure timely delivery of the transmission projects as recommended in the 2022 ISP
- ***NSW Government's Net Zero Plan Stage 1: 2020 – 2030*** (DPIE, 2020b) – this sets out the foundation in NSW for action on climate change and the goal to reach net zero emissions by 2050. The Net Zero Plan identifies the economic opportunities presented by solar panels and wind turbines, which in combination with firming technologies, such as gas, batteries and pumped hydro, are now the cheapest forms of new, reliable electricity generation
- ***NSW Transmission Infrastructure Strategy*** (DPIE, 2018a) – this is the NSW Government's plan to unlock private sector investment in priority transmission infrastructure projects that can deliver least-cost energy to customers through to 2050
- ***NSW Electricity Strategy*** (DPIE, 2019) – the NSW Government plans for a reliable, affordable and sustainable electricity future that supports a growing economy and sets out actions to support the energy market
- ***NSW Electricity Infrastructure Roadmap*** – (DPIE, 2020a) this provides a framework for developing the electricity system in NSW. The Roadmap is the State's plan to transform our electricity system into one that is cheap, clean and reliable
- ***The Riverina Murray Regional Plan 2041*** (DPE, 2023) ***and the South East and Tablelands Regional Plan 2036*** (NSW Government, 2017) – these plans set out the strategic land use planning framework for these two regions. Both regional plans recognise the role of the regions in supporting NSW's transition to net zero carbon emissions by 2050 by prioritising and supporting renewable energy, and include specific strategic directions with respect to encouraging investment in renewable energy to support regional economic development.

27.3. Iterative and responsive design development

The concept for HumeLink was first identified in the *NSW Transmission Infrastructure Strategy* (DPE, 2018) initially referred to as SnowyLink North. Since then, the project has been developed through a comprehensive design and options development process including detailed route and corridor design refinements processes and environmental assessment. These processes all involved development of a concept design that best balances engineering and cost requirements and addresses the project objectives whilst avoiding and minimising potential impacts on the environment. The design development and route selection process has and continues to be comprehensive and informed by consultation with affected landowners, communities (as detailed in Section 27.4) and other key stakeholders. A summary of the process, including the opportunities for public involvement, is shown in Figure 2-3 in Chapter 2 (Strategic context and project need).

The general approach adopted for this EIS has been to conservatively assume that any area within the project footprint has the potential to be directly impacted by the project. The finalisation of the project design and construction methodology is continuing with the objective of further avoiding and minimising potential impacts on the environment and community. The proposed transmission line easement would be refined to be generally 70 metres wide, which is almost three times smaller than the nominal 200 metre width of the project footprint.

27.4. Consideration of community views

Community engagement began in early 2020 and included individual landowner meetings, community information sessions and other targeted activities to support the preparation of technical studies, which have included Aboriginal heritage, social and agricultural impact assessments. Transgrid developed the HumeLink Engagement Strategy for the project based on *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2022d) and the International Association of Public Participation (IAP2) public participation spectrum. The key objectives of the engagement strategy are to:

- work in partnership with local communities and businesses
- listen to feedback, understand community views, and consider how these can deliver a better project
- be accessible and provide engagement that works for communities and considers audiences
- deliver long-term social, economic, and environmental legacies for communities and regions
- build awareness of HumeLink's role in providing reliability, clean energy and affordable electricity to consumers
- establish a social licence for Transgrid to develop HumeLink.

Engagement tools and activities have included:

- establishment of three independently facilitated Community Consultation Groups (CCGs)
- targeted discussions with affected landowners
- meeting with key stakeholders including:
    - key government agencies including the Commonwealth, State and local councils
    - Local Aboriginal Land Councils
    - Traditional Owner group briefings

- preparation of community information material including:
  - project newsletters
  - guides and fact sheets
  - “What we heard” reports
  - feedback forums
  - images and infographics
  - community sentiment surveys
- communication channels including:
  - project hotline
  - project email
  - project webpages (including FAQs, interactive map, engagement suggestion surveys)
  - person to person engagement via place managers and land access officers
  - social media
  - electronic direct emails
  - letter box drops
  - media releases and media events.

Key areas of discussion and feedback from the community and how these have been addressed in the design or the environmental assessment of the project are summarised in Table 27-1. Chapter 6 (Engagement) provides further information on the topics raised by the community and how they have been responded to in the EIS. Chapter 2 (Strategic context and project need) provides an overview of the projects options development and analysis process with further details in Appendix E (Options Report).

Table 27-1 Key community issues raised and how addressed

Key theme and topics raised	Summary response
Design and construction including the following topics: • transmission line structure locations • potential to underground transmission lines • alignment and route selection • electric and magnetic fields • vegetation clearance methodology.	The project has been developed to avoid and minimise impacts where feasible and reasonable to do so (including minimisation of vegetation clearance and electric and magnetic fields) and has been informed by landowner consultation in addition to wider considerations. This included iterative refinement of the potential transmission line corridor, consideration of alternate options proposed by the community as well as assessment of alternative locations for key project components. The finalisation of the design and construction methodology, including the specific location of transmission line structures within the project footprint, would be further developed in consultation with landowners and to further avoid and minimise potential impacts on the environment and the local community. Potential changes to the concept design assessed in the EIS would be identified during the detailed design and construction stages and be informed by ongoing consultation with stakeholders, landowners and the community. In response to community suggestions, an independent investigation was carried out to assess the feasibility of building HumeLink via underground cable instead of overhead transmission lines. Overall, undergrounding HumeLink was not considered to be a feasible option and was not progressed.

Key theme and topics raised	Summary response
Environment and heritage including the following topics: • impacts on visual amenity • biosecurity risks • risks from electric and magnetic fields • impacts on biodiversity • impacts on Aboriginal heritage • impacts on local roads • impacts on tourism • impacts on bushfire.	The EIS has focussed on assessing all potential impacts including key issues raised by the community and provides environmental management measures to avoid or minimise the impacts identified where required. These impacts included: • visual amenity – discussed in Chapter 14 (Landscape character and visual amenity) • biosecurity impacts – discussed in Chapter 11 (Land use and property) • electric and magnetic fields and bushfire risks – discussed in Chapter 19 (Hazards and risks) • biodiversity – discussed in Chapter 8 (Biodiversity) • Aboriginal heritage – discussed in Chapter 9 (Aboriginal heritage) • local roads – discussed in Chapter 20 (Traffic, transport and access) • tourism – discussed in Chapter 13 (Social) • bushfire risk – discussed in Chapter 19 (Hazards and risks).
Project processes including the following topics: • consultation processes and provision of information (including with landowners) • contractor requirements for work health and safety • relevant regulatory frameworks.	Landowner, community and stakeholder engagement for HumeLink began in early 2020. Engagement has been carried out in line with the HumeLink Engagement Strategy, which was developed based on *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2022d) and the International Association of Public Participation's (IAP2) public participation spectrum. Chapter 6 (Engagement) provides details on the consultation activities carried out for the project, including landowner engagement, and the requirements for contractors during delivery of the project. The project would obtain and comply with all regulatory requirements. A compliance tracking and reporting program would be developed and implemented by the construction contractors. It would aim to monitor compliance with this EIS, relevant conditions of approval, licences and permits. Chapter 5 (Statutory context) and Chapter 26 (Environmental management) provide further information on the regulatory framework and environmental management framework for the project, including contractor requirements.
Property including the following topics: • compensation • land access agreements • property valuations.	Transgrid's easement negotiation and acquisition process (including property valuation and compensation) aligns with the NSW Government's *Land Acquisition (Just Terms Compensation) Act 1991* (Just Terms Act). Transgrid is working with each landowner to establish a Property Management Plan, which would include any property requirements such as fencing, construction access, biosecurity and rehabilitation. Transgrid took feedback from landholders and the Energy Commissioner into account and updated the easement option agreements to make them more user friendly. Transgrid also worked closely with Energy Corporation of NSW to support the strategic benefit payments scheme, which provides annual payments to landholders in addition to easement compensation.
Socio-economic including the following topics: • impacts on tourism • worker accommodation • local partnerships and opportunities for community benefits • impacts to mental health.	Transgrid, through its Community Investment and Benefits Plan has investigated opportunities to leave positive legacy outcomes for the communities near the project. Several mitigation measures would be implemented, including a Worker Accommodation Strategy, Workforce and Workforce Development Plan and property management plans, to help reduce the significance of identified negative social impacts that may arise from the project. This would include any potential adverse impacts associated with tourism, worker accommodation and mental health. Chapter 12 (Economic) and Chapter 13 (Social) provide further detail on the social and economic impacts identified, and how they are proposed to be managed.

27.5. Efforts to avoid and minimise impacts

The project has been developed following a robust and iterative process including detailed options analysis, design, environmental assessment and engagement. Where feasible and reasonable, the project has aimed to avoid and minimise biophysical, social and economic impacts. This has included the iterative refinement of the proposed transmission line corridor, consideration of alternate options suggested by the community as well as assessment of alternative locations for key project components including the proposed Gugaa 500 kV substation and ancillary locations such as construction compounds and worker accommodation facilities. The proposed transmission line corridor and locations for all key components of

the project included in the project footprint and subject to this EIS were selected on the basis of best meeting the project objectives having regard to avoiding and minimising the impacts on the environment. Appendix E (Options Report) provides information on the detailed consideration of alternative options and routes for the project.

Several aspects of the project design and construction methodology are continuing to be refined. As such, the EIS has been prepared on the basis of a concept design and using available information at the time to provide a conservative assessment of likely project impacts. Chapter 7 (Approach to assessment of impacts) provides further explanation of the approach adopted in this EIS. The detailed design process would be carried out by the construction contractors and informed by the assessment completed for the project as well as government, landowner, community and/or other stakeholder feedback received on the project. During this stage, the mitigation and management measures identified in this EIS relevant to the detailed design would be implemented to further enable the avoidance and minimisation of potential environmental impacts of the project.

Notwithstanding, it is inevitable and not uncommon, that a linear infrastructure project of this type and scale can result in some unavoidable impacts. Any unavoidable impacts would be managed and mitigated as far as feasible and reasonable.

27.6. Biophysical, social and economic impacts

The environmental impacts of the project have been assessed, including a comprehensive analysis of the key biophysical, social and economic impacts. Chapters 8 through 25 provide a summary of environmental assessments undertaken for the project including appropriate measures to avoid and/or minimise impacts. The following sections provide a summary of the biophysical, economic and social impacts during the construction and operation of the project.

27.6.1. Key biophysical impacts

The key potential impacts on the biophysical environment during construction would primarily relate to biodiversity impacts. The route has been refined to avoid and minimise impacts to biodiversity where possible, however based on the indicative disturbance area, this would likely include direct impacts on:

- about 670.21 hectares of native vegetation
- five BC Act listed threatened ecological communities (TECs), two of which are also listed TECs under the EPBC Act
- 58 threatened flora species:
    - 18 species listed under the BC Act
    - two species listed under the EPBC Act
    - 38 species listed under both the BC Act and EPBC Act
    - 11 threatened flora species listed as critically endangered under the BC Act and/or EPBC Act
- 33 threatened fauna species (12 bird, 11 mammal (including three bats), three reptile, five amphibian and two insect)
- two endangered fauna populations:
    - Yellow-bellied Glider population on the Bago Plateau
    - Squirrel Glider in the Wagga Wagga City Local Government Area.

Proposed management measures would aim to avoid and minimise impacts on biodiversity. However, there would be some residual impacts that could not be further mitigated. These residual impacts would be offset in accordance with the Biodiversity Offsets Scheme (BOS).

Other impacts on the biophysical environment including, soil, air quality, flooding and water quality (including surface water and groundwater), would be temporary, short term, limited in extent, and manageable through standard and proven construction management and mitigation measures.

Direct impacts on native vegetation and habitats of threatened species would continue to occur during operation. However, these impacts would be substantially less than those that would occur during construction. Impacts would be caused by ongoing vegetation management, which would be required to maintain vegetation clearance and asset protection zones within the new transmission line easement. Some indirect impacts associated with the project may also persist during operation.

27.6.2. Key social impacts

Key social impacts would be primarily associated with construction of the project, with many of the social benefits realised once the project is in operation. The key impacts would be:

- positive social impacts associated with:
  - new employment opportunities and skill acquisition for the local community, including Aboriginal people
  - potential for increased tourism from temporary workers and their guests in the Local Government Area (LGAs) surrounding the project
- negative social impacts associated with:
  - a loss of connection and change in landscape character and visual amenity of the surroundings
  - stress from uncertainty about property acquisitions and new easement arrangements requiring some internal property and access adjustments
  - amenity issues, such noise, traffic and dust generation, from the movement of construction vehicles and construction work in general
  - increase in demand for social infrastructure and accommodation, which may result in shortages
  - potential impacts on Aboriginal cultural heritage at up to 90 Aboriginal heritage sites and potential archaeological deposits (PADs) located within the project footprint, including 79 stone artefact occurrences, eight PADs and three modified trees. The number of sites to be directly impacted would be confirmed during detailed design, which would consider opportunities to avoid or minimise impacts
  - changes and restrictions to existing land uses and activities, including some agricultural and forestry land uses and activities.

The project would provide increased opportunities for community support and investment through Transgrid's community benefits and support initiatives, which would have a positive social impact in the surrounding communities.

However, potential negative social impacts associated with operation of the project would be associated with restrictions to activities near the easement and continued changes to amenity from the new transmission line. These impacts would be relatively localised to the landowners within and next to the project footprint. Transgrid would continue to work with local landowners to address potential negative social impacts through the implementation of mitigation measures and micro-siting of transmission line structures. All property acquisitions would occur in accordance with the requirements of the *Land*

Acquisition (Just Terms Compensation) Act 1991, and Transgrid would seek to reach agreement with owners on the compensation payable for the acquisition of their interest(s) in land.

27.6.3. Key economic impacts

The following key economic impacts have been identified for construction of the project:

- positive economic impacts associated with:
  - generation of economic activity from worker spending at local businesses and retailers in the LGAs surrounding the project (including spending on goods and services and accommodation) as well as an increase in visitation and tourism from family and friends of construction workers
  - employment of up to 1,200 full-time equivalent construction workers across multiple work fronts during peak construction
- negative economic impacts associated with:
  - increased competition for accommodation between the project construction workers and others, such as tourists, particularly during peak times temporary loss of agricultural and forestry land and associated productivity of land used to support construction.

Once operational, the project is expected to deliver $491 million in net benefits to electricity customers (Transgrid, 2021b). According to the *2022 Integrated System Plan,* the project is estimated to contribute roughly $1.3 billion in net market benefits associated with avoided unserved energy, fuel costs, energy generation/storage costs, REZ transmission capital expenditure and voluntary load curtailment as well as competition benefits. By increasing the amount of electricity that can be delivered to the National Electricity Market and providing greater access to reliable and affordable electricity, the project would increase competition in wholesale energy and help lower and stabilise electricity prices. More reliable and affordable energy would in turn help to increase business productivity and lower living expenses.

Direct adverse residual impacts would occur at a local level where permanent property adjustments are required. Landowners would be compensated under just terms under the *Land Acquisition (Just Terms Compensation) Act 1991* for any permanent property adjustments.

27.6.4. Cumulative impacts

Cumulative impacts describe the impacts of the project together with the impacts of other relevant projects within an identified area. The relevant projects that were identified for consideration of potential cumulative impacts were EnergyConnect (NSW – Eastern Section), Gregadoo Solar Farm, Inland Rail – Albury to Illabo (subject to approval), VNI West (subject to approval), Jeremiah Wind Farm (subject to approval), Rye Park Wind Farm, Crookwell 3 Wind Farm, Snowy 2.0 – Main Works, and Snowy 2.0 – Transmission Connection Project.

The cumulative impact assessment (refer to Chapter 25 (Cumulative impacts)) for the project identified potential cumulative impacts with respect to biodiversity, Aboriginal heritage, land use and property, economic, social, landscape character and visual, noise and vibration, traffic, transport and access and air quality. However, the combined effect of these cumulative impacts is not considered to be significant. Mitigation measures would be required to address the combined effect of cumulative impacts and would include ongoing coordination and collaboration with other major projects and relevant councils.

27.7. Principles of ecologically sustainable development

Biophysical, economic and social impacts have been assessed in the context of the principles of ESD. The EP&A Act adopts the definition of ESD contained in section 6(2) of the *Protection of the Environment Administration Act 1991* while the principles of ESD are also set out in clause 3A of the EPBC Act.

27.7.1. Precautionary principle

The environmental assessments carried out in preparing the EIS are consistent with accepted scientific and assessment methodologies or good practice and have taken into account relevant statutory and agency requirements and have been informed by consultation with stakeholders including government agencies and the community. The assessments have applied a conservative approach with regard to construction and operational arrangements, and the modelling used (where relevant). This has included assessing worst-case impacts and scenarios including a project footprint that will be further refined during detailed design, which is likely to result in impacts that are less severe than those identified in the EIS.

The project has been developed to avoid impacts where possible and to take into consideration the findings of the studies carried out for the project's assessment. As the project is subject to detailed design, a worst-case (conservative) impact assessment has been carried out, and a number of environmental mitigation measures have been proposed to further avoid and minimise risks to the environment. The lack of full scientific certainty has not been used as a reason for postponing measures to prevent environmental degradation.

27.7.2. Intergenerational equity

The principle of intergenerational equity provides that "the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations."

The project would provide a more secure electricity supply in the near term and would facilitate the longer-term transition of the energy sector across the NEM to new low-emission energy generation sources, benefiting current and future generations. It would increase economic activity, provide regional job opportunities and assist in unlocking the development of large-scale renewable energy generation. The project has been designed to meet the needs of both current and future generations with a design life of about 50 years (which could be extended to more than 70 years for some assets) and would contribute to an increase in resilience and capacity of the electricity network.

During construction of the project, opportunities would be taken to reduce resource and material use and maximise the use of materials with low embodied environmental impact, where feasible. Initiatives to deliver benefits to local communities, including employment opportunities, have also been identified.

27.7.3. Conservation of biological diversity and ecological integrity

The development of the project has been carried out with the aim of identifying, avoiding, minimising and mitigating impacts on biological diversity and ecological integrity in accordance with relevant legislation. This includes field investigations and assessment, which have informed the concept design and project footprint to avoid and minimise impacts.

Where potential impacts cannot be avoided, mitigation measures would be implemented to reduce the impact as far as possible. An offsets strategy has also been developed to compensate for the potential threatened species impacted by the project.

27.7.4. Improved valuation, pricing and incentive mechanisms

The project has been designed to minimise adverse environmental impacts through an option selection and design process that includes the consideration of environmental factors. The assessment has further identified environmental management measures, where appropriate, with an objective of minimising potential impacts on the surrounding environment. Biodiversity offset credit costs have also been calculated as a way to value and price residual biodiversity impacts. Transgrid has prepared and would implement a Biodiversity Offset Strategy to address the offset requirements.

Any project-related decisions should consider environmental factors in a cost-effective way and be guided by the whole-of-life costs of providing goods and services.

27.8. Compliance and monitoring performance

27.8.1. Compliance with relevant statutory requirements

The EIS has been prepared to meet the requirements of the EP&A Act and the Commonwealth EPBC Act in addition to addressing relevant requirements of other Commonwealth and State legislation. This EIS has been prepared to address the Planning Secretary's Environmental Assessment Requirements (SEARs) (including the Supplementary SEARs regarding Commonwealth requirements) and has been guided by the *State significant infrastructure guidelines – preparing an environmental impact statement* (DPE, 2022d). Technical studies provided in the EIS have been completed in accordance with the applicable technical requirements and guidelines and informed by consultation with relevant government agencies and other stakeholders. The EIS has also been reviewed and contains the appropriate declaration of a Registered Environmental Assessment Practitioner.

Further details on how the EIS has addressed these requirements are provided in Appendix A (SEARs compliance tables) and Appendix B (Statutory compliance tables).

27.8.2. Compliance monitoring and communication

Transgrid will be responsible for ensuring compliance with the conditions of approval (if the project is approved), and liaising with DPE, other regulators, and the community.

27.8.2.1. Construction

During construction, the environmental management and performance framework for the project would comprise relevant construction management and monitoring plans. This management framework would be adaptive, establishing a continuous cycle of monitoring, assessment, investigation and corrective actions. This process would be used to continuously evaluate and monitor the effectiveness of the environmental management measures proposed in the relevant environmental assessment documents and identify any corrective actions to be carried out if required.

A compliance tracking and reporting program would be developed as part of the Construction Environmental Management Plan (CEMP) and implemented by the construction contractors. It would aim to monitor compliance with this EIS, relevant conditions of approval, licences and permits. Compliance monitoring would be undertaken in the form of audits, including site audits undertaken by Transgrid. Frequency and reporting parameters would be identified in the CEMP and conditions of approval for the project.

27.8.2.2. Operation

The operation of the project would be managed through the practices, procedures and processes within Transgrid's EMS, Environmental Assessment Framework, and environmental checklists, as well as *Transgrid's Environmental Handbook* (Transgrid, 2021d) and/or as otherwise outlined in this EIS.

Details of the environmental constraints identified as part of this EIS that are relevant to the ongoing operation and maintenance of the asset would be included in the appropriate Transgrid GIS. Due diligence environmental checks, including review of environmental information generated from GIS where relevant, would be carried out with required protection measures identified and confirmed before any maintenance works are carried out.

27.9. Key uncertainties and actions proposed to address the uncertainties

Uncertainties with regard to potential biophysical, social and economic impacts have been largely minimised through the design process, assessment approach, extensive field investigations, experience and expertise gained from similar scale projects constructed in similar environments as well as the identification and commitment to extensive environmental management and mitigation measures.

The EIS has been prepared based on a concept design and using information available at the time of preparation to provide a conservative assessment of project impacts. The details of the project would be refined during detailed design, and include input from construction contractors.

The assessment of impacts in this EIS has been based on several different geographic areas that have been adopted where most appropriate to assess the extent and nature of impacts from the project (refer to Chapter 7 (Approach to assessment of impacts) for more information). These areas are as follows:

- The project footprint has been adopted in this EIS as a conservative area that has the potential to be directly affected by the construction and operation of the project. The project footprint has been developed to achieve a level of flexibility for future design refinement that allows for further avoidance and minimisation of impacts while allowing for a rigorous level of impact assessment to be carried out. The key components of the project would be located within the project footprint. For example, the new transmission line easement would generally be 70 metres wide, which is far smaller than the 200 metre width used for the majority of the transmission line portion of the project footprint.
- Various study areas have been defined for the assessment of impacts for specific environmental aspects. These study areas have been defined by technical specialists and are generally larger than the project footprint, which has enabled a greater understanding of the context of the project and assessment of impacts.
- An indicative disturbance area has been defined within the project footprint to provide a more refined area for assessment of biodiversity impacts related to vegetation clearance.
- An indicative area and location of individual concept design elements (such as transmission line structures and access tracks) have been adopted for some specialist assessments. These concept design elements are located within the project footprint and indicative disturbance area.

This approach to impact assessment is required because several aspects of the project design and construction methodology would continue to be refined, including:

- finalising the location of the proposed transmission line route
- micro-siting the transmission line structures along the proposed transmission line route
- confirming the location and number of construction compounds as well as developing construction compound layouts and final boundaries of these temporary facilities
- confirming the location of associated ancillary infrastructure (including brake and winch sites)
- confirming the final design arrangement of the proposed Gugaa 500 kV substation and the modifications to the Wagga 330 kV substation and Bannaby 500 kV substation, including any required drainage and other associated infrastructure
- confirming the requirements for utility connections and/or relocations and property adjustments
- confirming the layout of the Tumbarumba accommodation facility (AC1) and the overall worker accommodation strategy
- micro-siting and design of temporary and permanent access tracks and any road upgrades required.

The detailed design process would be carried out by the construction contractors and informed by the assessment completed for the project as well as government, landowner, community and/or other stakeholder feedback received on the project. During this stage, the mitigation and management measures identified in this EIS relevant to the detailed design would be implemented to enable the avoidance and minimisation of potential environmental impacts. Any deviations from the project as described in the EIS would be subject to a consistency assessment and, if required, subject to further environmental assessment and approval.

In addition, access was restricted to some areas of the project footprint due to several factors. This was particularly notable in relation to biodiversity and Aboriginal heritage surveys, as follows:

- Biodiversity – In some locations, sub-optimal weather conditions and lack of access to private properties restricted the ability to carry out the necessary field investigation. For these locations, the assessment adopted a worst-case (ie assumed presence) approach. Further biodiversity surveys can be undertaken once the final disturbance area is determined. Following further surveys (if required) and design refinement, the potential for impacts on biodiversity would be confirmed, and the Biodiversity Offset Strategy updated as required.
- Aboriginal heritage – There were a number of locations where access to private property for field investigations was restricted. For these locations a predictive model was used to identify and assess the likely presence of Aboriginal artefacts and values, with avoidance strategies identified to minimise impacts on potential high value locations and artefacts. Further archaeological investigation such as subsurface testing may be undertaken once the final design and construction methodology is determined, to confirm the potential for impacts on Aboriginal sites. Following further archaeological investigation and design refinement, the potential for direct impacts on known Aboriginal heritage sites would be confirmed. Mitigation measures to protect known Aboriginal sites located close to construction or maintenance activities from accidental impacts would be implemented in accordance with management plans relevant to the construction stage. During operation and maintenance, any residual impacts would be managed in accordance with Transgrid's Environmental Management System. Where direct impacts on sites cannot be avoided during design refinement, mitigation measures would be implemented to minimise the potential impacts on Aboriginal heritage, such as surface salvage of artefacts or a program of salvage excavations in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b).

27.10. Evaluation and conclusion

It is anticipated that the HumeLink project would bring the following key benefits:

- Reliable power: NSW households would have greater access to reliable and affordable electricity.
- Economic growth: HumeLink would unlock the full capacity of the expanded Snowy Hydro Scheme and enable greater sharing of energy across the eastern states.
- Cleaner, sustainable future: HumeLink would enable more renewable energy generation to enter the market, supporting Australia's emissions reduction targets.
- Jobs and opportunities: HumeLink would create more than 1,000 construction jobs.
- Economic growth: HumeLink would contribute to economic activity in regional NSW, generating major benefits for local communities along the route.

The project has been developed following a robust and iterative process that has involved substantial options analysis, design, environmental assessment, and stakeholder engagement. Where feasible and reasonable, the project has aimed to avoid and minimise biophysical, social and economic impacts. At this stage of assessment, a conservative worst-case assessment has been carried out, which indicates that no unacceptable impacts are anticipated.

Not proceeding with the project would reduce the security of the electricity supply in NSW, particularly as coal-fired generators are retired. It would also discourage investment in energy generation and storage within the emerging REZs. The provision of appropriate infrastructure to these zones is required to allow the adoption of new renewable technologies in the future, which is required to support the delivery of commitments and policies at a State, Commonwealth and international level.

Key adverse residual impacts of the project would be associated with:

- Biodiversity as a result of vegetation clearance within the proposed easement during construction and operation – impacts would be offset in accordance with BAM calculations for both ecosystem and species credits and through implementation of the Biodiversity Offset Strategy for the project.
- Aboriginal heritage as a result of ground disturbance during construction – some Aboriginal heritage sites may not be able to be avoided and there remains the possibility that potential unrecorded Aboriginal heritage sites and/or PADs were not identified and could be impacted during construction of the project. However, impacts would be minimised through management measures including the implementation of an unexpected finds protocol.
- Land use and property – impacts would include restrictions on some agricultural and forestry land uses in the new transmission line easement. Numerous refinements have been (and would continue to be) made to minimise impacts, and compensation would be provided for all directly affected landowners for the acquisition and use of transmission line easements.
- Visual amenity – the new large-scale transmission infrastructure would be visible from public and private viewpoints. For easement affected landowners, compensation would consider residual visual impacts. Currently, there is no existing legislative mechanism within NSW outlining compensation measures for non-easement affected properties that may have visual impacts as a result of transmission projects. For residences where the project is predicted to have a moderate to high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options would be confirmed in consultation with the affected landowner and implemented where practicable.

These impacts are common for major transmission line projects which are similar in nature and location, as well as other linear infrastructure projects (such as roads, rail and pipelines). The project would be

managed with proven mitigation and management measures to reduce the likelihood, magnitude and consequences of any residual impacts. This would be confirmed through monitoring and auditing requirements. The design and construction methodology for the project would be refined with the objective of further avoiding and minimising potential impacts on the local and regional environment, and the local community.

Overall, the project is a critical component in delivering long-term benefits to the NEM and supporting its transition to a greater mix of low-emission renewable energy sources in accordance with the *2022 Integrated System Plan*.

The project has been designed to avoid and minimise impacts, and to respond to the issues raised by the community and stakeholders. The finalisation of the design and construction methodology for the project would be further developed by the construction contractors with the objective of further avoiding and minimising potential impacts on the environment and local community.

On balance, it is considered that the strategic need and benefits of the project outweigh the mitigated project impacts and, therefore, the project is justified and would be in the public interest.

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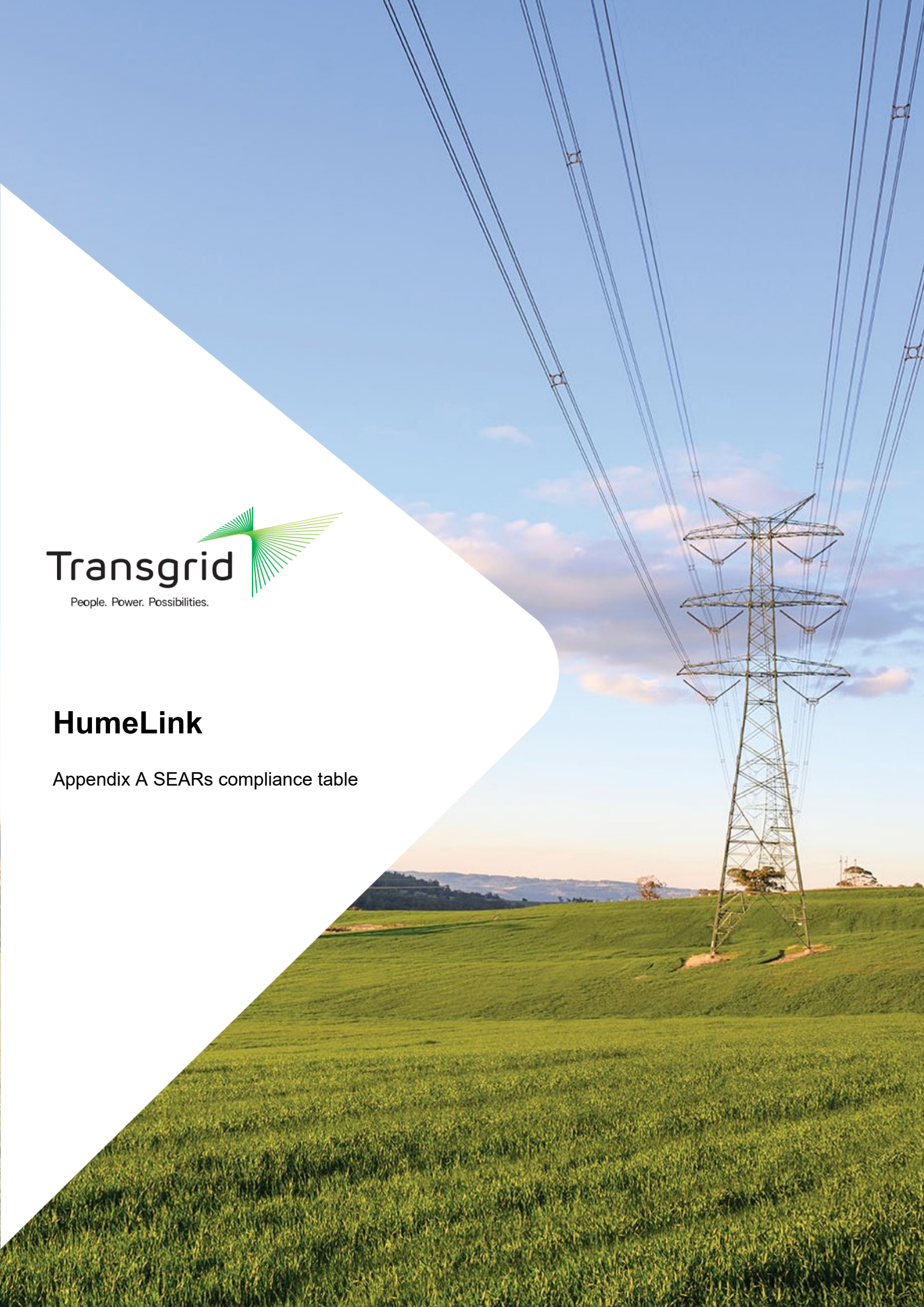
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Part D – Appendices



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Appendix A SEARs compliance table

Appendix A SEARs compliance table

A.1 EIS SEARs compliance table

Table A-1 details the response to requirements detailed in the SEARs.

Table A-1 Secretary's Environmental Assessment Requirements cross-reference

Requirement	Item	Where principally addressed in EIS
General Requirements	The Environmental Impact Statement (EIS) must meet the minimum form and content requirements as prescribed by Part 8, Division 5 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) and must have regard to the State Significant Infrastructure Guidelines. In particular, the EIS must include:	Appendix A (SEARs compliance table) Appendix B (Statutory compliance table)
	• a stand-alone executive summary;	Summary Report
	• a summary of the background to the project, including alternatives that were considered to the project;	Chapter 1 (Introduction) Chapter 2 (Strategic context and project need) Appendix E (Options Report)
	• a full description of the project, accompanied by suitable maps and plans, including the: - disturbance area; - physical layout of the project over time, including sections of key components; - key uses and activities to be carried out on site; - likely timing of the project including any stages, the key phases within each stage (site preparation, construction, commissioning, operation, decommissioning and rehabilitation) and the sequencing of these stages and phases;	Chapter 3 (Project description – infrastructure and operation) and Chapter 4 (Project description – construction) Chapter 7 (Approach to assessment of impacts)
	• the relevant strategic context for the project, having regard to: - State legislation, policies and guidelines including current initiatives to improve energy security and reliability in the National Electricity Market; - any other existing, approved or proposed projects that could result in cumulative impacts with the project; - the need for the project and why the proposed project is preferred over other alternatives, including detailed consideration of alternative options and routes (including other existing easements and connections to other transmission lines) and justification for the preferred routes;	Chapter 1 (Introduction) Chapter 2 (Strategic context and project need) Chapter 25 (Cumulative impacts) Appendix E (Options Report)
	• the relevant statutory context for the project, including: - the assessment pathway for the project under the *Environmental Planning and Assessment Act 1979*; - the approvals required before the project may be carried out; - any relevant matters for consideration;	Chapter 5 (Statutory context) Appendix A (SEARs compliance table) Appendix B (Statutory compliance table)

Requirement	Item	Where principally addressed in EIS
	• a description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved;	Chapter 6 (Engagement) Appendix C (Engagement Outcomes Report) *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* Technical Report 7 (Social Impact Assessment)
	• an assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any relevant Government legislation, policies and guidelines (see below), including: - the state of the existing environment; - community views; - the measures that would be implemented to avoid or minimise impacts, including a consolidated summary of the proposed mitigation measures for the project; - the predicted impacts of the project, including any cumulative impacts of the site and existing or proposed developments in the region taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice including Cumulative Impact Assessment Guideline (DPIE, November 2021); - actions proposed to deal with any uncertainties associated with the assessment;	Chapters 8 to 24 Chapter 25 (Cumulative impacts) Chapter 26 (Environmental management) Technical reports 1 to 18 Appendix D (Mitigation Measures)
	• a detailed evaluation of the merits of the project as a whole.	Chapter 27 (Project justification and evaluation)
	• In addition the EIS must also be accompanied by: - a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value (CIV) of the project (as defined in the Dictionary of the Regulation), including details of all assumptions and components from which the CIV calculation is derived; - an estimate of the jobs that will be created during the construction and operational phases of the proposed project; and - certification that the information provided is accurate at the date of preparation.	CIV Report to accompany EIS
	The level of assessment of key matters must be proportionate to the likely significance of the impacts on the matter. In particular, the EIS must address the following specific matters:	
Key issues		
Biodiversity	• an assessment of the biodiversity impacts of the project, in accordance with the NSW Biodiversity Conservation Act 2016, the Biodiversity Assessment Method (BAM) 2020, the Guideline for applying the Biodiversity Assessment Method at severely burnt sites 2020 and documented in a Biodiversity Development Assessment Report (BDAR);	Chapter 8 (Biodiversity) *Technical Report 1 (Biodiversity Development Assessment Report)*
	• the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; and	Chapter 8 (Biodiversity) *Technical Report 1 (Biodiversity Development Assessment Report)*

Requirement	Item	Where principally addressed in EIS
	• an assessment of the impacts of the project on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts; and	Chapter 8 (Biodiversity) *Technical Report 1 (Biodiversity Development Assessment Report)*
	• if an offset is required, details of the measures proposed to address the offset obligations.	Chapter 8 (Biodiversity) *Technical Report 1 (Biodiversity Development Assessment Report)*
Heritage	• an assessment of the impact to Aboriginal cultural heritage items (cultural and archaeological) in accordance with the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011) and the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010) including results of archaeological test excavations (if required);	Chapter 9 (Aboriginal heritage) *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)*
	• evidence of consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures), having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010); and	Chapter 6 (Engagement) Chapter 9 (Aboriginal heritage) *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)*
	• assess the impact to historic heritage having regard to the NSW Heritage manual	Chapter 10 (Non-Aboriginal heritage) *Technical Report 3 (Historic Heritage Impact Assessment)*
Water and soils	• an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Goobarragandra River, Lachlan River, Murrumbidgee River, Tarlo River, Tumut River, Wollondilly River, Yass River and Blowering Dam, Burrinjuck Dam and Wyangala Water Catchment Areas, having regard to NSW Water Quality Objectives;	Chapter 17 (Surface water and groundwater quality) *Technical Report 12 (Surface Water and Groundwater Impact Assessment)*
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Chapter 17 (Surface water and groundwater quality) *Technical Report 12 (Surface Water and Groundwater Impact Assessment)*
	• an assessment of the impacts of the project on groundwater aquifers and groundwater dependent ecosystems having regard to the NSW Aquifer Interference Policy and relevant Water Sharing Plans;	Chapter 17 (Surface water and groundwater quality) Chapter 8 (Biodiversity) *Technical Report 12 (Surface Water and Groundwater Impact Assessment)*
	• an assessment of the potential flooding impacts and risks of the project;	Chapter 18 (Hydrology and flooding) *Technical Report 11 (Hydrology and Flooding Impact Assessment)*

Requirement	Item	Where principally addressed in EIS
	• where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013); and	Chapter 8 (Biodiversity) Chapter 17 (Surface water and groundwater quality) *Technical Report 1 (Biodiversity Development Assessment Report)* *Technical Report 12 (Surface Water and Groundwater Impact Assessment)*
	• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).	Chapter 8 (Biodiversity) Chapter 16 (Soils, geology and contamination) Chapter 17 (Surface water and groundwater quality) *Technical Report 1 (Biodiversity Development Assessment Report)* Appendix D (Mitigation measures) *Technical Report 10 (Phase 1 Contamination Assessment)* *Technical Report 12 (Surface Water and Groundwater Impact Assessment)*
Land	• an assessment of impacts of the project on soils and land capability of the site and surrounds;	Chapter 11 (Land use and property) Chapter 16 (Soils, geology and contamination) *Technical Report 4 (Agricultural Impact Assessment)* *Technical Report 5 (Land Use and Property Impact Assessment)* *Technical Report 10 (Phase 1 Contamination Assessment)*
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site); and	Chapter 16 (Soils, geology and contamination) *Technical Report 10 (Phase 1 Contamination Assessment)*
	• assessment of impact of the project on agricultural land, land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State Forests, travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors.	Chapter 11 (Land use and property) *Technical Report 4 (Agricultural Impact Assessment)* *Technical Report 5 (Land Use and Property Impact Assessment)*
Transport	• an assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local and State road network and the rail network; and	Chapter 3 (Project description – infrastructure and operation) Chapter 20 (Traffic and access) *Technical Report 16 (Traffic and Transport Impact Assessment)*

Requirement	Item	Where principally addressed in EIS
	• details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road.	Chapter 20 (Traffic and access) *Technical Report 16 (Traffic and Transport Impact Assessment)*
Amenity	• an assessment of the likely visual impacts of the project on surrounding residences, scenic or significant vistas, night lighting, air traffic and road corridors in the public domain; and	Chapter 14 (Landscape character and visual amenity) *Technical Report 8 (Landscape Character and Visual Impact Assessment)*
	• an assessment of the construction, operational and road noise and vibration impacts of the project.	Chapter 15 (Noise and vibration) *Technical Report 9 (Noise and Vibration Impact Assessment)*
Air	• an assessment of the air quality impacts of the project.	Chapter 21 (Air quality) *Technical Report 17 (Air Quality Impact Assessment)*
Hazards	• an assessment of potential hazards and risks associated with electric and magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA);	Chapter 19 (Hazards and risks) *Technical Report 15 (Electric and Magnetic Field Study)*
	• an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, the handling and use of any dangerous goods and potential impacts to high pressure gas pipelines;	Chapter 19 (Hazards and risks) *Technical Report 13 (Bushfire Risk Assessment Report)*
	• assess potential impacts on aviation safety, including: - defined air traffic routes, aircraft operating heights, approach / departure procedures, radar interference, communication systems, navigation aids, use of emergency helicopter access, aerial baiting and culling in the National Parks, safe and efficient aerial application of agricultural fertilisers and pesticide; - identify aerodromes within 30 km of the transmission line and consider the impact to nearby aerodromes and aircraft landing areas; and - address impacts on obstacle limitation surfaces.	Chapter 11 (Land use and property) Chapter 19 (Hazards and risks) *Technical Report 4 (Agricultural Impact Assessment)* *Technical Report 13 (Aviation Impact Statement)*
Waste	• identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Chapter 16 (Soils, geology and contamination) Chapter 23 (Waste) *Technical Report 10 (Phase 1 Contamination Assessment)*
Social	• an assessment of the social impacts in accordance with Social Impact Assessment Guideline (DPIE, July 2021) and consideration of construction workforce accommodation.	Chapter 13 (Social) *Technical Report 7 (Social Impact Assessment)*
Economic	• an assessment of the benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services, and details of how the construction workforce will be managed to minimise local impacts, including a consideration of the construction workforce accommodation and an assessment of the impacts to State Forests.	Chapter 12 (Economic) *Technical Report 4 (Agricultural Impact Assessment)* *Technical Report 5 (Land Use and Property Impact Assessment)* *Technical Report 6 (Economic Impact Assessment)* *Technical Report 7 (Social Impact Assessment)*

Requirement	Item	Where principally addressed in EIS
Plans and Documents	• The EIS must include all relevant plans, architectural drawings, diagrams and relevant documentation required under Part 3 of the EP&A Regulation. Provide these as part of the EIS rather than as separate documents. • In addition, the EIS must include high quality files of maps and figures of the subject site and proposal.	Chapter 3 (Project description – infrastructure and operation) Chapter 4 (Project description – construction)
Legislation, Policies & Guidelines[1]	• The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. • A list of some of the legislation, policies and guidelines that may be relevant to the assessment of the project can be found at: - https://www.planning.nsw.gov.au/Policy-and-Legislation/Planning-reforms/RapidAssessment-Framework/Improving-assessment-guidance - https://www.planningportal.nsw.gov.au/major-projects/assessment/policies-and-guidelines; and - http://www.environment.gov.au/epbc/publications#assessments	Chapters 5 Chapters 8 to 25 Appendix B (Statutory compliance table) Technical Reports 1 to 18
Engagement	• During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners, Native Title holders, exploration licence holders, quarry operators and mineral title holders.	Chapter 6 (Engagement) Appendix C (Engagement Outcomes Report) *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* *Technical Report 7 (Social Impact Assessment)*
Expiry Date	• If you do not lodge an EIS for the infrastructure within 2 years of the issue date of these SEARs, your SEARs will expire. If an extension to these SEARs will be required, please consult with the Planning Secretary 3 months prior to the expiry date	The requirements were issued on 14 March 2022. The 2 year period has not expired.

[1] SEARs links are currently out of date, current link accessed at: https://www.planning.nsw.gov.au/policy-and-legislation/planning-reforms/rapid-assessment-framework/improving-assessment-guidance

A.2 Supplementary SEARs compliance table

Table A-2 details the response to requirements detailed in the Supplementary SEARs (HumeLink (EPBC 2021/9121), which commences from Paragraph 5 onwards. Paragraphs 1 to 4 outline an introduction to the controlled action.

Table A-2 Supplementary Secretary's Environmental Assessment Requirements cross-reference

Requirement	Item	Where principally addressed in EIS
Relevant Regulations	5. The Environmental Impact Statement (EIS) must address all matters outlined in Schedule 4 of the EPBC Regulations and all matters outlined below in relation to the controlling provisions.	Appendix A (SEARs compliance table) Appendix B (Statutory compliance table)
Project Description	6. The title of the action, background to the action and current status.	The title of the action (being HumeLink) and details of the proponent are available on the Certification page of the EIS. This EIS seeks approval for the action. The objectives of the project are outlined in Chapter 1 of the EIS. The consequences of not proceeding with the project is outlined in Chapter 2 of the EIS.
	7. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on Matters of National Environmental Significance (MNES).	A description of the project is provided in Chapter 3 and Chapter 4 of the EIS. The assessment considers an indicative disturbance area as described in Chapter 7 of the EIS. Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) *Technical Report 1 (Biodiversity Development Assessment Report)* *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* *Technical Report 3 (Historic Heritage Impact Assessment)*
	8. How the action relates to any other actions that have been, or are being taken in the region affected by the action.	The cumulative impacts of the project are provided in Chapter 25 of the EIS. Cumulative impacts are also provided in Technical Reports 1 to 18.
	9. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	A description of the project is provided in Chapter 3 and Chapter 4 of the EIS. The assessment considers an indicative disturbance area as described in Chapter 7 of the EIS. Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) *Technical Report 1 (Biodiversity Development Assessment Report)* *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* *Technical Report 3 (Historic Heritage Impact Assessment)*

Requirement	Item	Where principally addressed in EIS
Impacts	10. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i. a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; ii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; iii. analysis of the significance of the relevant impacts; and iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Chapter 8 (Biodiversity) Chapter 13 of *Technical Report 1 (Biodiversity Development Assessment Report*) . Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* *Technical Report 3 (Historic Heritage Impact Assessment)*
Avoidance, mitigation and offsetting	11. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: i. a description, and an assessment of the expected or predicted effectiveness of the mitigation measures; ii. any statutory policy basis for the mitigation measures; iii. the cost of the mitigation measures; iv. an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; v. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Avoidance measures are discussed in Chapter 8 (Biodiversity) and Chapter 12 of *Technical Report 1 (Biodiversity Development Assessment Report).* The proposed mitigation measures specific to biodiversity are described in Chapter 8 (Biodiversity) and Chapter 14 of *Technical Report 1 (Biodiversity Development Assessment Report).* Chapter 26 (Environmental Management) discusses the expected or predicted effectiveness of the mitigation measures and the cost of mitigation measures. It also details the Construction Environmental Management Plan and sub-plans that would be prepared and approved by the relevant agency in accordance with the relevant conditions of approval. An outline of the Biodiversity Management Plan is provided in mitigation measure B17 in Chapter 8 (Biodiversity).
	12. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	Chapter 8 (Biodiversity) Chapters 15 and 16.of *Technical Report 1 (Biodiversity Development Assessment Report*)
	13. For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: i. conservation advice or recovery plan for the species or community; ii. relevant threat abatement plan for the species or community; iii. wildlife conservation plan for the species; and iv. any strategic assessment. **Note:** the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl	Chapter 13 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report)* provide the impact assessment of MNES.

Requirement	Item	Where principally addressed in EIS
	14. In addition to the general requirements described above, specific information is required with respect to each of the determined controlling provisions. These requirements are outlined in paragraphs 15-18.	Refer to Provisions 15 to 18 below.
Key Issues		
Biodiversity (threatened species and communities and migratory species)	15. The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	MNES, including threatened species and ecological communities and migratory species likely to be impacted by the project, are identified in Chapter 11 of *Technical Report 1 (Biodiversity Development Assessment Report).* Species with potential to occur within the project footprint and broader locality were also considered and are addressed in Attachment 16 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).*
	16. Further analysis of the impacts of the 2019-2020 bushfires on EPBC Act listed threatened species and communities should be undertaken during the assessment. Further assessment will determine whether the remaining habitat within the proposed action area is of substantially greater importance to the survival of the listed threatened species following the fires and/or whether the population of the species in the area is considered an important population. This information, once obtained, can be considered when determining avoidance, mitigation and offset measures for these species.	Chapter 11 of *Technical Report 1 (Biodiversity Development Assessment Report)* presents the analysis of bushfire impacts on MNES and any implications for the project avoidance, mitigation and offsets.
	17. For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: i. description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; ii. details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements; iii. description of the relevant impacts of the action having regard to the full national extent of the species or community's range; and iv. description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; v. identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; vi. a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established.	Addressed in Chapter 11 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 11 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 4 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 13 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 12, Chapter 14 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 13 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 15, Chapter 16 of *Technical Report 1 (Biodiversity Development Assessment Report).*

Requirement	Item	Where principally addressed in EIS
	vii. details of how the current published NSW Biodiversity Assessment Method (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and viii. details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the BAM and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites. **Note:** For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action and deliver an overall conservation outcome that improves or maintains the viability of the MNES i.e. 'like for like'. Like-for-like includes protection of native vegetation that is the same ecological community or habitat being impacted (preferably in the same region where the impact occurs), or funding to provide a direct benefit to the matter being impacted e.g. threat abatement, breeding and propagation programs or other relevant conservation measures.	Addressed in Chapter 16 of *Technical Report 1 (Biodiversity Development Assessment Report).* Addressed in Chapter 15, Chapter 16 of *Technical Report 1 (Biodiversity Development Assessment Report).*
	18. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.	Addressed in Chapter 17 of *Technical Report 1 (Biodiversity Development Assessment Report).*
Heritage (National Heritage places)	19. The EIS must provide a detailed Heritage Impact Assessment conducted by an experienced and qualified heritage expert. The assessment must also include a visual impact assessment and detailed species assessment on potential impacts to the Bogong Moth (which is a value of the heritage place). Whilst not an EPBC Act listed threatened species, the Bogong Moth's assessment should follow the information requirements for EPBC listed species that is listed under paragraph 17.	A detailed heritage impact assessment is provided in *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)* and *Technical Report 3 (Historic Heritage Impact Assessment).* The impact assessment and results for the Bogong Moth are addressed in Chapter 13 and Attachment 18 of *Technical Report 1 (Biodiversity Development Assessment Report).* The impact assessment for the Bogong Moth are addressed in Chapter 10 of *Technical Report 2 (Aboriginal Cultural Heritage Assessment Report)*
Other approvals and conditions	20. Information in relation to any other approvals or conditions required must include the information prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) of the EPBC Regulations.	This EIS presents the environmental impact assessment to support the application for the project under Division 5.2, Part 5 of the EP&A Act. The status of the NSW planning approval process is summarised in Chapter 1 of the EIS. A determination from the NSW Minister for Planning will be required in addition to an approval under the EPBC Act. Requirements of the EPBC Regulations prescribed in Schedule 4 Clause 5 (a) (b) (c) and (d) are addressed throughout the EIS and summarised in Chapter 5 (Statutory context), Appendix B (Statutory compliance table) and Appendix D (Mitigation measures).

Requirement	Item	Where principally addressed in EIS
		Other approvals, licences or permits required under NSW legislation are summarised in Appendix B (Statutory compliance table). Other than the EIS, no other environmental assessment has been, or is being carried out for the project for the purpose of any local or state plan or policy.
Environmental Record of person proposing to take the actions	21. Information in relation to the environmental record of a person proposing to take the action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations.	Refer to detail below this table in Appendix A.3.
Information Sources	22. For information given in an EIS, the EIS must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	Technical reports 1 to 18.

A.3 Environmental record of person proposing to take the action

Transgrid has a consistent record of proactively seeking environmental approvals where required and ensuring that any commitments or conditions placed on activities as a result of these approval processes are adhered to.

In 2001, Transgrid was subject to proceedings under State environmental laws for clearing vegetation in the vicinity of transmission lines. Transgrid subsequently invested $5 million toward site rehabilitation. Since the 2001 incident, Transgrid has not been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

Transgrid is committed to conducting its activities and services in a manner that minimises pollution and complies with relevant environmental legislation, industry standards and codes of practice. Transgrid implores all employees and contractors to stop and consider the potential impact to the environment from activities.

Transgrid aims to enhance systems and processes in a manner that promotes continuous improvement in environmental management and which will lead to the achievement of industry best practice.

In meeting these commitments, Transgrid:

- maintains an Environmental Management System (EMS) that provides the framework for setting and reviewing environmental objectives and targets, including the implementation, monitoring and review of these objectives and targets, as well as facilitating continuous improvement in environmental performance
- continues to develop systems that recognise sensitive environmental and cultural sites at or near infrastructure, and provides processes to manage activities with the aim of preventing environmental harm or adversely impacting the environment
- integrates environmental management considerations into the planning, design, siting, construction, maintenance, operation, decommissioning and disposal of all Transgrid assets
- provides environmental training, assessment and authorisation under the EMS to employees and contractors to enable them to perform their duties in an environmentally sensitive manner
- engages with the community, customers, employees, government and other stakeholders regarding potential environmental or cultural impacts associated with plans and activities
- pursues opportunities to maximise resource efficiencies and reduce the generation of waste through avoidance, reduction, reuse and recycling programs
- identifies, sets and monitors realistic environmental measures and communicates them to all employees and stakeholders.

The project (the action) would be undertaken in accordance with Transgrid's environmental policy and planning framework which is accredited under ISO 14001:2015.

Transgrid's Environmental Policy commits to protecting and enhancing the natural environmental and social values in all Transgrid's activities. Transgrid's planning framework allows for early identification of environment and social values and methods for avoiding, minimising and mitigating impacts caused as a result of development.

Transgrid's EMS is independently certified and covers all of the processes and activities that have the potential to impact on the environment. The EMS enables compliance with Transgrid's environment and heritage compliance obligations, providing the framework for driving environmental requirements throughout leadership, planning, support, operation, performance evaluation and continuous improvement actions. The proposed action, therefore, will be undertaken, monitored and measured in accordance with Transgrid's EMS.

Details of previous warnings and infringement notices issued to Transgrid under State and Commonwealth legislation are listed below. Transgrid has implemented measures to ensure that these incidents and learnings are communicated to staff and contractors and necessary changes are made to relevant management procedures, as required.

Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: (a) the person proposing to take the action; and (b) for an action for which a person has applied for a permit—the person making the application	
5 April 2023	Written warning received from the DPE in relation to unauthorised damage to land on Blue Hill Trail in Yengo National Park.
19 March 2023	Written warning received from the DCCEEW for non-compliance with a condition of approval issued under the Environment Protection and Biodiversity Conservation Act 1999 (project reference No. 2016/7784).
12 October 2022	Clean-up Notice issued by the NSW Environmental Protection Authority (EPA) as a result of a transformer fire at the Marulan Substation (Canyonleigh Road Brayton NSW 2579 ("Premises")). The Notice directed Transgrid to remove residual oil from the surface of a secondary containment dam at the premises.
14 March 2019	Penalty Infringement Notice received from the Office of Environment and Heritage (OEH) for an offense committed under Section 90J (1) of the *National Parks and Wildlife Act 1974* (failure to comply with the conditions of an Aboriginal Heritage Impact Permit).
6 November 2018	Warning letter received from the OEH for an offense committed under the *National Parks and Wildlife Act 1974* (failure to comply with the conditions of an Aboriginal Heritage Impact Permit).
14 August 2017	Warning letter received from the NSW EPA regarding alleged breaches of s143 of the *Protection of the Environment Operations Act 1997* (POEO Act) (causing or permitting waste to be transported to a place that cannot lawfully be used as a waste facility for that waste). The alleged breach related to the removal of asbestos contaminated waste from the Beaconsfield Substation site.
29 September 2015	Warning letter received from the NSW EPA. The letter constituted a warning for failure to comply with section 10 of the *Pesticides Act 1999* and section 148/152 of the POEO Act. The EPA Investigation was in relation to the discharge of herbicide contaminated stormwater at Gullen Range Wind Farm Switching Station (Gurrundah, NSW).



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Appendix B Statutory compliance table

Appendix B Statutory compliance table

This appendix outlines the environmental planning related statutory requirements for consideration in the environmental assessment of the project.

B.1 Objects of the *Environmental Planning and Assessment Act 1979*

Consideration of the project against the objects of the EP&A Act is provided in Table B-1.

Table B-1 - Consideration of the objects of the EP&A Act

Object	Consideration
a.to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	The project has considered impacts to the community and social and economic impacts of the project have been assessed (refer to Chapter 13 (Social) and Chapter 12 (Economic)). Overall, the operation of the project would deliver a more reliable and more sustainable electricity grid by increasing the amount of renewable energy that can be delivered across the electricity grid, helping Australia transition to a low carbon future. This would provide NSW households with greater access to reliable and affordable electricity. As discussed in Chapter 2 (Strategic context and project need), the selection of the preferred corridor aimed to best meet the project objectives having regard to avoiding and minimising the impacts on the environment. Mitigation measures (refer to Appendix D (Mitigation measures)) would seek to further avoid and minimise environmental, social and economic impacts of the project where possible.
b. to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	The principles of ecologically sustainable development have been considered in the planning and development of the project. Further details are provided in Chapter 27 (Project justification and evaluation) and Chapter 24 (Sustainability). Importantly, HumeLink would be consistent with the Commonwealth Government's climate change initiatives in facilitating the longer-term transition of the energy sector to low-emission energy sources (refer to Chapter 2 (Strategic context and project need)).
c. to promote the orderly and economic use and development of land,	The project would promote the orderly and economic use and development of land by improving transfer of renewable energy and enhancing the region's capability as a hub for renewable energy. Consultation with affected landowners and other key stakeholders has occurred during the project option selection and refinement process enabling their views, operating practices and use of land to be considered. The project has been developed to minimise impacts on land use where possible. The transmission line easement may restrict certain agricultural activities and/or require different farming methodologies to be adopted. However, the overall impact on existing agricultural activities is expected to be relatively small and would have a minor effect on productivity, particularly as grazing and other agricultural activities would typically be able to continue within the future transmission line easements. Mitigation measures have been identified that would further minimise impacts to land uses along the transmission line route.
d. to promote the delivery and maintenance of affordable housing	The project would not affect the delivery and maintenance of affordable housing.

Object	Consideration
e. to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	The project option selection process considered a range of constraints to avoid and/or minimise the impacts on the environment (refer to Chapter 2 (Strategic context and project need) and Appendix E (Options Report)), with a particular focus on the avoidance or impact minimisation of important biodiversity values. These constraints included a range of ecological factors such as ecological conservation areas, waterway crossings, forested areas and wetlands. The impacts on biodiversity have been assessed in Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report* in accordance with the Biodiversity Assessment Method. The assessment found that while the project has been refined to avoid and minimise impacts to biodiversity values where practicable, direct impacts are expected to a number of native plant community types and threatened species and their habitats identified under the BC Act and EPBC Act. These impacts would primarily be attributed to the removal of vegetation and threatened ecological communities within the project footprint. Only minor impacts associated with other biodiversity impacts are expected (such as impacts to water quality). Measures to minimise impacts to native vegetation and threatened species include the implementation of a Biodiversity Management Plan. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined the project to be a controlled action under the EPBC Act. The assessment on the relevant Matters of National Environmental Significance (MNES) found that the project has potential to lead to a significant impact on TECs, threatened species (and/or their habitats) and migratory species under the EPBC Act (refer to Table B-3 for further consideration of EPBC Act requirements). Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report* provide further assessment on potential impacts on MNES and recommends mitigation measures to avoid or minimise these impacts. During finalisation of the project design, opportunities to further avoid or minimise impacts would be investigated. Further mitigation measures have also been identified to manage any such impacts, and an offsets strategy would be implemented to address the residual impacts of the project on biodiversity.
f. to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)	The impacts on Aboriginal and historic heritage have been assessed (refer to Chapter 9 (Aboriginal heritage) and Chapter 10 (Non-Aboriginal heritage), and the corresponding *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* and *Technical Report 3 – Historic Heritage Impact Assessment*. The project has been designed to avoid impacts on heritage items where possible. A number of non-Aboriginal heritage sites/items have been identified within or close to the project footprint. Impacts to all items/sites would be negligible. The project has the potential to directly impact up to 90 Aboriginal sites (including eight PADs) generally of low to moderate significance. Opportunities to further avoid or minimise these impacts through micro-siting new transmission line structures, brake and winch sites and access tracks would be considered during detailed design, where practicable. Where impacts cannot be avoided, a range of mitigation and management measures would be implemented in consultation with RAPs.
g. to promote good design and amenity of the built environment,	There would be impacts on the amenity of the built environment as a result of construction and/or operational impacts, including noise, air (dust) and visual amenity. These impacts would be minimised through the mitigation measures summarised in Appendix D (Mitigation measures). Permanent infrastructure would be designed and operated in accordance with Transgrid's public safety and technical requirements.
h. to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The design, construction and maintenance of any buildings (including substation work) would be carried out in accordance with applicable standards and the construction contractors or Transgrid's management systems as applicable. The health and safety of workers would also be managed in accordance with the contractors or Transgrid's management systems as applicable.

Object	Consideration
i to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Transgrid is seeking approval for the project under Division 5.2, Part 5 of the EP&A Act. The project will be assessed under the Assessment bilateral agreement process between the Commonwealth and NSW Governments. Therefore, a single EIS has been prepared to address the requirements set out by the DPE and DCCEEW. Consultation completed to date is outlined in Chapter 6 (Engagement). This has included engagement with relevant Commonwealth, NSW and local government agencies, the Energy Regulator/Operator and relevant Members of Parliament. Ongoing consultation will occur during the construction of the project.
j. to provide increased opportunity for community participation in environmental planning and assessment	Community and stakeholder consultation for the project commenced in early 2020 and is ongoing and will continue throughout construction of the project. Consultation completed to date is outlined in Chapter 6 (Engagement) and Appendix C (Engagement Outcomes Report). The EIS will be placed on public exhibition and during this time stakeholders and the community have the opportunity to review and make comment via submission to DPE. Transgrid will prepare a submissions report that responds to comments and feedback on the EIS. This process provides further opportunity for community participation in the planning and assessment process for this project.

B.2 Environmental Planning and Assessment Regulation 2021 checklist

How the EIS has addressed the form and contents requirements for an Environmental Impact Statement as required under the Environmental Planning and Assessment Regulation 2021 is provided in Table B-2.

Table B-2 Requirements of section 190 and 192 of Part 8 Division 5 of the Environmental Planning and Assessment Regulation 2021

Requirement	Where addressed in the EIS
190. Form of environmental impact statement	
(1) An environmental impact statement must contain the following information	
(a) the name, address and professional qualifications of the person who prepared the statement,	Certification page at the front of the EIS
(b) the name and address of the responsible person	Certification page at the front of the EIS
(c) the address of the land (i) to which the development application relates, or (ii) on which the activity or infrastructure to which the statement relates will be carried out,	Certification page at the front of the EIS
(d) a description of the development, activity or infrastructure,	Chapter 3 (Project description – infrastructure and operation) Chapter 4 (Project description – construction)
(e) an assessment by the person who prepared the statement of the environmental impact of the development, activity or infrastructure, dealing with the matters referred to in this Division	Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) Chapter 11 (Land use and property) Chapter 12 (Economic) Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 15 (Noise and vibration) Chapter 16 (Soils, geology and contamination) Chapter 17 (Surface water and groundwater quality) Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 20 (Traffic, transport and access) Chapter 21 (Air quality) Chapter 22 (Climate change and greenhouse gas)

Requirement	Where addressed in the EIS
	Chapter 23 (Waste) Chapter 25 (Cumulative impacts) Chapter 26 (Environmental management) The corresponding technical reports appended to the EIS.
(2) The person preparing the statement must have regard to	
(a) for State significant development—the State Significant Development Guidelines, or	This EIS has been prepared having regard to the *State Significant Infrastructure Guidelines – preparing an Environmental Impact Statement* (Appendix B, DPE November 2022), which addresses the information required under the *Registered Environmental Assessment Practitioner Guidelines* (DPIE, 2021).
(b) for State significant infrastructure—the State Significant Infrastructure Guidelines.	
(3) An environmental impact statement must also contain a declaration by a relevant person that	
(a) the statement has been prepared in accordance with this Regulation, and	Certification page at the front of this EIS
(b) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure, and	
(c) the information contained in the statement is not false or misleading, and	
(d) for State significant development or State significant infrastructure—the statement contains the information required under the *Registered Environmental Assessment Practitioner Guidelines*	This EIS has been prepared having regard to the *State Significant Infrastructure Guidelines – preparing an Environmental Impact Statement* (Appendix B, DPE November 2022).
192. Contents of the environmental impact statement	
An environmental impact statement must also include each of the following:	
(a) a summary of the environmental impact statement	EIS Summary Report
(b) a statement of the objectives of the development, activity or infrastructure	Chapter 1 (Introduction)
(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 2 (Strategic context and project need) Appendix E (Options Report)
(d) an analysis of the development, activity or infrastructure, including:	
(i) a full description of the development, activity or infrastructure, and	Chapter 3 (Project description - infrastructure and operation) Chapter 4 (Project description – construction)
(ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Chapter 1 (Introduction) Chapter 3 (Project description - infrastructure and operation) Chapter 4 (Project description – construction) Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) Chapter 11 (Land use and property) Chapter 12 (Economic)

Requirement	Where addressed in the EIS
	Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 15 (Noise and vibration) Chapter 16 (Soils, geology and contamination) Chapter 17 (Surface water and groundwater quality) Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 20 (Traffic, transport and access) Chapter 21 (Air quality) Chapter 22 (Climate change and greenhouse gas) Chapter 23 (Waste) Chapter 25 (Cumulative impacts) The technical reports appended to the EIS.
(iii) the likely impact on the environment of the development, activity or infrastructure, and	Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) Chapter 11 (Land use and property) Chapter 12 (Economic) Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 15 (Noise and vibration) Chapter 16 (Soils, geology and contamination) Chapter 17 (Surface water and groundwater quality) Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 20 (Traffic, transport and access) Chapter 21 (Air quality) Chapter 22 (Climate change and greenhouse gas) Chapter 23 (Waste) Chapter 25 (Cumulative impacts) The technical reports appended to the EIS.
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Chapter 8 (Biodiversity) Chapter 9 (Aboriginal heritage) Chapter 10 (Non-Aboriginal heritage) Chapter 11 (Land use and property) Chapter 12 (Economic) Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 15 (Noise and vibration) Chapter 16 (Soils, geology and contamination) Chapter 17 (Surface water and groundwater quality) Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 20 (Traffic, transport and access) Chapter 21 (Air quality) Chapter 22 (Climate change and greenhouse gas) Chapter 23 (Waste) Chapter 24 (Sustainability)

Requirement	Where addressed in the EIS
	Chapter 25 (Cumulative impacts) Chapter 26 (Environmental management) Appendix D (Mitigation measures)
(v) a list of the approvals that must be obtained under another Act or law before the development, activity or infrastructure may lawfully be carried out,	Chapter 5 (Statutory context)
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	Appendix D (Mitigation measures)
(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in section 193.	Chapter 27 (Project justification and evaluation)

B.3 Consideration of the *Environmental Protection and Biodiversity Conservation Act 1999*

The EPBC Act is the Commonwealth Government's key piece of environmental legislation. It enables the Commonwealth Government to join with the states and territories in providing a national scheme of environment and heritage protection and biodiversity conservation. The EPBC Act focuses Commonwealth Government interests on the protection of matters of national environmental significance, with the states and territories having responsibility for matters of state and local significance. Key parts of the EPBC Act that are relevant to the project are:

- Part 3 – requirements for environmental approvals
- Part 5 – bilateral agreements
- Part 7 – whether an approval is needed
- Part 8 – assessing the impacts of a controlled action
- Part 9 – the approval of actions.

Part 3 of the EPBC Act provides for a referral to the Commonwealth Minister for the Environment and Water for a project that is likely to have a significant impact on the following:

- Matters of National Environmental Significance (MNES)
- an action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment
- an action which has, will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

These issues are considered in Table B-3.

Table B-3 Consideration of EPBC Act requirements

MNES	Relevance to the project
World heritage properties	None
National heritage places	The project would have a negligible impact to two items on the National Heritage List.
Wetlands of international importance	None
Commonwealth listed threatened species and ecological communities	The project has the potential to lead to significant impact on two threatened ecological communities and 27 threatened species and/or their habitats.
Commonwealth listed migratory species	The project has the potential to impact on six migratory species.
Nuclear action	None
Commonwealth marine area (including Great Barrier Reef Marine Park)	None
Protection of water resources from coal seam gas development and large coal mining	None
Action by the Commonwealth or a Commonwealth Agency	Not applicable
Action which has, will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.	The project would not have a significant impact on the environment on Commonwealth land.

Based on the assessed potential impacts to the listed threatened species, a referral under the EPBC Act was submitted in March 2022. On 13 April 2022 DCCEEW confirmed the project to be a controlled action and subject to the assessment bilateral agreement under section 45 of the EPBC Act.

The current assessment bilateral agreement provides for certain actions that are SSI to be accredited for the purposes of meeting the requirements for assessment and public exhibition of an action under the provisions of the EPBC Act.

The requirements to meet the assessment bilateral agreement have been included within the Supplementary SEARs provided by the DPE for the project (refer to Appendix A).

B.4 Approvals or authorisations that are not required or cannot be refused

In accordance with Section 5.23 (1) of the EP&A Act, the following authorisations are not required for approved SSI:

- a permit under Sections 201, 205 and 219 of the *Fisheries Management Act 1994* (FM Act)
- an approval under Part 4, or an excavation permit under Section 139 of the *Heritage Act 1977*
- an Aboriginal heritage impact permits under Section 90 of the *National Parks and Wildlife Act 1974* (NP&W Act)
- a bush fire safety authority under Section 100B of the *Rural Fires Act 1997*
- a water use approval under Section 89, water management work approval under Section 90, or an activity approval (other than an aquifer interference approval) under Section 91 of the *Water Management Act 2000.*

Section 5.23 (2) of the EP&A Act provides that:

- Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent or interfere with the carrying out of approved SSI.

Section 5.23 (3) of the EP&A Act also specifies that the following directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved Critical State Significant Infrastructure:

- an interim protection order (within the meaning of the NP&W Act)
- an order under Division 1 (Stop work orders) of Part 6A of the NP&W Act or Division 7 (Stop work orders) of Part 7A of the FM Act
- a remediation direction under Division 3 (Remediation directions) of Part 6A of the NP&W Act
- an order or direction under Part 11 (regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016*
- an environment protection notice under Chapter 4 of the *Protection of the Environment Operations Act 1997* (POEO Act)
- an order under section 124 of the *Local* Gover*nment Act 1993*.

Section 5.24 of the EP&A Act identifies approvals or authorisations that cannot be refused if they are necessary for carrying out approved SSI and are to be substantially consistent with the approval. Of potential relevance to the project would be:

- an environment protection licences (EPLs) under Chapter 3 of the POEO Act
- a consent under Section 138 of the *Roads Act 1993* (refer to Table B-4 for the application of the *Roads Act 1993* relevant to the project).

With respect to EPLs, Schedule 1 of the POEO Act, does not define electricity transmissions lines or substations as a scheduled activity requiring an EPL.

Chapter 3 of the POEO Act details the types of EPLs that may be issued for scheduled activities. The following activities would be deemed to be scheduled activities that may trigger an EPL if the relevant limits are exceeded:

- cement or lime handling - under Clause 6 of Schedule 1 of the POEO Act, an EPL may be required if the amount of cement or lime handled (not including the production of pre-mixed concrete (concrete batching)) exceeds:
  - 150 tonnes of cement or lime per day, or
  - 30,000 tonnes of cement or lime per year
- crushing and screening - Clause 16(2) of Schedule 1 of the POEO Act deems this to be a scheduled activity that requires an EPL if the crushing and screening plant has the capacity to process:
  - more than 150 tonnes of materials per day, or
  - 30,000 tonnes of materials per year
- helicopter related activities – Clause 20(1) of the POEO Act deems this to be a scheduled activity that requires an EPL if:
  - the activity has an intended use of more than 30 flight movements per week (where take-off and landing are separate flight movements), and
  - the activity is conducted within one kilometre of a dwelling not associated with the landing, take-off or parking of helicopters.

An EPL is not anticipated to be required for the project based on the concept design and indicative construction methodology as assessed in this EIS.

B.5 Other NSW and Commonwealth legislation of potential relevance to the project

Table B-4 identifies other NSW and Commonwealth legislation of potential relevance to the project.

Table B-4 Other NSW and Commonwealth planning legislation of potential relevance to the project

Legislation	Relevance to HumeLink and consideration of issues
Aboriginal Land Rights Act 1983	The purpose of the *Aboriginal Land Rights Act 1983* includes providing for land rights for Aboriginal persons and representative Aboriginal Land Councils in the State. This Act applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. This Act recognises and acknowledges the statutory role and responsibilities of NSWALC and Local Aboriginal Land Councils (LALCs). The project footprint extends across the boundaries of Wagga Wagga, Brungle/Tumut, Onerwal and Pejar LALCs. All relevant LALCs have been consulted during the assessment of the project.
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)	This Act provides for the protection of Aboriginal cultural property that are of particular significance to Aboriginal people in accordance with Aboriginal tradition and may apply to Aboriginal cultural property as well as to ancient sites. An Aboriginal and Cultural Heritage Report (ACHAR) has been prepared which identified that no declarations relevant to the project footprint have been made under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.* Further details are provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* and summarised in Chapter 9 (Aboriginal heritage).
Biodiversity Conservation Act 2016 (BC Act) and Biodiversity Conservation Regulation 2017	This legislation establishes a framework for assessment and offsetting of biodiversity impacts as well as investment in biodiversity conservation. Under the BC Act, SSI projects are required to prepare a biodiversity development assessment report (BDAR) to identify and assess biodiversity impacts under the provisions of the BC Act and offset those impacts by retiring biodiversity credits, determined using the Biodiversity Assessment Methodology (BAM). A BDAR has been prepared for the project in accordance with the BAM under the BC Act. The BDAR concludes that the unavoidable impacts of the project on ecological values includes a total credit requirement of 10,997 ecosystem credits and 134,578 species credits. It also outlines the biodiversity offset credit liability for the project that has been calculated in accordance with the BAM to offset the unavoidable impacts of the project. Further details are provided in *Technical Report 1 – Biodiversity Development Assessment Report* and summarised in Chapter 8 (Biodiversity).
Biosecurity Act 2015	The *Biosecurity Act 2015* provides for the prevention, elimination, minimisation and management of biosecurity risks in NSW posed by biosecurity matter. Under the *Biosecurity Act 2015*, weeds are defined as a plant that is a pest and a biosecurity risk exists where invasive weeds, termed priority weeds, have the potential to negatively impact on the environment. The *Biosecurity Act 2015* introduces a responsibility for landowners or land managers to control and prevent the introduction and spread of these priority weeds, which is to be known as a General Biosecurity Duty. No evidence of pathogens such as the root-rot fungus *Phytophthora cinnamomi*, Myrtle Rust (*Austropuccinia psidii*) and Chytrid Fungus (*Batrachochytrium dendrobatidis*) was recorded within the project footprint. Other potential biosecurity risks such as sheep lice, Ovine Johne's Disease, and ovine footrot are expected to be low and would be manageable with the implementation of proven mitigation measures. High Threat Weeds, Priority weeds and Weeds of National Significance recorded within the project footprint include blackberry (*Rubus fruticosus*) and sweet briar (*Rosa rubiginosa*). Further details on the consideration of priority weeds and the duties under the *Biosecurity Act 2015* are provided in Chapter 8 (Biodiversity), Chapter 11 (Land use and property), *Technical Report 1 – Biodiversity Development Assessment Report* and *Technical Report 4 – Agricultural Impact Assessment*.

Legislation	Relevance to HumeLink and consideration of issues
Civil Aviation Regulation 1988 (Commonwealth) and Civil Aviation Safety Regulations 1998	These regulations establish controls and requirements with respect to airspace and aerial operations. The project footprint would be wholly contained within uncontrolled airspace and would be situated outside any Special Use Airspace that is reserved for military flying training operations. The project footprint is also outside the clearance zones associated with aviation navigation aids, radar systems and communication facilities. An infringement of OLS is expected at Wagga Wagga Airport. There would be no infringements of the PANS-OPS at Wagga Wagga Airport. No infringement of OLS and PANS-OPS at Goulburn or Tumut airports. The use of cranes and erection of transmission line structures within the project footprint during construction may result in some risks to aerial operations such as applications of fertilisers and pesticides, aerial baiting in NPWS estate and emergency services operations. This would be appropriately managed through the implementation of the proposed environmental management measures. Further details are provided in Chapter 19 (Hazards and risks) and in *Technical Report 14 – Aviation Impact Statement.*
Climate Change Act 2022 (Commonwealth)	The Act sets out emission reduction targets and establishes the Climate Change Authority. A GHG Management Plan would be prepared for the project to develop strategies to reduce GHG emissions in line with Transgrid's Science Based Targets initiatives and the Commonwealth emission reduction targets. Further details are provided in Chapter 22 (Climate change and greenhouse gas).
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act outlines the circumstances in which notification of the NSW Environment Protection Authority (EPA) is required in relation to the contamination of land. A Phase 1 contamination Assessment has been prepared for the project to inform the design and EIS process. This assessment identified some areas within the project footprint as Areas of Environmental Concern (AEC) with a moderate risk ranking for contamination to be present based on historic and present day land uses. This includes the Yass substation, which is a notified site currently under assessment under the CLM Act. Any potential impacts from encountering existing contamination within these areas or the potential for the project to inadvertently cause contamination would be minimised through the use of proven environmental management measures. Further details on the consideration of contamination are provided in Chapter 16 (Soils, geology and contamination) and in *Technical Report 10 - Phase 1 Contamination Assessment*.
Crown Land Management Act 2016	The *Crown Land Management Act 2016* outlines the permissions and authorisations needed when planning the development of activities on Crown Land as well as the process for the acquisition of Crown Land. There are areas of Crown Land that would be affected by the project. A licence or easement will be separately sought for the construction and operation of the project over Crown Land. The largest impacted Crown land areas would be the part of Bago State Forest intersected by the project footprint, south-east of Batlow and on the western shore of Pejar Dam. Other areas of Crown land intersected by the project footprint are far smaller, and are generally classified as grazing land uses or managed resource protection areas. Further details on impacts to Crown Land are provided in Chapter 11 (Land use and property).
Dangerous Goods (Road and Rail Transport) Act 2008 and Dangerous Goods (Road and Rail Transport) Regulation 2022	This Act regulates the transport of dangerous goods by road and rail in order to promote public safety and protect property and the environment. Based on the implementation of standard and proven management measures and adherence to relevant legislation, the risk associated with onsite storage, handling and transport of dangerous goods and hazardous materials would be considered negligible. Further information is provided in Chapter 19 (Hazards and risks).

Legislation	Relevance to HumeLink and consideration of issues
Electricity Supply Act 1995	Transgrid is a transmission operator and network operator under the *Electricity Supply Act 1995.* Under clause 45(1), for the purpose of exercising its functions under this or any other Act or law, a network operator may carry out any of the following work: (a) work comprising the erection, installation or extension of electricity works on public land, (b) work on any land comprising or connected with the alteration, maintenance or removal of existing electricity works on any land, (c) work on public land that is connected with the erection, installation, extension, alteration, maintenance or removal of electricity works on any land. However, in accordance with Clause 45(4) no such work (other than routine repairs or maintenance work) may be carried out unless: (a) notice of the project to carry out the work has been given to the local council, and (b) the local council has been given a reasonable opportunity (being not less than 40 days from the date on which the notice was given) to make submissions to the network operator in relation to the project, and (c) the network operator has given due consideration to any submissions so made. Transgrid have provided notification to Wagga Wagga City Council, Snowy Valleys Council, Cootamundra-Gundagai Regional Council, Yass Valley Council and Upper Lachlan Shire Council, as required in accordance with this Act.
Environmental Planning and Assessment Regulation 2021 (EP&A Regulation)	The project is CSSI and subject to the relevant content and form provisions of the EP&A Regulation. Consistency with the form and contents required by the EP&A Regulation is provided in Table B1. An assessment of the project with regard to the principles of ESD is provided in Chapter 27 (Project justification and evaluation). In accordance with s181 of the EP&A Regulation, Transgrid as the proponent will arrange for notice of the project to landowners or advertise in the local newspaper. Chapter 6 (Engagement) provides further details of existing publicly available information and what will be published during future stages of the project.
Environmentally Hazardous Chemicals Act 1985	This Act is aimed at controlling the introduction, use and disposal of environmentally hazardous chemicals. The construction compounds and work sites would be arranged so that hazardous materials and chemicals are stored at a suitable distance from sensitive receivers and in accordance with supplier's instructions, Australian Standards, and relevant legislation. Further discussion is provided in Chapter 19 (Hazards and risks).
Fisheries Management Act 1994 (FM Act)	The FM Act provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. One of the key objectives of the FM Act is to conserve fish stocks and key fish habitats. Part 7 of the FM Act establishes that a permit is generally required to dredge, reclaim, obstruct fish passage, harm marine vegetation, use explosives or electrical devices in a waterway that is classified as key fish habitat. The project would involve work within and near aquatic habitats however no net loss of key fish habitat is anticipated to occur as a result of the project. However, as CSSI, the project is exempt from the need to obtain permits under Sections 201, 205 and 219 of the FM Act. Notwithstanding, impacts from the project have been assessed and further details are provided in Chapter 8 (Biodiversity) and in *Technical Report 1 – Biodiversity Development Assessment Report*.
Forestry Act 2012	The forestry industry in NSW operates under the legal framework of the *Forestry Act 2012* (NSW). The *Forestry Act 2012* establishes the Forestry Corporation of NSW (FCNSW) as a State owned corporation to efficiently and effectively manage the environmentally sustainable supply of timber from relevant lands, as well as to contribute to regional development and conduct its activities in line with ecologically sustainable development principles. An easement for the transmission lines through three State forests would be by agreement with FCNSW via a Deed of Easement, or in accordance with the requirements of the *Land Acquisitions (Just Terms Compensation) Act 1991*. Further discussion is provided in *Technical Report 5 – Land Use and Property Assessment.*

Legislation	Relevance to HumeLink and consideration of issues
Heritage Act 1977 (Heritage Act)	The Heritage Council must be notified if a relic is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic. The Heritage Council must also be notified if an item listed on a Government Agency's Section 170 Heritage Register is demolished. Section 139 specifies that a person must not disturb or excavate land knowing, or suspecting, that the action may result in the discovery, exposure, movement, damage or destruction of a relic, unless the work is undertaken in accordance with an excavation permit. Additionally, section 146 requires that the discovery or location of a relic must be notified to the Heritage Council unless the Heritage Council is aware of the relic's location. Under the SSI provisions for the project, exemptions and permits that would otherwise be required under Part 4 and section 139 of the Heritage Act are not required for approved SSI projects by reason of section 5.23 of the EP&A Act. Notwithstanding, heritage impacts associated with the project have been assessed in accordance with the *Heritage Act 1977*. The results of this assessment are presented in the *Technical Report 3 – Historic Heritage Impact Assessment* and summarised in Chapter 10 (Non-Aboriginal heritage).
Land Acquisition (Just Terms Compensation) Act 1991 (Land Acquisition Act)	This Act controls the acquisition of land on just terms by authorities of the State with the objective of simplifying and expediting the compulsory acquisition process while ensuring compensation on just terms for the owners of land that is acquired by an authority of the State when the land is not available for public sale. Transgrid is an authority of the State for the purposes of the Land Acquisition Act and the Act applies to the project. Further discussion of potential land acquisition associated with the project is discussed in Chapter 11 (Land use and property).
Local Land Services Act 2013	This Act establishes the Local Land Services (LLS) to manage programs and advisory services associated with agricultural production, biosecurity, natural resource management and emergency management and TSRs. Relevant matters are discussed in Chapter 8 (Biodiversity), Chapter 11 (Land use and property) and Chapter 19 (Hazards and risks).
National Environment Protection Council Act 1994 (NEPC Act)	The National Environment Protection Council (NEPC) was established under the NEPC Act. The primary functions of the NEPC are to: • prepare National Environment Protection Measures (NEPMs) • assess and report on the implementation and effectiveness of the NEPMs in each state and territory. NEPMs are a special set of national objectives designed to assist in protecting or managing aspects of the environment eg air quality and waste. Relevant matters are discussed in Chapter 21 (Air quality) and Chapter 23 (Waste).
National Greenhouse and Energy Reporting Act 2007 (NGER Act) (Commonwealth)	The NGER Act established a single national framework for reporting and disseminating company information about GHG emissions, energy production, and energy consumption. A rule made under this Act and enacted in 2015 was to establish the Safeguard Mechanism, which operates in tandem with the ERF. Under the *National Greenhouse and Energy Reporting Scheme* (NGERS), emitters (as defined under the Safeguard Mechanism, discussed below) must report annually all Scope 1 and Scope 2 emissions, and results are presented on the Clean Energy Regulator website. Further details are provided in *Technical Report 18 – Greenhouse Gas Assessment* and summarised in Chapter 22 (Climate change and greenhouse gas).
National Parks and Wildlife Act 1974 (NP&W Act)	The NP&W Act provides for the control and management of all national parks, historic sites, nature reserves, wetlands and other state reserves. The project is situated near Tarlo River National Park, Minjary National Park, Mudjarn Nature Reserve, Bango Nature Reserve, Back Arm Nature Reserve and Kosciuszko National Park. The project footprint was refined to reduce impacts to biodiversity and avoid national parks. The NP&W Act also provides for the protection of 'Aboriginal objects' and 'Aboriginal places' and makes it an offence to harm Aboriginal objects, places or sites without permission. Despite certain Aboriginal heritage approvals not being required, as per section 5.23 of the EP&A Act, an Aboriginal cultural heritage assessment report (ACHAR) has been prepared for the project.

Legislation	Relevance to HumeLink and consideration of issues
	The ACHAR identified 90 Aboriginal sites within the project footprint that may be directly or indirectly impacted by the project. These include eight PADs and three modified trees. The remaining 79 sites are stone artefact occurrences including artefact scatters and isolated finds. There are also five cultural trees, six modified trees of non-Aboriginal origin and one cultural site that are not 'objects' as defined by the NPW Act. Further details are provided in *Technical Report 1 – Biodiversity Development Assessment Report*, *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* and summarised in Chapter 8 (Biodiversity) and Chapter 9 (Aboriginal heritage).
Native Title Act 1994 (NSW) *and Native Title Act 1993* (Commonwealth)	The NSW *Native Title Act 1994* provides for native title in relation to land or waters. The *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) stipulates that, where relevant, consultation must be conducted with Native title holders or registered native title claimants in accordance with the *Native Title Act 1994*. The Commonwealth *Native Title Act 1993* also recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act, a future act includes proposed public infrastructure on land or waters that affects native title rights or interest. A search of the Native Title Tribunal Native Title Vision website was carried out, with no Native Title claims or Native Title holders registered within the project footprint. There are no Crown lands subject to a native title claim within the project footprint. The Gundungurra Indigenous Land Use Agreement (ILUA) is located at the eastern end of the project footprint and the Tumut Brungle ILUA is located in the centre of the project footprint around the Tumut area. However, the ILUAs do not recognise native title over these lands. Further details are provided in *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* and summarised in Chapter 11 (Land use and property).
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is a key piece of environment protection legislation administered by the NSW EPA, which enables the Government to establish instruments for setting environmental standards, goals, protocols, and guidelines. The objects of this Act include to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development. Under Part 5.7 of the POEO Act, the NSW EPA must be notified of any pollution incidents that cause or threaten material harm to the environment. Chapter 3 of the POEO Act also imposes requirements for EPLs to be obtained for certain activities. Section 147 of the POEO Act requires anyone carrying on an activity or occupying a premises who becomes aware of a pollution incident to report it immediately if there is a risk of 'material harm to the environment'. Further details are provided in *Technical Report 10 – Phase 1 Contamination Assessment* and *Technical Report 17 – Air Quality Impact Assessment* and summarised in Chapter 16 (Soils, geology and contamination), Chapter 21 (Air quality) and Chapter 23 (Waste).
Rail Safety Act 2008 (Rail Safety Act)	The principal object of the Rail Safety Act of relevance to the project is the regulation of the carrying out of various activities within railway corridors. The transmission line would cross an operating rail corridor - the Main Southern Railway Line, approximately 7 km north-west of Yass. This would require rail possessions during construction with no disruptions to operations on the rail network. The timing and duration of the rail possessions would be undertaken in accordance with the Australian Rail Track Corporation's requirements. Further details are provided in Chapter 20 (Traffic, transport and access).

Legislation	Relevance to HumeLink and consideration of issues
Roads Act 1993 (Roads Act)	The principal object of the Roads Act of relevance to the project is the regulation of the carrying out of various activities on public roads. Part 9 of the Roads Act nominates the requirements for undertaking works within a public road, including the requirement to obtain consent under section 138 for carrying out works in, on or over a public road (this includes the erection of structures), and the digging up or disturbance of the surface of a public road. The project would likely require temporary/partial closure of classified roads for the construction of the project and may require work to connect new access points. Transgrid would require consent to undertake any work on classified roads. However, as a network operator under the *Electricity Supply Act 1995,* Transgrid is not required to obtain consent under Section 138 of the *Roads Act 1993* for work in, on or over unclassified roads (other than a Crown road) due to application of section 5 of Schedule 2 of the *Roads Act 1993.*
Rural Fires Act 1997 (Rural Fires Act)	The objects of the Rural Fires Act are focused on the prevention, mitigation and suppression of bush and other fires in rural fire districts, and the co-ordination of firefighting and prevention across the State. Potential hazards associated with bushfire risk to the project (including during construction), have been considered as part of *Technical Report 13 – Bushfire Risk Assessment* and summarised in Chapter 19 (Hazards and risks).
Waste Avoidance and Resource Recovery Act 2007 (WARR Act)	The WARR Act promotes waste avoidance and efficient resource use to reduce generation of waste through the Waste Avoidance and Resource Recovery Strategy. The project would consume some natural resources and would produce waste. Waste management would be carried out in accordance with the WARR Act. Further details on waste and resource impacts associated with the project are provided in Chapter 23 (Waste).
Water Act 2007 (Commonwealth)	This Act provides the legislative framework for ensuring that the Murray-Darling Basin is managed in the national interest and lead to the development of the Basin Plan 2012 and WRPs. The Basin Plan 2012 sets water quality targets and objectives to protect water quality in the Murray-Darling Basin's rivers for people and livestock as well as for wetlands and floodplains. The WRPs set rules on how much water can be taken from the Basin, ensuring that the sustainable diversion limit is not exceeded over time. Further details are provided in Chapter 17 (Surface water and groundwater quality) and in *Technical Report 12 – Surface Water and Groundwater Impact Assessment*.
Water Management Act 2000 (WM Act) *and the Water Act 1912*	The *Water Act 1912* establishes conditions by which users need a licence or authority to take water. Many of the functions of the *Water Act 1912* are being repealed and replaced with provisions in the WM Act. The WM Act provides for the sustainable and integrated management of water resources. Water use approvals, which authorise and confer a right on the holder of the approval to use water for a particular purpose at a particular location, are dealt with in section 89 of the WM Act. Section 90 of the WM Act identifies three kinds of water management works approvals, being a water supply work approval, a drainage work approval and a flood works approval, with all three of these approvals conferring a right on the holder of the approval to construct and use the specified works at a specified location. Section 91 of the WM Act relate to controlled activities and aquifer interference, both of which confer a right on the holder to carry out the specified activity at the specified location. As the project is CSSI, under the provisions of section 5.23(1) of the EP&A Act, a water use approval pursuant to section 89 of the WM Act, a water management work approval pursuant to section 90 of the WM Act, and an activity approval (other than an aquifer interference approval) pursuant to section 91 of the WM Act are not required and accordingly, do not apply to an approved SSI project. Temporary dewatering and construction activities that interfere with aquifers are generally identified as aquifer interference activities in accordance with the WM Act and the *NSW Aquifer Interference Policy* (Department of Primary Industries, 2012). In water sources where a water sharing plan applies, an aquifer interference approval is required under section 91(3) of the WM Act. If more than three megalitres of groundwater is to be taken as part of the aquifer interference activity then a water access licence under the WM Act is also required

Legislation	Relevance to HumeLink and consideration of issues
	(clause 7 of Schedule 4 Water Management (General) Regulation 2018). Where no water sharing plan applies, an aquifer interference activity that involves the taking of groundwater must hold a water licence under Part 5 of the *Water Act 1912*. Approvals for groundwater aquifer interference would be confirmed once details of potential quantity of groundwater interception is understood. Further details on the NSW Aquifer Interference Policy are provided in *Technical Report 12 – Surface Water and Groundwater Impact Assessment.*
Work Health and Safety Act 2011 and Work Health and Safety Regulation 2017	This main object of this Act is to provide for a balanced and nationally consistent framework to secure the health and safety of workers and workplaces. The health and safety of workers would be managed in accordance with Transgrid's existing management systems. Further consideration of issues relevant to work health and safety are discussed in Chapter 19 (Hazards and risks).

B.6 Consideration of NSW environmental planning instruments

Section 5.22 of the EP&A Act states that environmental planning instruments do not apply to SSI and CSSI projects. Notwithstanding, a number of key environmental planning instruments have been considered in relation to the assessment of the project as summarised in Table B-5.

Table B-5 Consideration- of key environmental planning instruments for the project

Environmental planning instruments	Relevance to HumeLink
State environmental planning policies	
State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP)	The project has been declared SSI and CSSI under section 5.13 of the EP&A Act pursuant to section 2.15 and Schedule 5, paragraph 9 "Snowy 2.0 and Transmission Project" of the Planning Systems SEPP.
State Environmental Planning Policy (Biodiversity and Conservation) 2021	This SEPP consolidates the planning provisions of a number of previous SEPPs of potential relevance to the project with respect to: • Vegetation in non-rural areas • Koala habitat protection • Water catchments. <u>Vegetation in non-rural areas</u> Chapter 2 of the SEPP aims to protect the biodiversity value of trees and other vegetation in non-rural areas and to preserve the amenity of non-rural areas through the preservation of trees and other vegetation. The SEPP only applies to projects that require development consent under Part 4 of the EP&A Act. The Biodiversity Development Assessment Report (BDAR) carried out for the project has considered potential impacts to vegetation. Further details are provided in Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report.* <u>Koala habitat protection</u> Chapter 4 of the SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. Section 4.4 of the SEPP identifies the land where koala habitat protection applies. This includes land within the project footprint in the Wagga Wagga City, Snowy Valleys, Yass Valley and Upper Lachlan Shire LGAs, however it does not apply to land zoned RU1 Primary Production, RU2 Rural Landscape or RU3 Forestry. The policy does not apply to the Cootamundra-Gundagai LGA. The SEPP only applies to projects that require development consent under Part 4 of the EP&A Act on land with an area of more than one hectare or adjoining land in the same ownership of more than one hectare.

Environmental planning instruments	Relevance to HumeLink
	Regardless a Biodiversity Development Assessment Report (BDAR) has been prepared for the project and has considered potential impacts to koala populations. Further details are provided in Chapter 8 (Biodiversity) and *Technical Report 1 – Biodiversity Development Assessment Report.* <u>Water catchment</u> Part 6.5 of the SEPP relates to the use of land within the Sydney drinking water catchment. Section 6.61 requires consideration of whether or not development will have a neutral or beneficial effect on water quality before carrying out the development. Whilst the provisions of the SEPP do not apply to SSI, a neutral or beneficial effect assessment is included in *Technical Report 12 – Surface Water and Groundwater Impact Assessment* . The NorBE assessment indicates that the project is expected to have an overall neutral impact on water quality during construction and in operation. Further details are provided in Chapter 17 (Surface water and groundwater quality) and *Technical Report 12 – Surface Water and Groundwater Impact Assessment.*
State Environmental Planning Policy (Primary Production) 2021	This SEPP aims to facilitate the orderly economic use and development of land for primary production and 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. The SEPP also provides for mapping biophysical strategic agricultural land (BSAL) and State significant agricultural land (SSAL). The BSAL and draft SSAL within the project footprint has been considered in *Technical Report 4 – Agricultural Impact Assessment.* Further details are provided in Chapter 8 (Biodiversity), Chapter 11 (Land use and property), *Technical Report 1 – Biodiversity Development Assessment Report* and *Technical Report 4 – Agricultural Impact Assessment.*
State Environmental Planning Policy (Resilience and Hazards) 2021	The State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) consolidates and repeals the provisions of the following SEPPs: • SEPP (Coastal Management) 2018 • SEPP 33 – Hazardous and Offensive Development • SEPP 55 – Remediation of Land. The potential relevance the SEPP to this project would be Chapter 4 – Remediation of land. The object of this Chapter is to provide a State wide planning approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. Whilst the provisions of the SEPP do not apply to SSI, the issues for consideration by a consent authority have been included in the assessment of the project. These considerations include: • whether the land is contaminated • if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out • if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose. A Phase 1 contamination assessment was carried out for the project to inform the design and EIS process. The assessment concluded that based on the information reviewed and assessed, the contamination study area is not affected by broad-scale contamination, and the risk of soil and groundwater contamination is generally low. These impacts can be avoided or managed through the implementation of the proposed environmental measures. Operational contamination risk management was also considered to be manageable with standard controls and procedures. Further consideration of contamination is summarised in Chapter 16 (Soils, geology and contamination) and in *Technical Report 10 - Phase 1 Contamination Assessment.*

Environmental planning instruments	Relevance to HumeLink
Regional environmental planning policies	
Riverina Murray Regional Plan 2041 and South East and Tablelands Regional Plan 2036 and Draft South East and Tablelands Regional Plan 2041	The Riverina Murray Regional Plan 2041 and the South East and Tablelands Regional Plan 2036 and Draft South East and Tablelands Regional Plan 2041 set out the strategic land use planning framework for the regions. Both regional plans recognise the role of the regions in supporting NSW's transition to net zero carbon emissions by 2050 through prioritisation and support of renewable energy. Relevant key strategic directions/objectives include: • Riverina Murray Regional Plan 2041 – Direction 13: Support the transition to net zero by 2050 (DPE, 2023) • South East and Tablelands Regional Plan 2036 - Direction 6: Position the region as a hub of renewable energy excellence (DPE 2017). • Draft South East and Tablelands Regional Plan 2036 – Objective 8: Plan for a net zero region by 2050 and Objective 12: Realise economic benefits from a connected regional economy. When operational, HumeLink would significantly assist in meeting these regional planning directions/objectives. It would support NSW's transition to net zero carbon emissions by providing additional transmission capacity in the regions to encourage prioritisation of investment in new renewable energy sources.
Local environmental plans (LEPs)	
Gundagai LEP 2011 Tumbarumba LEP 2010 Tumut LEP 2012 Upper Lachlan LEP 2010 Wagga Wagga LEP 2010 Yass Valley LEP 2013	Each local environmental plan (LEP) provides development standards, zoning and planning controls for development in the relevant LGA. While the LEP guides local development within the LGA, the EP&A Act expressly provides that LEPs do not apply to SSI or CSSI projects. However, the assessment has considered heritage items listed under the LEP in Chapter 10 (Non-Aboriginal heritage) and has considered impacts to land use and zoning in Chapter 11 (Land use and property). Other provisions of the LEPs have not been considered further in this EIS.



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Appendix C Engagement Outcomes Report

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Engagement Outcomes Report

July 2023

Document purpose

The HumeLink engagement outcomes report is delivered as supporting documentation for the Environmental Impact Statement (EIS) for the HumeLink project. This report expands on the community and stakeholder engagement details provided in Chapter 6 of the HumeLink EIS. The report maps key themes and topics raised during the engagement process against relevant stakeholder groups and consultation activity undertaken to 30 June 2023.

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1. Background

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley. The location of the project is shown on Figure 1.

HumeLink would involve construction of a new substation east of Wagga Wagga as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver cheaper and more reliable power for consumers by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the Wagga Wagga and Tumut Renewable Energy Zones (REZs). The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland, NSW, Australian Capital Territory (ACT), Victoria, South Australia and Tasmania

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. The project is estimated to be operational by 2026.

2. Project overview

Transgrid is seeking regulatory and environmental planning approval for the construction and operation of a around 360 kilometres of new 500 kV transmission lines and associated infrastructure between Maragle, Bannaby and Wagga Wagga, collectively referred to as HumeLink.

The project includes the following main components:

- construction and operation of around 360 kilometres of new double circuit 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle
- construction of a new 500/330 kV substation at Gregadoo (Gugaa 500 kV substation) approximately 11 kilometres south-east of the existing Wagga 330/132 kV substation (Wagga 330 kV substation)

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- demolition and rebuild of a section of Line 51 (around two kilometres in length) as a double circuit 330 kV transmission line connecting into the Wagga 330 kV substation
- modification of the existing Wagga 330 kV substation and Bannaby 500/330 kV substation (Bannaby 500 kV substation) to accommodate the new transmission line connections
- connection of transmission lines to the future Maragle 500/330 kV substation (Maragle 500 kV substation, approved under the Snowy 2.0 Transmission Connection Project (SSI-9717))
- provision of one optical repeater telecommunications hut and associated connections to existing local electrical infrastructure
- establishment of new and/or upgraded temporary and permanent access tracks
- ancillary works required for construction of the project such as construction compounds, worker accommodation facilities, utility connections and/or relocations, brake and winch sites, and helipad/helicopter support facilities.

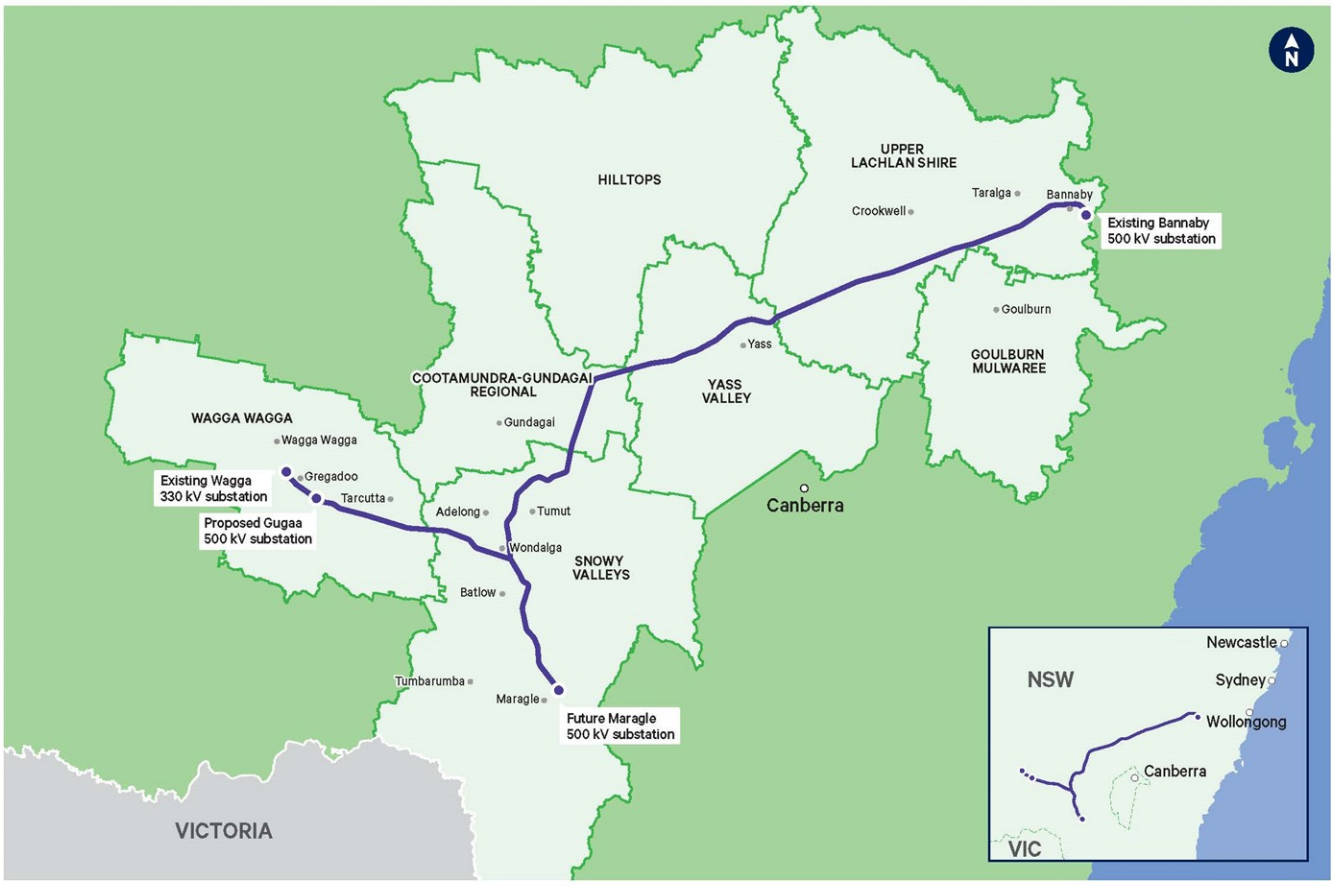


Figure 1 HumeLink project location

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3. Engagement overview and objectives

Transgrid strives to, where possible, place the voice of the community at the centre of our decision making. We strive to build positive and lasting relationships with our local communities, and create lasting benefits to our customers, community and the environment as part of our commitment to building a sustainable future.

Landowner, community and stakeholder engagement for HumeLink commenced in early 2020.

Ongoing concerns from landowners regarding the engagement activities led Transgrid to request a review and report on the HumeLink engagement process by independent Landowner and Community Advocate Rod Stowe, (referred to as 'the Stowe Report'). The Stowe Report was completed and made public in July 2021, prior to the Scoping Report for the project.

Following the publication of the Stowe Report, the project entered a 'reset' on its approach to community engagement and implemented each of the Stowe Report's recommendations.

This meant considerable strategic planning to develop a clear five-step process (shown in Figure 2) to ensure Transgrid not only met the requirements of the SEARs, but continued to deliver best practice engagement and consultation opportunities during the planning and regulatory approvals stage of the HumeLink project.



Figure 2 Five-step process of engagement for HumeLink

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Throughout the lifetime of the project, Transgrid has continued to engage with communities and stakeholders meaningfully and effectively to deliver a project that the community values, sees the benefits of, and feels they have the opportunity to be involved in. Due to the significant project footprint, the engagement program delivered has been extensive, covering a large geographical area, a multitude of audiences and delivering a high volume of engagement activities.

Transgrid approach to community and stakeholder engagement approach for HumeLink has been developed in line with Transgrid's broader Community Engagement Policy: Engagement - Nurture Trust and Transition | Transgrid

4. Engagement activities and tools

4.1 HumeLink Engagement Strategy

Transgrid is committed to engaging with landowners, communities and other stakeholders through the life of the project. The HumeLink community and stakeholder engagement strategy and plans developed and implemented across the project lifecycle are outlined below in Figure 3.

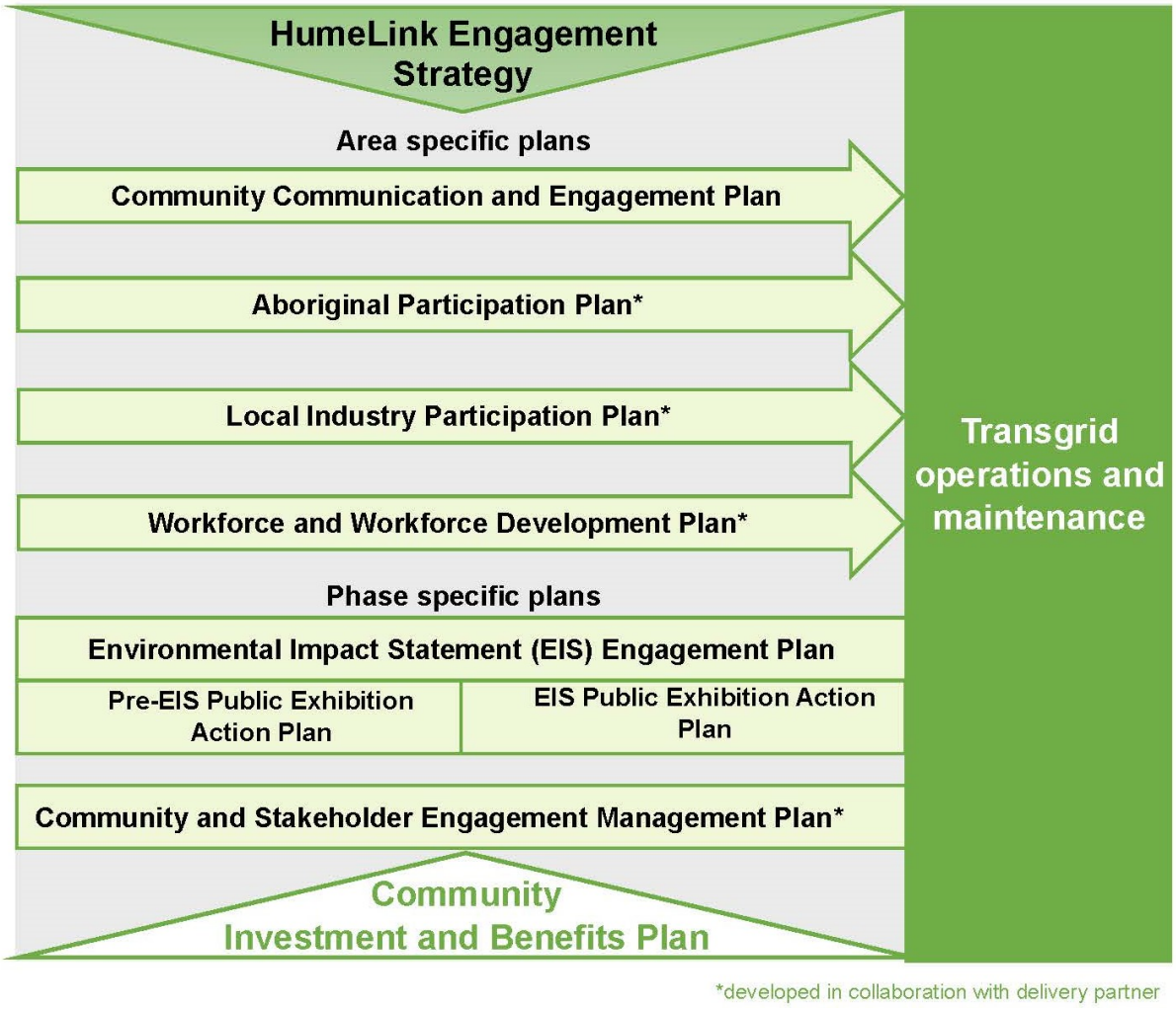


Figure 3 Humelink Community and Stakeholder Engagement strategy and plans

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All engagement activities undertaken during the project stages have been considered in line with the interests, needs, accessibility and availability of stakeholders and the community. Transgrid developed *The HumeLink Engagement Strategy* (HES), a project specific engagement strategy (refer to Attachment A) based on the *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2022) and the International Association of Public Participation's (IAP2) public participation spectrum.

The HES sets the strategic engagement direction and framework for all engagement activities within the HumeLink project. It outlines ongoing engagement with communities, Indigenous people, landowners and stakeholders. It also aligns to Transgrid's expectations for the delivery of best practice engagement for all communities and stakeholders along the corridor, and people more broadly interested in the project.

The development of the HES has considered and responded to feedback from stakeholders, the Landowners Advocate, Community Consultative Group and people with an interest in the project. All engagement activities undertaken during the project have been considered in line with the interests, needs, accessibility and availability of stakeholders and the community.

All 20 recommendations of the Landowner and Community Advocate's Review of HumeLink's engagement process (see Attachment A - appendix 8.1) have been embedded within the HES. These recommendations have been considered business-as-usual within the HumeLink project, and quality assurance has been built-in to ensure ongoing effective and best practice engagement.

The HES and associated engagement plans have been reviewed on a yearly basis as the HumeLink project progresses.

4.1. HumeLink EIS Engagement Plan

Supporting the engagement strategy is the *EIS Engagement Plan* that addresses specific engagement and consultation activity to support the SEARs.

The SEARs for HumeLink include a detailed requirement to consult with relevant local, State or Commonwealth Government authorities, service providers, community groups, affected landowners, Native Title holders, exploration licence holders, quarry operators and mineral title holders. The consultation undertaken to support the SEARs requirement is documented in this Engagement Consultation Report.

The *EIS engagement plan* considers the use of collateral and materials, communication channels, and direct engagement and consultation as per Figure 4. It also considers how a targeted engagement program can be deployed across the entirety of the project footprint and the relevant communities.

The associated engagement activities are aligned to the project phases, particularly the EIS development and public exhibition stages. Community and stakeholders have been consulted on their preferences and prioritisation of particular EIS topics discussed and preferred type of engagement. This feedback has been incorporated into the development of the engagement plan. The plan has also been updated and modified based on community feedback throughout the process, demonstrating responsiveness.

Engagement tools and activities have been designed to:

- raise awareness of the project
- explain key information and processes
- seek feedback
- align objectives, where possible
- build trust
- listen and respond to questions and enquiries
- understand community sentiment and concerns
- incorporate local insights

Collateral and materials	Communication channels	Direct engagement and consultation
• Project newsletter • Guides and fact sheets • What we heard reports • Feedback forms • Icons/images and infographics	• Project hotline • Project email • Project webpages • Digital EIS webpage • Place Managers and Land Access Officers • HumeLink interactive map • Social media • Electronic Direct Mail (EDM) • Letterbox drops • Advertising • Media • Info distributor groups	• Stakeholder briefings • Regulatory stakeholder and governmental agency meetings • Local Aboriginal Land Councils and Aboriginal Stakeholders meetings • Community information sessions • Community information webinars • Community / special interest group briefings and presentations • CCG meetings • Mobile community engagement hub • One-on-one landowner meetings • Facilitated landowner Q&A webinars.

Figure 4 Engagement tools and activities used for HumeLink

4.2. Communications materials

Transgrid developed a suite of communications materials to support HumeLink engagement activities. The materials focused on key technical, commercial and program aspects. Materials were developed proactively where the project team anticipated stakeholder interest and reactively where areas of interest were identified through consultation. In most cases, communications materials were updated as more information became available through the early development stages of the project.

Samples of communications materials are provided in Section 6.4.

The information provided in the sections below is accurate as of 30 June 2023.

Project newsletters

The HumeLink project newsletters provide landowners, stakeholders and community members with detailed project updates in plain language at regular intervals. The topics included in each of the issues of the newsletter reflect prioritised topics based on community, stakeholder and Community Consultative Group (CCG) feedback – in line with Transgrid's engagement policy.

***11** project newsletters distributed and made available on the webpage.*

*Print issues delivered directly to over **77,700** landowners and communities across the project footprint and surrounding areas as of June 2023.*

Over 6,500 electronic versions of the project newsletters delivered via email to the *project email subscribers list.*

Newsletters releases have increased in frequency (from November 2022) in the lead up to the public exhibition of the EIS to provide landowners and other key stakeholders with regular and informative communication on the EIS process and general project progress.

To minimise environmental impact, monthly newsletters are now made available online and shared via email. An extended quarterly issue is printed and distributed directly to stakeholders within a 5km radius of the project footprint as well as other key stakeholders outside of the 5km radius. The newsletters are also made available on the HumeLink webpage.

Guides and fact sheets

Guides and fact sheets have been created to provide landowners, the community and other stakeholders with key information on specific topics. They are shared with CCG members prior to being made publicly available to identify opportunities for improvement and to incorporate information needs from the community.

***Over 25** HumeLink related guides and fact sheets made available online on the project webpage and at community events.*

HumeLink guides and fact sheets have been shared across multiple channels via direct post to landowners, on the HumeLink project webpage, and made available at in person consultation activities.

Examples of landowner guides or fact sheets are available for the following topics:

- HumeLink Factsheet
- HumeLink Biosecurity Procedure
- Landowner Consultation brochure
- Biodiversity offsets
- Heritage Test Excavation program
- Landowner Easement and Compensation Guide
- Guideline for Payment of Professional Fees
- Transmission towers
- Geotechnical Investigations
- HumeLink EIS factsheets.

Fact sheets on each of the EIS specialist studies are also available on the project webpage and distributed during community information sessions. Specific topics are outlined below:

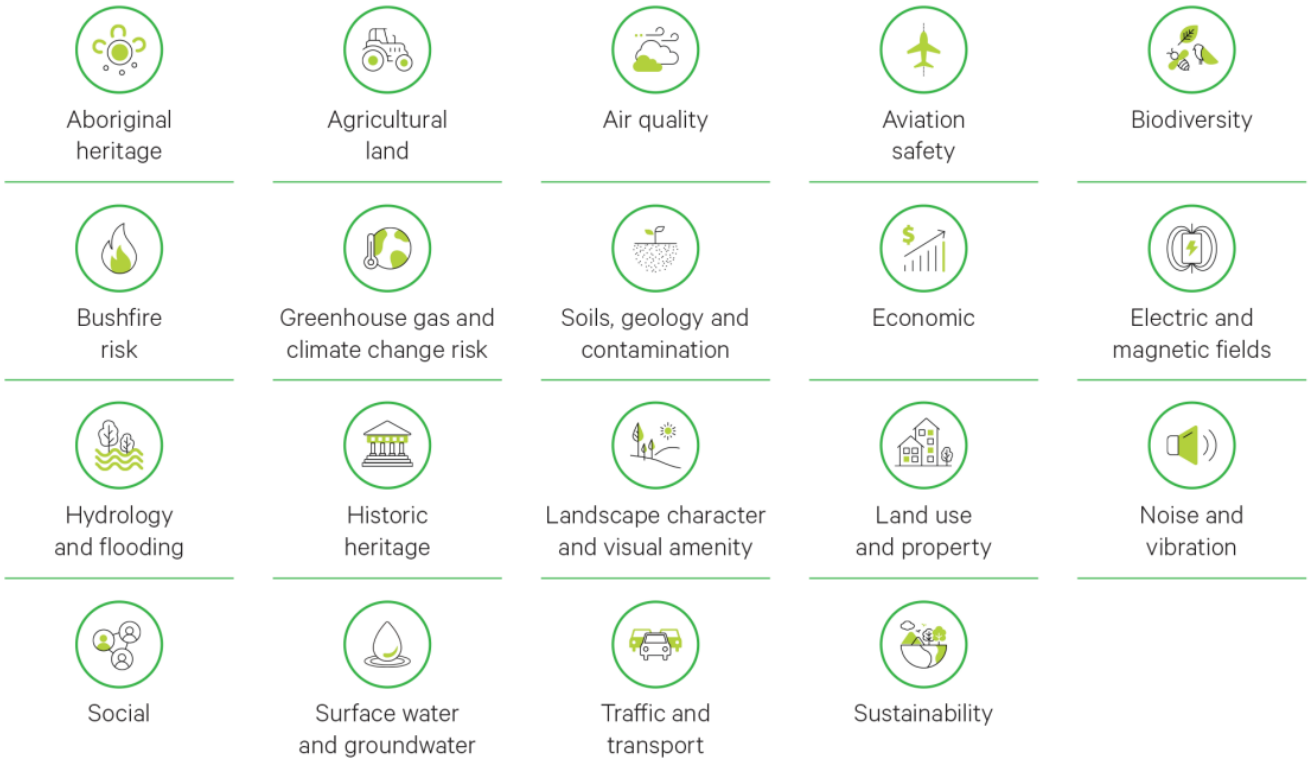


Figure 5 HumeLink EIS technical study fact sheets

What we heard reports

The what we heard reports provide an important share-back opportunity with stakeholders and the community. The report is updated after each community engagement activity round* and includes details on the key themes and topics heard at the activity. The reports form a key part of Transgrid's public-facing accountability and transparency regarding the HumeLink project.

What we heard reports are published on the HumeLink webpage covering community information sessions and webinars held from ***September 2022****.*

The report is available as PDF documents on the HumeLink webpage and is updated after each round of activity.

*An engagement activity round is a series of Community Information Sessions and Webinars held within a batched timeframe i.e., across 1, 2 or 3 weeks, or on a particular topic.

Feedback forms

Providing opportunities for stakeholder and community feedback is imperative for two-way communication and engagement. Digital feedback forms have been made available at all in-person community information sessions via a QR code and emailed to attendees of webinar events.

Any feedback received is reviewed by Transgrid and shared with the appropriate team and/or leader. A direct response is provided to the stakeholder when requested or required.

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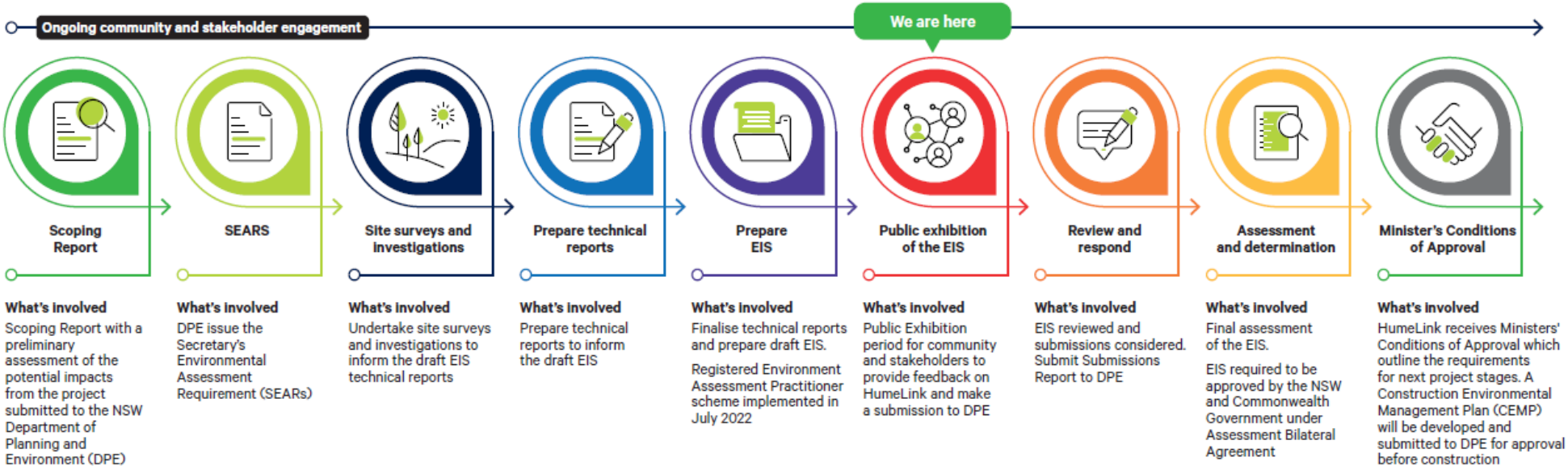


Figure 6 HumeLink EIS process

Icons/images and infographics

The planning and regulatory approvals stage of major projects can be complex and cumbersome for landowners and the community. A suite of infographics and icons has been developed to help visually represent the key stages of HumeLink with a particular focus on helping landowners and the community to understanding the EIS process and technical studies. Figure 6 above is an example of a graphic prepared.

4.3. Communication channels

A project of HumeLink's scale, size and geographical span requires an variety of communication channels to reach the audience via their preferred method. HumeLink traverses a range of regional and rural communities with unique communications needs. These varied communications requirements and needs have been put in the forefront when defining communication channels. These have been prepared with the primary view that there is no one-size-fits-all approach.

A suite of communication channels have been made available as part of the HumeLink project and have been chosen specifically to deliver on Transgrid's effort to engage in two-way communication with all stakeholders.

Project communication channels (hotline, email)

Dedicated lines of communication were established for stakeholders and members of the community to actively seek additional project information, make enquiries or provide feedback.

A toll-free number (1800 317 367) is answered Monday to Friday from 9am until 5pm with a voicemail for afterhours calls. Call types range from queries to feedback and information sharing.

To cater to preferred communication channels, both a project email address (humelink@transgrid.com.au) and mailing address was also established.

280 *landowner and community calls received via the 1800 hotline.*

2,349* *emails received via the project email address.*

1,025 *outgoing emails sent out via the project responding to community enquiries.*

*Email numbers include multiple inbound emails that may have been received under the same subject line

Both the toll-free number and project email address have been promoted in all advertisements and communication materials.

In addition to the toll-free number and the project email address, easement affected landowners are provided the direct contact details for a dedicated Place Manager and Land Access Officer to address their enquiries quickly and directly (note interactions with the Place Managers and Land Access Officers are not captured in the above numbers).

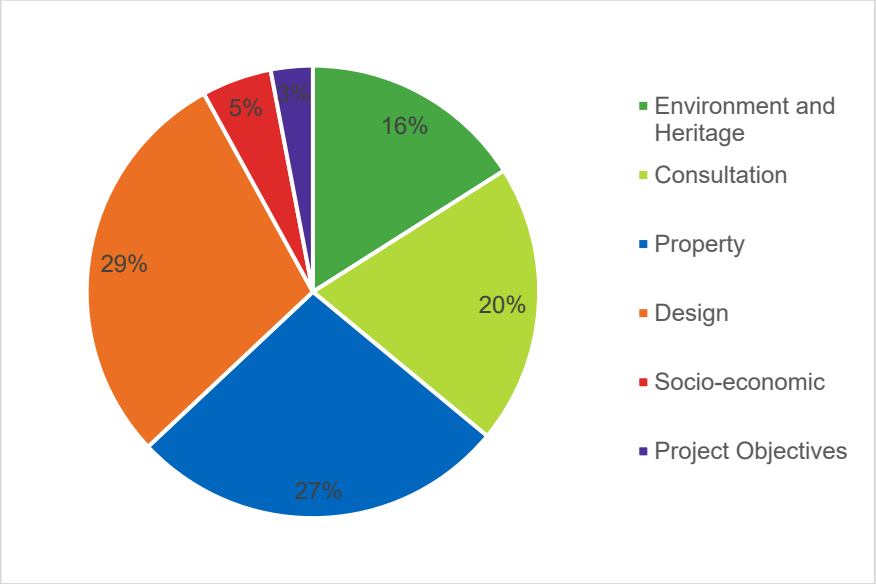


Figure 7 HumeLink project 1800 number - inbound calls

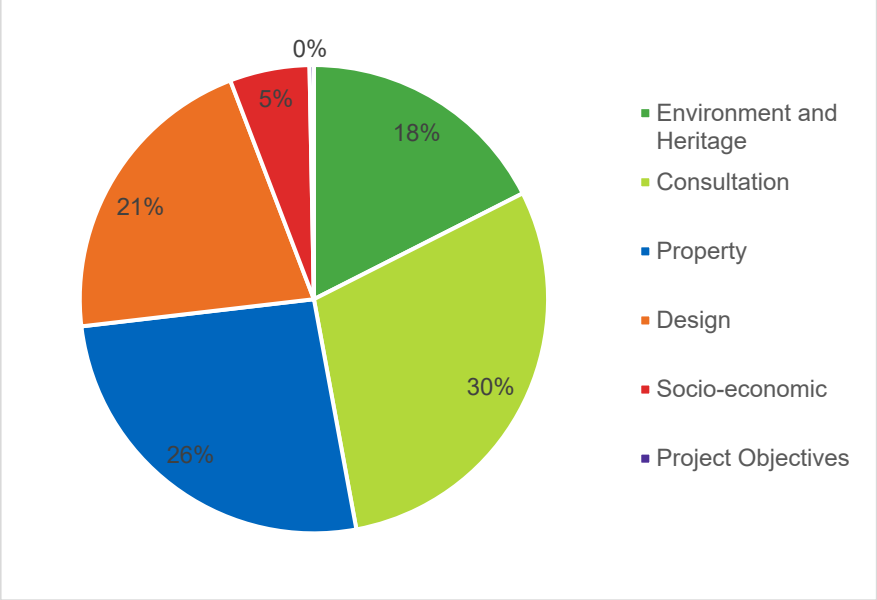


Figure 8 Humelink project email - inbound emails

Project webpage

The project webpage is held on Transgrid's corporate website (transgrid.com.au/Humelink) and provides all interested stakeholders with a central location to access up-to-date project information and documents used for public engagement. HumeLink major announcements, project updates, communications

***25,558** page views and **15,865** unique visitors to the HumeLink webpage since August 2022*.*

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collateral and material as well as presentations from webinars and minutes from community meetings are all available for review on the website.

*Statistics provided for the HumeLink webpage have been captured from 1 August 2022. Prior to this date no tracking was active on the page.

Interactive map

Hosted on the HumeLink webpage, the interactive map is updated to reflect transmission line corridor options and offer stakeholders the chance to provide feedback and insights, and comment on the transmission line corridor.

***2,175** comments of local insight and feedback submitted on the interactive map by **232** stakeholders.*

The comments submitted to the interactive map are reviewed for profanity, offensive phrasing, personal or private information or property details prior to being published. Alternatively, people are given the option of keeping their submission private in which case it is not published on the interactive map however the information is captured and passed onto the appropriate project team member for consideration. Information captured to date on the interactive map has been shared with the EIS and design teams to inform the work they are undertaking.

Stakeholders are asked to categorise their comment upon submission.

Local insights and feedback by category captured in the interactive map

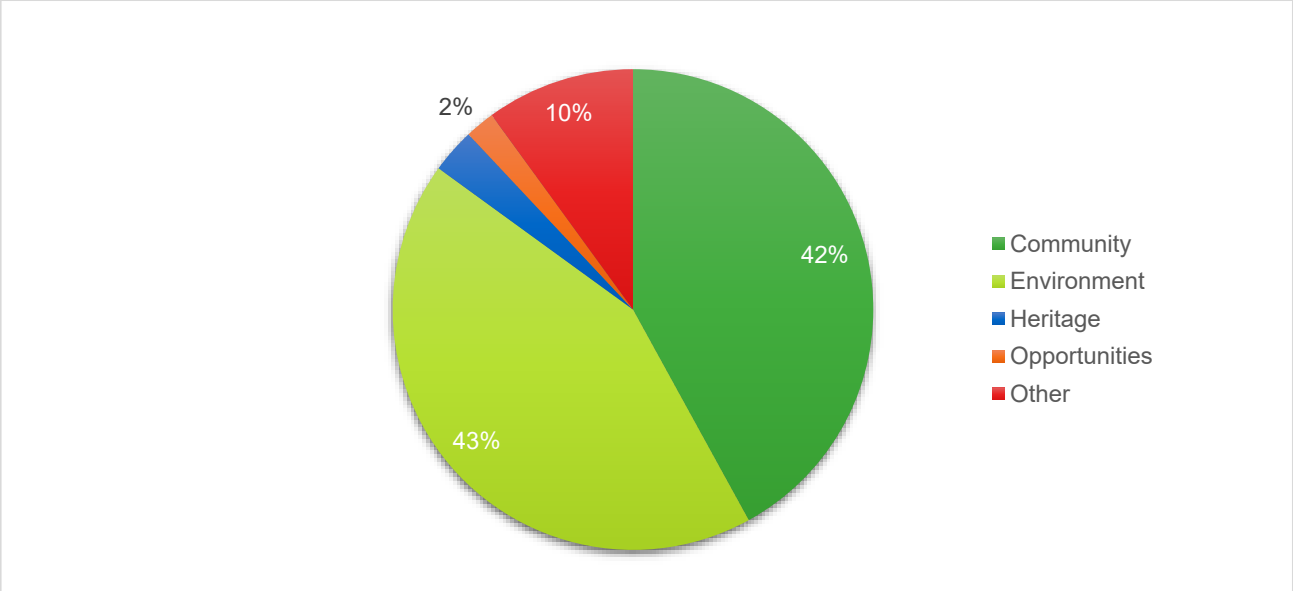


Figure 9 HumeLink interactive map comments by category

A summary of featured topics captured within the interactive map is available in Section 6.3.

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Digital EIS (DEIS) webpage

The DEIS is a user friendly and interactive platform to present the key outcomes of the EIS to support community engagement and improve understanding of the project. The DEIS delivers interactive mapping, multi-media and links to the full EIS on the DPE Planning Portal, further information to take the user on the journey of the project, environmental assessment and project outcomes. The DEIS has been launched to coincide with the public exhibition of the HumeLink EIS and will be available until the end of the environmental approvals process*.

The HumeLink Digital EIS is accessible from the HumeLink webpage.

*Due to launch timeframe no user data or stakeholder feedback was available at the time of publishing this report.

Place Managers and Land Access Officers

HumeLink's Land Access Officers and Place Managers have been actively engaging with directly impacted landowners within the project footprint to understand individual circumstances, impacts and queries and to facilitate appropriate support throughout the process. Place Managers and Land Access Officers are available locally and assigned for each of the project's impacted landowners.

9 *Place Managers and Land Access Officers operating in the project footprint for two-way communication with landowners.*

Over 1,100 *one-on-one meetings with impacted landowners.*

Over 10,500 *interactions with impacted landowners (including emails, text messages and phone calls).*

Place Managers and Land Access Officers are local to the regional localities and bring an invaluable local knowledge and perspective while engaging with the directly impacted landowners. Working across dedicated areas and with specialist skills and training, they are able to form long term relationships with landowners and develop informed background understanding of their needs and priorities. They are able to respond to requests from landowners and act as the direct contact point and case management.

They have delivered early engagement, route refinement and easement negotiations in line with the preferred approach discussed with the landowner. Interactions have included face-to-face meetings, phone calls, emails or texts.

Over 1,100 one-on-one meetings have been held with impacted landowners to date. These include meetings related to general project progress and update, as well as property compensation and acquisition related meetings. In some instances, where appropriate, technical experts and the projects senior leadership team also attended face to face meetings to discuss specific technical or project related matters.

Social media

Facebook has been the primary social media channel used to communicate details of upcoming community information sessions and webinars. Feedback from the community has demonstrated that this is an effective social media channel in reaching those

~3,018,493 *impressions and* ***23,091*** *clicks on paid Facebook posts promoting engagement opportunities in 2022 and 2023.*

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stakeholders and community members that were not able to be reached via formal project channels (website, emails, letterbox drops, phone calls).

Facebook provided a timely and engaging platform to post updates and events regarding the HumeLink project – this channel has been particularly used via the paid advertisement option to reach Facebook users geotargeted areas. Transgrid has pursued the use of social media via paid advertising only while allowing for two-way communication via other channels such as webinars and community information sessions.

Samples of paid Facebook posts are available in Section 6.4.1.

Electronic direct mail (EDM)

EDMs is an efficient way to reach a large number of people. The HumeLink project has an opt-in email subscriber list available for any interested parties to join. The option to subscribe is included on the HumeLink project webpage, across other materials and at consultation activities via a QR code.

Emails sent to the list are raising awareness of upcoming project engagement activities, project updates and newsletters, and where to find more information about HumeLink.

A sample of email sent to the subscriber list is available in Section 6.4.2.

852 *subscribers to the HumeLink project email list. Distribution segments:*

- *CCGs*
- *Directly impacted landowners*
- *Project subscribers*
- *Info Distributors*

95 *EDM campaigns sent as of June 2023.*

Letterbox drops

Delivering key information directly to the letterboxes of landowners, stakeholder and community members within the project footprint and surroundings via post.

77,780 *project newsletters letterbox dropped across the project footprint.*

Reaching community members with activity notifications directly delivered to their letterbox via a letterbox drop to raise awareness of the project and EIS process. A wide distribution area has been mapped ensuring landowners, stakeholders and community members either side of the project footprint are provided with project information via hard copy materials.

Transgrid has sought to strike a balance between minimising our environmental footprint by reducing the volume of hard copy distributions however given the variable connectivity across the project footprint hard copy distribution has remained a key communication channel.

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Advertisements in local media

Advertising has been used to reach the broader community and attract interest in the HumeLink project and EIS process from a wider community audience.

***31** ads placed across **10** local newspapers.*

***4** local radio stations featured ads about HumeLink community information sessions.*

Advertising for news, information and upcoming engagement opportunities have been placed across a variety of local media channels and brands. This includes newspapers, radio and public display such as posters.

Advertising has been utilised to develop awareness of the HumeLink project and its planning and regulatory approvals stage, including the EIS. Advertising for face to face and online engagement activities has appeared on the following publisher channels:

Radio

- Sounds of the Mountains
- 2AAA
- CapitalFM

Newspaper

- Finley Riverina News
- Goulburn Post
- Griffith Area News
- Gundagai Independent
- Hay Grazier
- Sunraysia Daily
- Tumbarumba Times
- Tumut & Adelong Times
- Wagga Daily Advertiser
- Yass Valley Times

Media releases, media events and broadcast

Transgrid has distributed media releases to communicate key information about the HumeLink project to national and local news outlets.

***12** media releases distributed by Transgrid since February 2022.*

***716** media mentions of HumeLink since August 2022, reaching approximately **16.41 million** people.*

All media released can be found on the Transgrid website (transgrid.com.au). Media release subjects and release dates since 2022:

- HumeLink Scoping Report submitted as corridor refinement commences – 11 February 2022
- Transgrid announces refined route for HumeLink transmission project – 3 April 2022
- Transgrid surveys landowners as part of new Community Engagement Policy – 11 August 2022
- Australian Energy Regulator approves early works funding for HumeLink – 17 August 2022
- Transgrid welcomes strategic payments for landowners hosting new transmission – 25 October 2022
- Transgrid shortlists proponents for critical HumeLink transmission – 27 October 2022
- Transgrid welcomes landmark transmission investment in NSW – 21 December 2022
- Federal underwrite of $385 million to accelerate the energy transition and secure critical supplies – 2 March 2023
- Transgrid and Hitachi Energy sign supply contract for transmission projects – 15 March 2023.
- Transgrid graduate recruitment – 4 April 2023

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- Transgrid awards engineering scholarships – 18 May 2023
- Transgrid System Security Roadmap released - 21 June 2023.

Additionally, the HumeLink project has been mentioned in and or provided a statement to media outlets at a local and national level on occasions that have not been triggered by a Transgrid media release.

The top media publications that have mentioned the HumeLink project are:

1. Tumut and Adelong Times
2. Australian Financial Review
3. The Australian
4. Daily Advertiser
5. Tumbarumba Times
6. Wagga Wagga Daily Advertiser
7. ABC Riverina
8. Energy Magazine.

Information distributors group

Over 120 *members of the HumeLink information distributors group.*

The Information Distributors groups includes stakeholders and stakeholder groups within the community that might contribute to sharing information about project updates, upcoming engagement activities, EIS engagement channels and opportunities for feedback. Sharing project information with the information distributors group has been an effective method to extend our reach to existing and new audiences that might be interested in knowing more about the project.

4.4. Direct engagement and consultation activity

Stakeholder briefings

Regular briefings offered to key stakeholder groups to provide project updates on progress through the planning and regulatory approvals stage of the project. Used as an opportunity to receive informal feedback and to understand sentiment.

Key stakeholder briefings will continue to progress throughout the environmental approvals and detailed design of the project as well as during construction.

Regulatory stakeholder and governmental agency meetings

Ongoing consultation with regulatory stakeholders and government agencies. Meetings have occurred throughout the concept design of the project and have been formal opportunities, with the presence of technical experts, to receive feedback on EIS topics from regulatory stakeholders and governmental agencies.

Transgrid will continue to consult with government agencies and regulatory stakeholders throughout the detailed design of HumeLink as well as through the EIS approvals process.

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Local Aboriginal Land Councils (LALCs) and Traditional Owner groups briefings

Working closely with the Yura Ngura Indigenous Advisory team, the project team has held regular briefings to address the project status, potential impacts and the progress of EIS engagement. Provides a mechanism for feedback and collaboration.

***Over 20** briefings held with **15** Local Aboriginal Land Councils and Traditional Owners Groups*

In-person community information sessions

Hosted at a range of community centres along the project footprint. The sessions provided an opportunity for the community to engage with Transgrid, learn more about the project, ask questions, and provide feedback.

***44** community information drop-in sessions held in person across **11** local areas with **Over 200** community and landowner attendees.*

Events program includes a general project introduction followed by specific sessions that address the EIS topics and the EIS public exhibition. Access to design and engineering specialists was provided at these sessions.

A full schedule of in-person events can be found in Section 6.2.

Community Information Webinars

A range of webinars focused on each of the EIS specialist studies were hosted online. These webinars were hosted via Zoom and were open to all interested community members and stakeholders.

***9** community information webinars hosted online with **over 75** community and landowners registered.*

The sessions provided an opportunity for the community to learn more about different EIS technical studies prior to the public exhibition period. The webinars also provided the opportunity to engage with Transgrid, learn more about the project, ask questions, and provide feedback.

A full schedule of community information webinars can be found in Section 6.2.

Community / special interest group presentations

Meetings held with groups in the community that are interested in HumeLink or groups that have formed with a focus on the progress of HumeLink.

***28** meetings, briefings or presentations held with community or special interest groups*

Community groups engaged with include:

- Batlow HumeLink Action Group
- Bannaby Residents Action Group
- Boorowa Community Landcare Group
- HumeLink Action Group
- Kyeamba Valley Concerned Landowner Group
- Energy Users Association of Australia
- Kyeamba Valley HumeLink Transmission Network
- Mulwaree Ponds Landcare Group
- National Parks Association of NSW
- Westwood Action Group
- NSW Farmers.

Community Consultative Group (CCG) meetings

CCG meetings are a forum for discussion and feedback between HumeLink, local councils and representatives of the community on matters relating to the project.

3 CCGs established with 33 members.

27 meetings held to date across the three groups:

- *Wagga Wagga CCG*
- *Upper Lachlan*
- *Yass CCG*

Scheduled CCG meetings allow for deep dives into key topics, project updates and are used to receive feedback and local insight on proposed engagement activity. The CCG meeting agenda is driven by members feedback and interest and has provided opportunities for key additional stakeholder and engagement opportunities such as the creation of the Undergrounding Feasibility Steering Committee.

Quarterly CCG meetings commenced in October 2021 and transitioned to a monthly schedule in September 2022. From March 2023, CCG meetings have been held as combined sessions between the three groups. This change was implemented in response to feedback from CCG members.

Remote Access Community Hub (RACH)

RACH enables Transgrid to deliver an enriched engagement experience in diverse and at times remote locations.

RACH is a mobile engagement hub solution and a custom-built tool that enables community place-making in an agile and responsive way. A presence of Transgrid at community events within the HumeLink project footprint (and immediate surrounds) is important to ensure a diverse population of the community is given access to information about HumeLink. The pop-ups are designed to promote conversation and information about the project and the EIS.

From May 2023 engagement has been undertaken in communities and on properties within the following LGAs:

- Wagga Wagga City
- Snowy Valleys
- Cootamundra-Gundagai Regional
- Yass Valley
- Upper Lachlan Shire
- Goulburn-Mulwaree.

Facilitated landowner Q&A webinars

In addition to one-on-one conversations with HumeLink's Land Access Officers and Place Managers, impacted landowners were invited to attend online sessions. The webinars were designed:

6 facilitated landowner Q&A webinars with 38 attendees

- to support landowners through the easement acquisition process
- provide clear and timely information to explain the easement acquisition and property evaluation process
- present an opportunity for landowners to ask questions directly to the project team and specialists

5. Stakeholder discussions and feedback

Engagement and consultation have been undertaken across a range of stakeholder groups. Feedback received is captured in this report and is defined as comments, suggestions, questions, clarifications, enquiries and discussions.

Feedback and topics of conversation can be broadly categorised under five themes. These themes are used to highlight the interests of a given stakeholder groups.

1. **Design and construction:** project concept design and route refinement process, design of the physical and structural elements of HumeLink including transmission line structure micro-siting and tower selection, construction methodology and timeline.
2. **Environment and heritage:** Aboriginal and non-Aboriginal cultural heritage, biodiversity (flora, fauna and ecosystems) and other environmental factors included as part of the EIS.
3. **Property:** land management activities associated with the private and public lands, including operations and maintenance impacts, property and easement access, biosecurity, current and future land use and easement acquisition and compensation.
4. **Project development process and consultation:** the scope, justification and benefits of HumeLink, as well as the planning and regulatory approvals and engagement processes through the life of the project.
5. **Socio-economic:** the opportunities and constraints regarding economic development, employment and procurement.

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Overall topics of discussion for all stakeholder groups

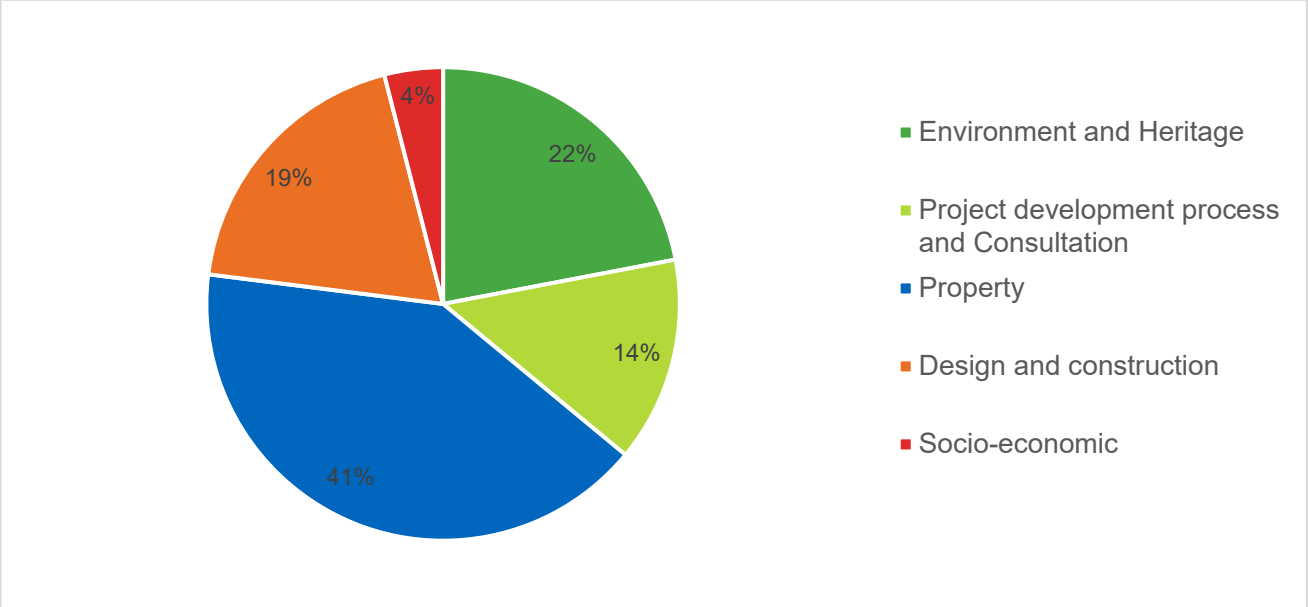


Figure 10 Engagement feedback by topics

5.1. Local Members of Parliament

Transgrid engages routinely with State and Commonwealth Members of Parliament. These interactions have provided an opportunity to share information with elected representatives on the HumeLink proposal and its benefits.

***216** engagements with local Members of Parliament, including meetings, project updates and issue-specific interactions.*

Updates regarding project timelines, approvals and community engagement activities have also been regularly provided. In turn, local Members of Parliament regularly advise Transgrid of current community views, key concerns and insights regarding the electorate.

Local Members of Parliament also represented the views of constituents to Transgrid on matters including:

- specific questions relating to the property acquisition and easement compensation process
- potential impacts to agricultural operations
- concerns regarding the proximity of the proposed transmission route to dwellings and natural land features.

Please see Section 5.6 for further details on responses to community members.

5.1.1 Commonwealth and State government departments and agencies

There were two key streams of engagement activities with government departments and agencies, which centred on the planning and regulatory approvals process.

The regulatory consultation process focused on the Regulatory Investment Test – Transmission (RIT-T). In parallel and following the regulatory consultation process, briefings and discussions relating to

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environmental planning approvals were undertaken. These focused on seeking inputs from decision makers and subject matter experts on the Secretary's Environmental Assessment Requirements (SEARs) as part of the EIS process.

Relevant topics discussed included:

- management of local environment and biodiversity, including potential offset strategies
- planning requirements, project applications and ongoing reporting
- engagement on cultural heritage matters
- project development activities.

5.1.2 Commonwealth government

As part of the regulatory engagement with government agencies, Transgrid has engaged in an ongoing basis with Commonwealth government agencies in relation to HumeLink.

***Over 100** engagements with Commonwealth government departments and agencies, including meetings, project updates and issue-specific interactions.*

The following agencies have provided comments on the HumeLink SEARs, which have been incorporated into the EIS as appropriate. Detailed information the feedback received, themes and topics and where in the EIS this has been addressed is outlined below:

Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
Department of Climate Change, Energy, The Environment and Water (DCCEEW) – formerly Department of Agriculture, Water and Environment (DAWE)	Potential impacts on Matters of National Environmental Significance including threatened species and communities, migratory species and the Australian Alps National Parks and Reserves and Snowy Mountains Scheme National Heritage places.	Environment and Heritage	Chapter 5 (Statutory context) Chapter 8 (Biodiversity) Chapter 10 (Non-Aboriginal heritage)
	Compliance with Commonwealth assessment and approval process	Project development process and consultation	
Department of Industry, Science and Resources	Australian *Jobs Act 2013* obligation and the implication on local business and local workforce involvement	Socio-economic	Chapter 12 (Economic) Chapter 13 (Social)
Crown Lands	Potential impacts to Crown Land and associated land acquisition requirements	Property	Chapter 11 (Land use and property)
	Potential impacts to Crown roads and process for access requirements through Councils	Design and construction	
Civil Aviation Safety Authority (CASA)	Potential impacts on existing Obstacle Limitation Surface (OLS) across the project footprint	Design and construction	Chapter 19 (Hazards and risks) *Technical Report 14 – Aviation Impact Assessment*
Department of Defence	Potential impacts to existing Defence Royal Australian Air Force (RAAF) base in Wagga Wagga from new transmission lines	Property	Chapter 19 (Hazards and risks)

Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
Murray Darling Basin Authority (MDBA)	Potential impacts to water quality, the riparian zone and threatened species and management under relevant regional, State and Commonwealth planning guidelines/legislation	Environment and Heritage	Chapter 17 (Surface water and groundwater quality)
Australian Rail Track Corporation (ARTC)	Potential impacts to any ARTC works including the Main South Railway line	Design and construction	Chapter 20 (Traffic, transport and access)
	Compliance with ARTC and Australian Standards, ARTC Network Rules and Procedures	Project development process and consultation	

5.1.3 NSW government

NSW Department of Planning and Environment (DPE)

Since the start of the planning and regulatory approvals stage for HumeLink, Transgrid has engaged with NSW Government agencies on an ongoing basis to discuss project updates, regulatory requirements, planning approvals, and to discuss specific project issues on an as needs basis.

Over 120 *engagements with State government departments and agencies, including meetings, project updates and issue-specific interactions.*

The following agencies have provided comments on the HumeLink's SEARs, which have been incorporated into the EIS as appropriate. Detailed information, the feedback and where in the EIS this has been addressed is outlined below:

Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
Department of Planning and Environment (DPE)	HumeLink's Biodiversity Offset Strategy and potential Biodiversity Stewardship Agreements	Environment and heritage	Chapter 2 (Strategic context and project need) Chapter 5 (Statutory context) Chapter 8 (Biodiversity) Chapter 11 (Land use and property) Chapter 14 (Landscape character and visual amenity)
	Interest in detail on vegetation clearance and associated impacts	Environment and heritage	
	Engagement with government agencies and other stakeholders such as councils	Project development process and consultation	
	EIS assessment and approval process including timeframes and additional opportunities	Project development process and consultation	
	Visual impacts (easement and non-easement affected landowners)	Design and construction	
Department of Planning and	Interest in understanding local biodiversity values	Environment and heritage	Chapter 8 (Biodiversity)

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Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
Environment – Biodiversity and Conservation Division (BCD)	Assessment methodology for biodiversity impacts including vegetation clearance approach, areas previously affected by bushfires, and assumed presence of threatened species	Environment and heritage	*Technical Report 1 – Biodiversity Development Assessment Report*
	Biodiversity management and potential offset strategies	Environment and heritage	
	Ecology surveys and fieldwork to support the development of the Biodiversity Development Assessment Report	Project development process and consultation	
	Management of inaccessible areas and land access prioritisation	Design and construction	
Heritage NSW	Cultural heritage (Aboriginal and non-Aboriginal) assessment requirements, impacts and management strategies	Environment and heritage	Chapter 9 (Aboriginal Heritage) *Technical Report 2– Aboriginal Cultural Heritage Assessment Report* Chapter 10 (Non-Aboriginal Heritage) *Technical Report 3 – Historic Heritage Impact Assessment* A Cultural Values Assessment is being prepared.
	Ensure appropriate consultation is conducted with Aboriginal stakeholders including Local Aboriginal Land Councils (LALCs) and Registered Aboriginal Parties (RAPs)	Project development process and consultation	
	Requesting Cultural Values Assessment	Project development process and consultation	
NSW Department of Primary Industries (DPI) Agriculture	Potential land use impacts and compatibility issues on agricultural land and farm businesses hosting transmission line infrastructure	Design and construction	Chapter 11 (Land use and property) and Chapter 12 (Economic) *Technical Report 4 – Agricultural Impact Assessment* *Technical Report 5 – Land Use and Property Impact Assessment*
	Current and future farming and rural land uses practices and impacts from project construction and operation stages	Socio-economic	
	Definition of prime agricultural land	Environment and heritage	
	Economic impacts, particularly on farm production and potential loss of productivity as a result of hosting transmission line on farming properties	Socio-economic	
	Landowner influence on route refinement	Design and construction	
	Easement land allocations	Property	
NSW Department of Primary	Impacts to waterway crossings, aquatic ecology and riparian vegetation	Environment and heritage	Chapter 8 (Biodiversity)

Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
Industries (DPI) Fisheries	Details of construction methodology for water quality monitoring and sourcing	Environment and heritage	*Technical Report 1 – Biodiversity Development Assessment Report* Chapter 17 (Surface Water and Groundwater Quality) *Technical Report 12 – Surface Water and Groundwater Impact Assessment*
DPE – Water (previously Natural Resources Access Regulator)	Impact assessment to include identification of an adequate and secure water supply for the life of the project	Environment and heritage	Chapter 17 (Surface Water and Groundwater Quality) *Technical Report 12 – Surface Water and Groundwater Impact Assessment*
	Assessment of potential impacts to surface and ground water sources	Environment and heritage	
Department of Regional NSW	Workforce availability and skills, and opportunities for collaboration	Socio-economic	Chapter 13 (Social) *Technical Report 7 – Social Impact Assessment*
	Workforce accommodation and potential impacts to housing	Socio-economic	
Transport for NSW (TfNSW)	Proposed transmission line crossing over state roads and potential associated impacts	Design and construction	Chapter 20 (Traffic, transport and access) *Technical Report 16 – Traffic and Transport Impact Assessment*
	TfNSW assets affected by proposed construction	Property	
	Potential impacts on road safety and capacity of current road network	Design and construction	
	Transportation of large materials and oversize loads	Design and construction	
	Traffic management during construction	Design and construction	
Forestry Corporation of NSW	Details of route options including access tracks	Environment and heritage	Chapter 4 (Project description – Construction) Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report* Chapter 11 (Land Use and Property) *Technical Report 4 – Agricultural Impact Assessment* *Technical Report 5 – Land Use and Property Impact Assessment*
	Cultural heritage significance of Red Hill State Forest	Environment and heritage	
	Transgrid land ownership structure	Property	
	Minimising impact on the plantation estate	Environment and heritage	
	Impacts on salvage harvest, and the continuing use of heavy machinery and vehicle by locals	Environment and heritage	
	Transmission line structure locations	Design and construction	
	Construction schedule	Project development	

Agency / government department	Feedback and topics raised	Theme	Where addressed in the EIS
		process and consultation	Chapter 9 (Aboriginal Heritage) *Technical Report 2– Aboriginal Cultural Heritage Assessment Report* Chapter 10 (Non-Aboriginal Heritage) *Technical Report 3 – Historic Heritage Impact Assessment*
	Bushfire risk and site access post fires	Environment and heritage	
	Biodiversity offsets strategy	Environment and heritage	
	Environmental surveys, with particular focus on flora and fauna	Environment and heritage	
NSW Rural Fire Service	Development of a bushfire assessment report to address potential risks associated with bushfires including: • ignition sources during construction and operation • operational access for firefighting appliance to the site • proposed bush fire protection measures, including vegetation management and fire suppression capabilities	Environment and heritage	Chapter 19 (Hazards and Risks) *Technical Report 13 – Bushfire Risk Assessment Report*
Fire and Rescue NSW	Requested to be consulted and given the opportunity to review the proposed fire and life safety systems, and their configuration, at the project's preliminary and final design phases	Environment and heritage	Chapter 19 (Hazards and Risks) *Technical Report 13 – Bushfire Risk Assessment Report*
SafeWork NSW	Worker accommodation strategy for the project in particular workers influx in Wagga Wagga, in consideration with the impacts of other major projects in the area	Socio-economic	Chapter 13 (Social) Chapter 20 (Traffic, transport and access)
	Worker safety during construction including workers health and wellbeing, commuting times and length, and temporary accommodation conditions	Design and construction	
Water NSW	Assessment of potential impacts to water supply infrastructure and water quality	Environment and heritage	Chapter 17 (Surface water and groundwater quality)

5.2. Local government

HumeLink traverses five local government areas (LGAs); Wagga Wagga City, Snowy Valleys. Yass Valley, Cootamundra-Gundagai and Upper Lachlan Shire. HumeLink has also engaged with two adjacent LGAs due to the close proximity to the project footprint and associated potential impacts and opportunities; Goulburn-Mulwaree and Hilltops.

Transgrid has consulted with local councils across the project footprint and surrounding areas throughout the planning and regulatory approvals stage of the project to address concerns, needs and opportunities

Official

from a local area perspective. Transgrid routinely engaged representatives of these local governments including elected Council representatives, senior management and operational staff.

Engagement with local governments included:

- Project overview and updates, focused on project milestones, key announcements, regulatory approvals, community engagement activities such as community information sessions and Community Partnership Program (CPP) timeframes.
- Consultation on the proposed transmission line corridor to better understand if and how the project may impact on local communities from an environmental, social and infrastructure perspective. The consultation also considered potential impacts on Council managed assets.
- Technical input seeking specialist input from local councils to inform project planning. This included requests for specialist land and environment information, traffic and transport data, and socio-economic data.

5.2.1 Wagga Wagga City Council

169 briefings, *project updates, subject matter specific engagement and correspondence*

Wagga Wagga City Council has been widely engaged as part of the HumeLink project, as well as other priority projects Transgrid is developing in the area (Project Energy Connect and VNI West). The HumeLink project aligns with Wagga Wagga City Council's strategic plans to strengthen energy security and drive renewable energy investment in the region.

Council noted the large infrastructure investment in the Wagga Wagga City Council area may result in consultation fatigue for the community, which has been noted by Transgrid and implemented in its approach to community engagement when it relates to the different projects being developed in the area. Similar to this, Transgrid has also consider the impacts from the current and planned infrastructure projects in the area in consideration of the worker availability, worker accommodation and construction compounds. These have been topics of ongoing conversation with Council.

Transgrid has had ongoing engagement with Wagga Wagga City Council in regard to the proposed Gugaa 500 kV substation as well as the potential impacts on the Gregadoo waste facility as part of both the Project Energy Connect and HumeLink projects.

Theme	Feedback	Where addressed in the EIS
Project development process and consultation	Community consultation fatigue in the Wagga Wagga area due to a number of large infrastructure projects happening concurrently	Chapter 2 (Strategic context) Chapter 13 (Social) Chapter 25 (Cumulative impacts)
Design and construction	Gugaa substation location and associated construction works	
Design and construction	Proximity of the project to the Gregadoo waste facility	
Design and construction **Environment and heritage**	Consideration of renewable energy opportunities within the area and how that can link to HumeLink	

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Theme	Feedback	Where addressed in the EIS
Socio-economic	Engaging with the local university and students	
Socio-economic	Worker accommodation and construction compounds	
Socio-economic	Building social licence	

5.2.2 Snowy Valleys Council

Transgrid's engagement with Snowy Valleys Council goes back to the Snowy 2.0 Transmission Connection Project. Some of the relationships built during the development of this project have been maintained throughout different stages of the HumeLink project.

***279** briefings, project updates, subject matter specific engagement and correspondence*

Engagement has contributed to an ongoing relationship enabling open discussions on critical project topics such as:

- route selection
- design and construction
- planning and regulatory approvals
- potential impacts from construction and operation of the project

Transgrid has also had ongoing engagement with Council in relation to the opportunities for temporary accommodation for the construction workforce and temporary construction compounds. These conversations have also included potential economic benefits to the region from attracting construction workers to the area as well as legacy and community investment opportunities for the Snowy Valleys area.

Theme	Feedback	Where addressed in the EIS
Design and construction	Route selection process including detail on approach to Kosciuszko National Park and Blowering route options	Chapter 2 (Strategic context and project need) Appendix E Options Report Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 19 (Hazards and risks), *Technical Report 13 – Bushfire Risk Assessment Report* *Technical Report 14 – Aviation Impact Statement* Chapter 20 (Traffic, transport and access)
Property	Process for managing easements	
Property	Impacts on Tumut Airport OLS and other aviation safety measures	
Environment and heritage	Bushfire risks and fire hazard, including ability to fight fires in areas with transmission lines	
Environment and heritage	Impacts to visual amenity	
Socio-economic	Benefits to Snowy Valleys region and potential legacy and community investment projects	
Design and construction	Impacts to local road network	

5.2.3 Upper Lachlan Shire Council

Ongoing consultation with Upper Lachlan Shire Council has focused on key topics including the potential cumulative impacts of the project in consideration of the existing infrastructure in the LGA (this includes existing transmission line network as well as existing and proposed wind farms). Particular focus has been given to potential visual impacts from the project.

193 *briefings, project updates, subject matter specific engagement and correspondence*

Council has also raised concerns about potential impacts to the local road network, particularly road safety from increased heavy vehicle movement during construction. This has led to conversations about potential opportunities for community investment and legacy projects in this area.

Theme	Feedback	Where addressed in the EIS
Socio-economic	Potential cumulative impacts on existing infrastructure	Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity) Chapter 25 (Cumulative impacts) Chapter 20 (Traffic, transport and access) *Technical Report 16 – Traffic and Transport Impact Assessment* Chapter 12 (Economic) *Technical Report 6 – Economic Impact Assessment*
Environment and heritage	Impacts to visual amenity	
Socio-economic	Impacts to tourism due to decreased visual amenity	
Design and construction	Impacts to local road network – particularly road safety	
Property	Process for landowner compensation	
Socio-economic	Impacts on community investment, legacy and overall benefits of HumeLink to the region	

5.2.4 Cootamundra-Gundagai Regional Council

Cootamundra -Gundagai Regional Council's main topics of interest in relation to HumeLink have included route selection process and associate impacts to visual amenity in the LGA.

99 *briefings, project updates, subject matter specific engagement and correspondence*

Council has also shown interest in knowing more about the potential electric and magnetic fields (EMF) impacts as a result of HumeLink.

Following the impacts from the flooding in late-2022, Council has also raised concerns about the conditions of their road infrastructure, particularly if these roads are intended to be used for heavy vehicle movement during construction.

Theme	Feedback	Where addressed in the EIS
Design and construction	Impacts from EMF	Chapter 2 (Strategic context and project need) Chapter 11 (Land use and property), Chapter 13 (Social) Chapter 14 (Landscape character and visual amenity)
Design and construction	Impacts to local road network – particularly heavy vehicle movement	
Design and construction	Deterioration of road condition from previous flooding events	

Theme	Feedback	Where addressed in the EIS
Project development process and consultation	Community consultation fatigue from other projects in the Cootamundra-Gundagai area	Chapter 18 (Hydrology and flooding) Chapter 19 (Hazards and risks) Chapter 20 (Traffic, transport and access) *Technical Report 16 – Traffic and Transport Impact Assessment* Chapter 25 (Cumulative impacts)
Environment and heritage	Visual impact, transmission line structure and line positioning to existing residences	
Project development process and consultation	Compulsory acquisition process	
Project development process and consultation	Project timeline and planning and regulatory approvals process	
Design and construction	Details on route selection process	

5.2.5 Yass Valley Council

Over the past years, Yass Valley Council has experienced a population increase and as such has raised the challenge of housing availability and affordability. This has led to conversations about workforce accommodation and potential impacts associated to influx of temporary workforce.

***129** briefings, project updates, subject matter specific engagement and correspondence*

Council has also highlighted that a project like HumeLink will provide employment opportunities for the entire area, which consequently will have a positive impact from an economic point of view.

Engagement with Council has also focused on potential visual impact, particularly in those areas where HumeLink will parallel with existing transmission lines.

Theme	Feedback	Where addressed in the EIS
Environment and heritage	Visual impact, transmission line structure and line proximity to existing residences	Chapter 12 (Economic) *Technical report 6 – Economic Impact assessment* Chapter 13 (Social) *Technical Report 7 – Social Impact Assessment* Chapter 14 (Landscape character and visual amenity) *Technical Report 8 – Landscape Character and Visual Impact Assessment* Chapter 16 (Soils, geology and contamination) *Technical Report 10 Phase 1 Contamination Assessment*
Socio-economic	Employment opportunities for the Yass Valley area	
Socio-economic	Population influx in LGA and impacts to housing and availability of accommodation	
Environment and heritage	Water and soil management during construction (spoil transport and management)	
Environment and heritage	Detail on bushfire hazard assessment completed for HumeLink	
Environment and heritage	Aboriginal heritage impacts	
Socio-economic	Community investment and community enhancement opportunities	

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Theme	Feedback	Where addressed in the EIS
		Chapter 17 (Surface water and groundwater) *Technical Report 12 – Surface Water and Groundwater Impact Assessment* Chapter 19 (Hazards and risks) *Technical Report 13 – Bushfire Risk Assessment* Chapter 25 (Cumulative impacts)

5.2.6 Goulburn – Mulwaree Council

84 briefings, project updates, subject matter specific engagement and correspondence

While HumeLink transmission line corridor does not traverse the Goulburn – Mulwaree Local Government Area there might be indirect impact as workers and materials are likely to travel through the area as well as opportunities such as local employment.

In conversation with Goulburn – Mulwaree Council it has also been brought to Transgrid's attention the potential impacts to tourism as Council manages Pejar Dam.

Theme	Feedback	Where addressed in the EIS
Environment and heritage	Assessment on presence of Golden Sun Moth	Chapter 2 (Strategic context and project need) Chapter 8 (Biodiversity) *Technical Report 1 – Biodiversity Development Assessment Report* Chapter 14 (Landscape character and visual amenity) *Technical Report 8 – Landscape Character and Visual Impact Assessment*
Design and construction	Route selection process	
Environment and heritage	Potential impacts tourism to Pejar Dam	

5.2.7 Hilltops Council

23 briefings, project updates, subject matter specific engagement and correspondence

While HumeLink does not traverse the Hilltops LGA there is the potential for indirect impacts as workers and materials are likely to travel through the area as well as opportunities such as local employment.

Theme	Feedback	Where addressed in the EIS
Socio-economic	Socio-economic impacts and community investment opportunities	Chapter 12 (Economic) Chapter 13 (Social)

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5.3. Traditional Owners and other Aboriginal groups

Engagement with Aboriginal and First Nations stakeholders has focused on sharing project information and facilitating field work, including participation in cultural heritage surveys, geotechnical surveys and test pit excavations to support the development of the Aboriginal Cultural Heritage Assessment Report (ACHAR) for HumeLink. First Nations representatives have also been invited to be part of HumeLink Community Consultative Groups.

***Over 20** briefings, project updates, subject matter specific engagement and correspondence*

Registered Aboriginal Parties (RAPs) have been actively engaged during the development of cultural heritage assessment methodologies and have had access to the draft ACHAR for comment.

RAPs have also indicated a willingness to continue participating and speaking for Country across aspects of project development (site walkthroughs) and activities associated with the construction stage of the project.

Detailed information on consultation with Aboriginal stakeholders, including HumeLink RAPs can be found in Chapter 6 – Engagement and Chapter 9 – Aboriginal Heritage and Technical Report 2 – Aboriginal Cultural Heritage Assessment Report.

From a cultural perspective, groups have advised that Transgrid should implement culturally appropriate ceremonies of recognition aligned with project activity and milestones. This also includes acknowledgment when visiting to cultural places on private land to explore shared values and enhance cultural heritage.

Transgrid is also undertaking a Cultural Values Assessment (CVA) to better understand Aboriginal cultural heritage within the HumeLink project footprint and its surroundings. Furthermore, as part of the Early Contractor Involvement (ECI) process, Transgrid is also working with the shortlisted tenderers to co-design the scope of the construction contract in relation to workforce and workforce development, and local industry participation, particularly Aboriginal business participation.

5.4. Community Consultative Groups (CCG)

Transgrid established three independently facilitated CCGs, which include a range of stakeholders including local government authorities, impacted landowners, and interested community members. The CCGs are one of many means by which Transgrid engage with communities and stakeholders and provide the opportunity to give feedback and guidance. CCGs are a forum for consultation, not a decision-making body.

***3** CCGs established with **33** members held **27** meetings to date across the three groups:*

- *Wagga Wagga CCG*
- *Upper Lachlan Yass CCG*
- *Snowy Valley CCG*

Below is a summary of key themes and topics discussed within the CCG meetings from their inception in October 2021 to the latest meetings held in April 2023. From March 2023 onwards, CCG members and Transgrid amalgamate the three groups into one. Detailed CCG meeting minutes are available on the HumeLink webpage.

Theme	Relevant topic of feedback	Transgrid response	CCG
Design	**Transmission tower structures**	Transgrid has provided CCG ongoing design updates as part of the monthly meetings. Current design of the HumeLink towers is based on steel lattice towers with heights that range between 50 and 76m. Tower height depends on different variables including type of tower and topographic conditions. The final location and specification of each transmission tower will depend on a range of factors such as the distance between each transmission tower, local geotechnical conditions, local environmental constraints. The type and arrangement of the structures would be refined during detailed design.	Snowy Valley CCG Upper Lachlan – Yass CCG
Design	**Route refinement:** - Route refinement and options	Route refinement and route options are addressed in the Options Report which is included as Appendix E of the EIS. Macroplan was engaged to undertake a 'Red Hat' review of the transmission line corridor in the Tumut and Bannaby areas focusing on feedback and input from the HumeLink Action Group, Bannaby Residents Action Group and impacted landowners. The review considered options prepared by Transgrid along with route options through the Green Hills State Forest and hybrid combinations of the above.	Snowy Valley CCG Upper Lachlan – Yass CCG Wagga Wagga CCG Gundagai combined CCG
Design	**Undergrounding of HumeLink**	Transgrid agreed to undertake a joint undergrounding feasibility study together with the community to investigate the feasibility of undergrounding the transmission line as an alternative to overhead lines and formed the Undergrounding Feasibility Steering Committee. Transgrid also commissioned an independent assessment of the feasibility to underground HumeLink. GHD Pty Ltd (GHD) was engaged to investigate concept designs for transmission network options for HumeLink using underground cables, with expert advice on high voltage direct current projects provided by Stantec. The findings of the review were documented in the report Concept Design and Cost Estimate – HumeLink Project – Underground (GHD, 22 August 2022). The report is available on Transgrid's website: https://www.transgrid.com.au/media/y0mpqzvw/humelink-project-underground-report-august-2022-final.pdf The cost of undergrounding the HumeLink transmission lines was estimated to be around three times more than the entire project's current cost. Undergrounding transmission lines would also mean a significant delay in completion of the project by up to five years. Based on the findings from the report, undergrounding HumeLink would not be consistent with the rules that require Transgrid to propose the most efficient option for	Snowy Valley CCG Upper Lachlan – Yass CCG Wagga Wagga CCG Gundagai combined CCG

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Theme	Relevant topic of feedback	Transgrid response	CCG
		consumers based on the capital cost of the solution, the ongoing operational costs, the market benefits, the expected reliability, and the costs associated with the impact on landowners, the community, and the environment.	
Design	**Tower location**	A concept design has been prepared for the project that identifies indicative tower locations. Ongoing engagement with landowners regarding tower location as the project design progresses. Final tower locations will be selected by the project delivery partners during detailed design.	Upper Lachlan – Yass CCG Snowy Valley CCG
Environment and heritage	**Visual impact assessment and management measures**	HumeLink EIS includes a Landscape Character and Visual Impact Assessment to understand potential impact and mitigation or management measures. February 2023 CCG meeting focused on discussing this EIS specialist study.	Upper Lachlan – Yass CCG Snowy Valley CCG Wagga Wagga CCG Gundagai combined CCG
Environment and heritage	**Biodiversity offsets:** Requested details on how biodiversity offsets are calculated and how the Biodiversity Offset Scheme works.	Transgrid has progressed identification of specific biodiversity offset requirements for HumeLink though the Biodiversity Development Assessment Report (BDAR), which forms part of the EIS.	Upper Lachlan – Yass CCG Snowy Valley CCG Wagga Wagga CCG
Environment and heritage	**Bushfire risk**	Bushfire risk considered as part of the EIS chapter on Hazards and Risks with an associated Technical Report on Bushfire Risk Assessment. Ongoing meetings with NSW RFS working to identify how Transgrid can further support firefighting efforts, communications, access tracks and assets. Targeted learning sessions with local RFS crews. First Bushfire Management Workshop held with the Snowy Valleys stakeholders in July 2022. Bushfire Management Workshop with the community will be held in late 2023.	Upper Lachlan – Yass CCG Snowy Valley CCG Gundagai combined CCG
Environment and heritage	**Biosecurity:** concerns about cross contamination and how are biosecurity measures put in place.	Biosecurity measures are defined in the contract with HumeLink delivery partners as part of the Construction Environment Management Plan. Biosecurity measures are covered on a case-by-case basis via the Property Management Plans. These will cover weed and pest management (both terrestrial and aquatic). Transgrid has made available a set of Biosecurity Measures Frequently Asked Questions on the project website.	Upper Lachlan – Yass CCG

Theme	Relevant topic of feedback	Transgrid response	CCG
Environment and heritage	**Impacts to agricultural land**	Potential impacts to agricultural land and agricultural activities, and mitigation and management measures are considered as part of the Agricultural Impact Assessment – part of the HumeLink Environmental Impact Statement. Specific EIS topic was discussed at February 2023 CCG meetings	Upper Lachlan – Yass CCG Snowy Valley CCG Wagga Wagga CCG Gundagai combined CCG
Environment and heritage	**Consultation with local Aboriginal communities**	Consultation with First Nations stakeholders and RAPs has occurred as part of the ACHAR – which forms part of the EIS. This consultation has included RAPs taking part on the test pit excavations and associated Aboriginal heritage surveys. Transgrid is also undertaking a Cultural Values Assessment (CVA) to better understand Aboriginal cultural heritage within the HumeLink project footprint and its surroundings.	Upper Lachlan – Yass CCG
Environment and heritage	**Noise**	Potential noise and vibration impacts are considered as part of the Noise and Vibration Impact Assessment which forms part of the EIS	Snowy Valley CCG Gundagai combined CCG
Environment and heritage	**Air Quality**	Potential air quality impacts are considered as part of the Air Quality Impact Assessment which forms part of the EIS.	Gundagai combined CCG
Environment and Heritage	**Maintenance of local road infrastructure**	Potential impacts to the existing road network are assessed as part of the Traffic and Transport Impact Assessment which forms part of the HumeLink EIS. Prior to construction, road dilapidation surveys will be carried out in consultation with road authorities. The surveys will assess the current condition of the road surface. On completion of project construction, a subsequent road condition assessment will be prepared to assess the damage to roads accessed by project related traffic. Any damage caused by the project will be rectified in consultation with the relevant road authority.	Upper Lachlan – Yass CCG Snowy Valley CCG Gundagai combined CCG
Property	**Property acquisition and compensation process and recently announced Strategic Benefits Payment**	Property acquisition and compensation process guided by the legislative requirements under the *Just Terms Act*. Landowners have a dedicated Land Access Officer and Place Manager to liaise with during the process. Information on the process and channels available to landowners can be found on the project website: Landowner compensation brochure Information on Strategic Benefits Payment Scheme can be found on the NSW Government website: Strategic Benefit Payments Scheme | EnergyCo (nsw.gov.au)	Upper Lachlan – Yass CCG Snowy Valley CCG Wagga Wagga CCG Gundagai combined CCG

Official

Theme	Relevant topic of feedback	Transgrid response	CCG
Property	**Impacts on aerial spraying**	Place Managers / Land Access Officers will work with landowners to capture property specific provisions within the Property Management Plan. Potential aviation impacts are considered as part of the Aviation Impact Assessment which forms part of the EIS	Upper Lachlan – Yass CCG Snowy Valley CCG
Project development process and consultation	**Consultation with near neighbours**	Transgrid has implemented an ongoing approach to engagement with near neighbours including those properties that are adjacent to the directly impacted landowners, as well as all properties located within a 2km buffer either side of the project footprint.	Upper Lachlan – Yass CCG Snowy Valley CCG Gundagai combined CCG
Project development process and consultation	**Community investment and benefits**	This matter has been considered as part of the HumeLink Community Investment and Benefits Plan which includes: • Social legacy • Care for Country • Accessible housing • Local business opportunities • Community connectivity • Workforce development	Upper Lachlan – Yass CCG Snowy Valley CCG Wagga Wagga CCG
Project development process and consultation	**Community engagement** HumeLink Community Information Sessions: where and how have they been advertised, how often do they occur and who are they suitable for (previous RSVP process for the sessions).	In 2022 Transgrid applied an RSVP process for the Community Information process as part of the COVID-19 approach – to ensure appropriate size of venue was considered in line with number of RSVPs for the sessions. From 2023 onwards, sometimes Transgrid will ask people to register for sessions to better understand staffing requirements at each session. RSVP process is also used to allow community members and stakeholders to register to receive project updates following the community sessions, and in some cases to follow up with additional information where required. HumeLink webinars will continue to have a strict RSVP process as this allows registered community members and stakeholders to get relevant updates on each webinar as well as registration and access links.	Upper Lachlan – Yass CCG Snowy Valley CCG Gundagai combined CCG
Project development process and consultation	**Regulatory process**	Transgrid have provided CCG members with ongoing updates on project progress, including a diagram presenting how planning and regulatory approvals processes are undertaken as part of HumeLink.	Wagga Wagga CCG
Socio-economic	**Impact of project on social and mental health**	Potential social and mental health impacts of the project are assessed as part of the Social Impact Assessment within the EIS. Transgrid put in place a number of measures to be proactive providing support such as setting up a free independent counselling service to impacted landowners. Place Managers and Land Access Officers also actively promoted the free counselling service.	Upper Lachlan – Yass CCG Snowy Valley CCG

5.5. Exploration licence and mineral title holders

Consultation with exploration licence and mineral title holders has started via direct communication with each of the title holders. Where required, initial consultation has been followed up via arranging meetings to discuss project updates and route refinement.

Consultation will continue during the construction stage as required in line with the Community and Stakeholder Engagement Management Plan (CSEMP).

5.6. Landowners and community members

Theme	Relevant topic of feedback	Engagement activity where feedback was received
Design and Construction	**Potential option to underground transmission lines:** • Undergrounding assessment outcomes • Technical assessment process • Financial feasibility • Visual impact of overhead transmission lines • Environmental impacts	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox • Project hotline number
Design and Construction Environment and Heritage	**Electric and magnetic fields (EMF):** • EMF impacts to grazing and stock under transmission lines • EMF related health impacts	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox
Design and Construction	**Transmission line route and structure locations:** • Transmission line structure and route location need to consider topography to reduce visual impact • Need confirmation of the transmission line structure locations • Requirements and regulations around distances between the transmission lines and residential properties • Why the project is not located in the big cities where the power is going	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox
Design and Construction	**Route options:** • Decision around Blowering option, and through Kosciuszko National Park. • Route option in Bannaby • General “why” around route selection process – aligning line wherever possible to the existing lines • How HumeLink would connect with surrounding projects (VNI West and EnergyConnect) • Western Route option (Green Hills)	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox

Theme	Relevant topic of feedback	Engagement activity where feedback was received
Design and Construction **Environment and Heritage** **Property**	**Visual amenity and impact:** • Visual impact to neighbouring landowners • Potential compensation options to mitigate visual impact to neighbouring properties • General visual amenity concerns	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox • Project hotline number
Property **Environment and Heritage**	**Biosecurity:** • Adherence to biosecurity measures when accessing property • Biosecurity measures within properties that have contained weeds and pests in certain areas. Concerns about project team moving around property and spreading weeds around different locations within a property • General biosecurity concerns • Impact to aerial spraying and weed control • Minimise cross contamination during soil remediation and weed control	• HumeLink interactive map • Community Information Sessions • Community Information Webinars • Landowner interactions • Project inbox • Project inbox
Environment and Heritage **Design and Construction**	**Vegetation:** • Transgrid strategies to minimise vegetation clearance	• HumeLink interactive map • Community Information Sessions • Landowner interactions
Environment and Heritage	**Aboriginal Heritage:** • Aboriginal heritage sites located on directly impacted land • Assessment process for EIS	• HumeLink interactive map • Community Information Sessions • Landowner interactions
Environment and Heritage	**Historic Heritage:** • Historic properties around the Bannaby area	• HumeLink interactive map • Project inbox • Project hotline number
Environment and Heritage	**Ecology:** • Response to ecology report Bannaby Residents Action Group submitted to Transgrid • Threatened species – location and species identified on interactive map • Native lilies and orchids • Ecological sensitivity around Bannaby Creek, part of the Sydney catchment. • Plant species identified on Tomneys Plains • Impacts on national parks and State forests • Impacts to koala population	• HumeLink interactive map • Community Information Sessions • Landowner interactions

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Theme	Relevant topic of feedback	Engagement activity where feedback was received
Design and Construction	**Renewable energy:** • Potential interactions with local wind farms	• Community Information Sessions
Design and Construction	**Traffic and transport:** • Impact on local roads and road maintenance • Use of private access tracks • Potential increase of traffic and impacts to public safety	• Community Information Sessions • Landowner interactions
Project development process and consultation	**Corporate interest:** • Project funding	• Community Information Sessions • Landowner interactions
Project development process and consultation Design and Construction	**Project status:** • Confirmation that HumeLink construction had not started and work on existing transmission lines is not related • Project timeline • Consultation prior to EIS public exhibition and timings for EIS exhibition	• HumeLink interactive map • Community Information Sessions • Community information webinars • Landowner interactions
Project development process and consultation	**Delivery partners:** • Contractor worker safety protocols • Safe Works to be engaged ahead of start of construction to discuss worker safety matters • Announcement of HumeLink delivery partners	• Community Information Sessions
Project development process and consultation	**Regulatory:** • Consideration of the weighting of impacts to private landowners in comparison to other aspects of the EIS such as Aboriginal heritage • NSW legislative framework for EIS and Property Acquisition and Compensation process	• Community Information Sessions • Landowner interactions
Project development process and consultation Property Socio-economic	**Landowner consultation:** • Not enough contact and communication with Land Access Officer and Place Manager • Perceived lack of genuine consultation with landowners • Open forum with Transgrid Executives requested • Strategic Benefits Payment • Dissatisfaction with property valuation	• HumeLink interactive map • Community Information Sessions • Community information webinars • Landowner interactions

Theme	Relevant topic of feedback	Engagement activity where feedback was received
	• Visual impact to neighbouring landowners • Public availability of photomontages and project visualisations	
Environment and Heritage **Socio-economic**	**Tourism property:** • Impact to future tourism opportunities on properties impacted by visual amenity (Airbnb and B&Bs)	• HumeLink interactive map • Community Information Sessions • Landowner interactions
Property **Environment and Heritage** **Socio-economic** **Project process**	**Property impacts:** • Compensation for neighbouring properties (not in project footprint) • Compensation information provided to some property owners but not others • Request to evaluate options for ongoing (annual) compensation due to ongoing impact on land value and productivity of land • Land value impact • Impact on land use during construction • Impact and management of livestock during construction • Impact to existing irrigation infrastructure • Impact to aerial spraying from hosting transmission lines on property • Vegetation clearing impact to timber industry • Strategic Benefits Payment	• HumeLink interactive map • Community Information Sessions • Community information webinars • Project inbox • Landowner interactions
Socio-economic	**Workforce:** • Workforce management issues including worker shortage due to scale of major projects in the area • Worker accommodation during construction in/near the town to support the economy • Increased demand for social infrastructure and social services from non-local workers supporting the project during construction	• Community Information Sessions
Socio-economic	**Local partnerships:** • Opportunities to partner with local Taralga/Bannaby initiatives, including the local showground refurbishment • Opportunities for communities and community groups to partner with the project for community investment and social legacy opportunities • Local business opportunities • Community Partnerships Program	• Community Information Sessions • Community information webinars

Theme	Relevant topic of feedback	Engagement activity where feedback was received
Socio-economic	**Impacts to mental health particularly from property acquisition process**	• Community Information Sessions • Landowner interactions
Existing Transgrid infrastructure	**Asset management:** • Asset management and existing easement maintenance – issues related to existing transmission lines flagged by community members. • Ongoing maintenance costs.	• Community Information Sessions • Landowner interactions

6. Referenced information

6.1. Key stakeholders

Stakeholder group	Stakeholders
Government – Political representatives	• Commonwealth Minister for Climate Change and Energy – Hon. Chris Bowen MP • Commonwealth Minister for the Environment and Water – Hon Tanya Plibersek MP • Commonwealth Shadow Minister for Energy – Ted O'Brien MP • NSW Minister for Environment and Minister for Heritage – Penny Sharpe MLC • NSW Minister for Planning – Paul Scully MP • Former NSW Minister for Energy and Environment – Matthew Kean MP • Former NSW Minister for Planning – Anthony Roberts MP
Energy Regulator / Operator	• Australian Energy Market Operator • Australian Energy Regulator • Australian Energy Market Commission • Energy Security Board
NSW Members of Parliament (and others where appropriate)	*Commonwealth* • Angus Taylor, Hume • Kristy McBain, Eden-Monaro and Minister for Regional Development, Local Government and Territories • Michael McCormack, Riverina *State Members* • Joe McGirr, Wagga Wagga • Wendy Tuckerman, Goulburn • Stephanie Cooke, Cootamundra • Justin Clancy, Albury
Local government	• City of Wagga Wagga Council • Snowy Valleys Council • Upper Lachlan Shire Council • Cootamundra–Gundagai Regional Council • Yass Valley Council • Goulburn–Mulwaree Council • Hilltops Council
Government agencies	**Commonwealth Government** • Department of Climate Change, Energy, The Environment and Water (DCCEEW, formerly Department of Agriculture, Water and Environment – DAWE) • Department of Industry, Science and Resources • Crown Lands • Civil Aviation Safety Authority (CASA) • Department of Defence • Murray Darling Basin Authority (MDBA) • Australian Rail Track Corporation (ARTC)

Stakeholder group	Stakeholders
	NSW Government • NSW Department of Planning and Environment (DPE) ○ NSW Environment Protection Authority ○ WaterNSW • Biodiversity and Conservation Division (BCD) • Heritage NSW • Department of Regional NSW ○ NSW Forestry Corporation • DPI Agriculture • DPI Fisheries • NSW Treasury ○ Office of Energy and Climate Change ○ Energy Corporation of NSW (EnergyCo) • NSW Department of Education • Transport for NSW • Centre for Property Acquisition (NSW) • NSW Rural Fire Service • Fire and Rescue NSW • Health NSW • SafeWork NSW • Local police, ambulance, and fire services
Directly impacted landowners (within project footprint)	Landowners who will be impacted by project infrastructure (temporary or permanent).
Indirectly impacted landowners or "Near Neighbours" (outside of project footprint)	Landowners who are not easement affected and outside of the project footprint who might experience construction or operation impacts as a result of the project.
Traditional Owners and other Aboriginal groups	• Brungle Tumut LALC • Wagga Wagga LALC • Onerwal LALC (Yass) • Pejar LALC (Goulburn) • Wagonga LALC (Narooma) RAPs • Thunderstone Aboriginal Cultural Services Pty Ltd • Buru Ngunnawal Aboriginal Corporation • Bidy Marra Consultancy • Gunjeewong Cultural Heritage • Murrabidgee Mullaangari • Muragadi Heritage Indigenous Corporation • PD Ngunawal Consultancy • Konanggo Aboriginal Cultural Heritage Services • Yurwang Gundana Cultural Heritage Services • Ngurambang • Bundyi Aboriginal Cultural Knowledge • Ngunnawal Elders Corporation • Gulgunya Ngunawal Heritage Aboriginal Consultancy (GNHAC) • Ngunawal Heritage Aboriginal Corporation • Bangerang Aboriginal Corporation • Didge Ngunawal clan • Corroboree Aboriginal Corporation • 19 individual RAPs

Official

Stakeholder group	Stakeholders
Community Consultative Groups (CCGs)	• Yass and Upper Lachlan • Snowy Valleys • Wagga Wagga and Cootamundra-Gundagai
Community / special interest groups	• Special interest groups • HumeLink Action Group (HAG) • Bannaby Residents Action Group (BRAG) • Kyeamba Valley Concerned Landowners Group • Yass Valley Group • HumeLink Alliance • Progress associations • Service groups • Local business chambers
Local community	Communities within local government areas listed below: • Wagga Wagga City Council • Snowy Valleys Council • Upper Lachlan Shire Council • Cootamundra–Gundagai Regional Council • Yass Valley Council • Goulburn–Mulwaree Council • Hilltops Council
Local suppliers	Suppliers within project footprint and local government areas listed above
Other suppliers	Greater-NSW and Australian suppliers
Industry groups	• Energy Networks Australia • Infrastructure Partnerships Australia • Clean Energy Council • Business Council of Australia
Unions	• Electrical Trade Union • Construction, Forestry Maritime, Mining and Energy Union
Service providers / utilities	Existing utility and service providers in the region including Telstra, WaterNSW, local water utilities and other communications providers
Exploration Licence holders **Quarry operators** **Mineral title holders**	• New South Resources Pty Ltd • Cullarin Metals Pty Ltd • Godolphin Tenements Pty Ltd • Legacy Minerals Pty Ltd • Rox 1 Pty Ltd • Carbozorb Pty Ltd • Aurum Metals Pty Ltd • Trk Resources Pty Ltd • New Base Metals Pty Ltd • Right Resources Pty Ltd • Wildcat Gold Pty Ltd • Right Resources Pty Ltd • Gilmore Metals Pty Ltd.
Media	Local, State and National print, radio and television

Stakeholder group	Stakeholders
General public	Members of the public outside the project footprint who may take an interest in the project
Energy customer groups	• Public Interest Advocacy Centre (PIAC) • Energy Users' Association of Australia (EUAA) • Energy Consumers Australia (ECA) • St Vincent de Paul • Tesla • AiGroup • Australian Energy Infrastructure Commissioner (AEIC) • Transgrid Advisory Council (TAC) • Landowner Advocate
Education and training providers	• Charles Sturt University • TAFE NSW

6.2. Community information session timeline

In-person events

Date	Location
13 September 2022 11am	Yass Soldiers Memorial Hall
13 September 2022 5pm	
14 September 2022 11am	Valmar, Tumut
15 September 2022 11am	Literary Institute, Batlow
15 September 2022 5pm	
16 September 2022 11am	Glenfield Community Centre, Wagga Wagga
16 September 2022 5pm	
17 September 2022 10am	Valmar, Tumut
20 September 2022 11am	Taralga War Memorial, Taralga
20 September 2022 5pm	
21 September 2022 5pm	Gundagai District Services Club, Gundagai
24 October 2022 5pm	Crookwell Memorial Hall, Crookwell
25 October 2022 11am	Gunning Shire Hall, Gunning
25 October 2022 5pm	
26 October 2022 5pm	Adelong Showground Pavilion, Adelong
27 October 2022 11am	Tarcutta Memorial Hall, Tarcutta
27 October 2022 5pm	Tumbarumba Motel and Elms Restaurant, Tumbarumba
21 February 2023 11am	Valmar, Tumut
21 February 2023 4pm	
22 February 2023 11am	Adelong District Services Club, Adelong
23 February 2023 11am	Lake Albert RSF, Wagga Wagga
23 February 2023 4pm	
27 February 2023 4pm	Tarcutta Memorial Hall, Tarcutta
28 February 2023 11am	Tumbarumba Motel, Tumbarumba
28 February 2023 4pm	
1 March 2023 11am	Literary Institute, Batlow
2 March 2023 11am	Gundagai District Services Club, Gundagai
7 March 2023 11am	Crookwell Memorial Hall, Crookwell
7 March 2023 4pm	Gunning Shire Hall, Gunning
8 March 2023 11am	Yass Soldiers Memorial Hall
8 March 2023 4pm	
9 March 2023 11am	Taralga War Memorial, Taralga
9 March 2023 4pm	
22 May 2023 4pm	Kooringal Mall, Wagga Wagga
23 May 2023 11am	Valmar Support Services, Tumut
24 May 2023 11am	Gundagai District Services Club, Gundagai

Date	Location
24 May 2023 4pm	Literary Institute, Batlow
25 May 2023 11am	Adelong District Services Club, Adelong
25 May 2023 4pm	Tumbarumba Motel and Elms Restaurant, Tumbarumba
29 May 2023 4pm	Yass Soldiers Memorial Hall
30 May 2023 11am	Crookwell Memorial Hall, Crookwell
30 May 2023 4pm	Gunning Shire Hall, Gunning
31 May 2023 11am	Taralga War Memorial, Taralga
31 May 2023 4pm	

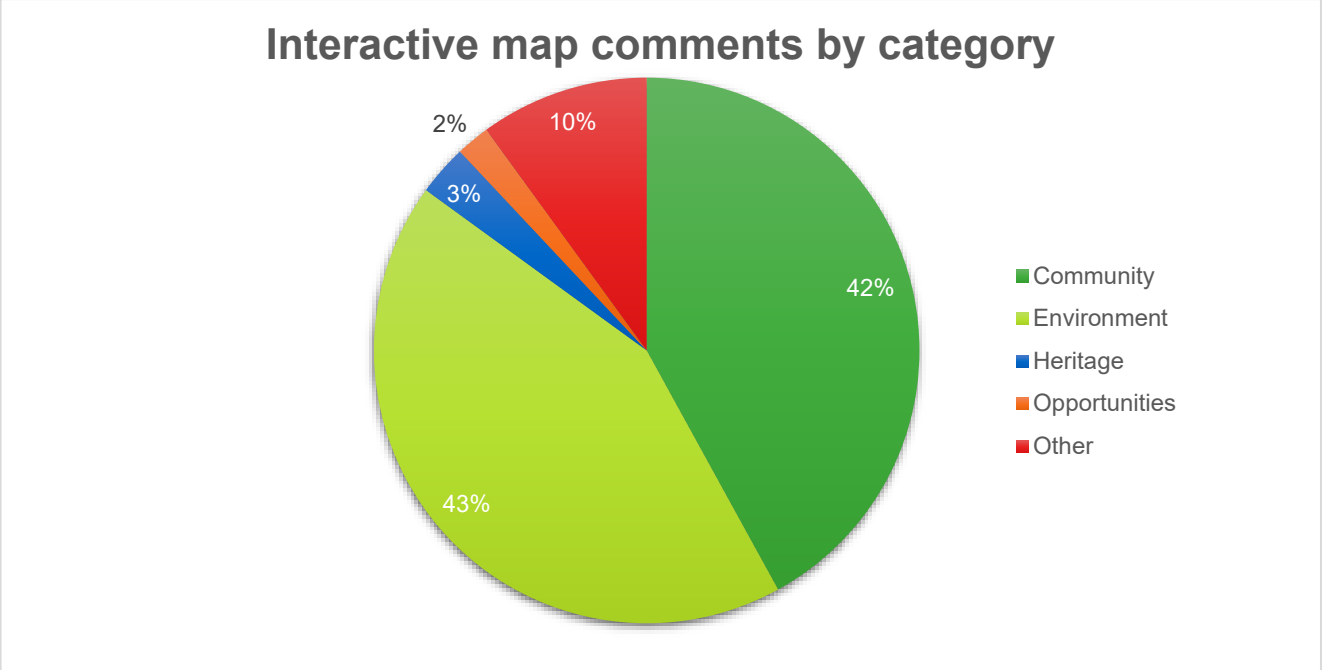
Further rounds of community information sessions are planned to be undertaken during the EIS public exhibition stage.

Online webinar events

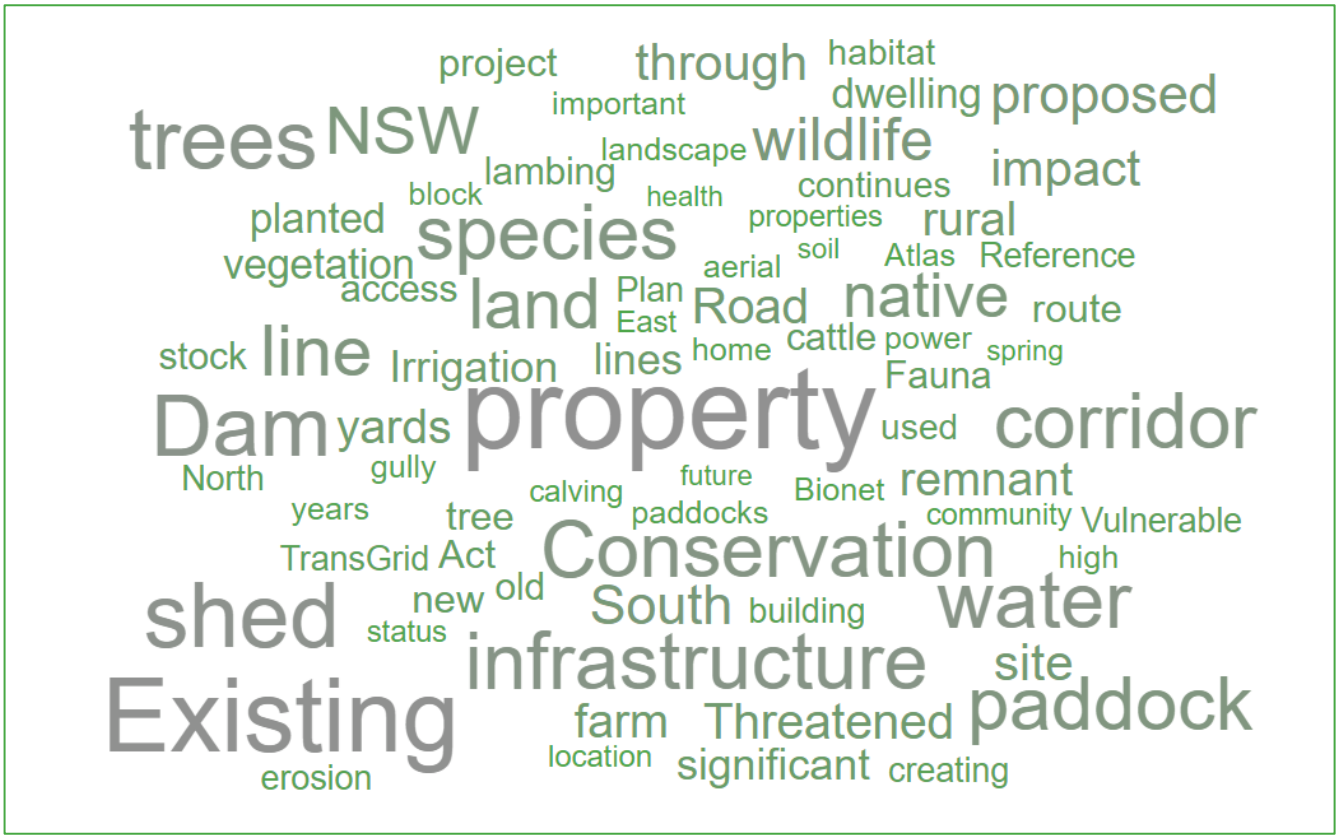
Date	Topic
30 November 2022	Project update and introduction to the Environmental Impact Statement
2 December 2022	
6 December 2022	
7 December 2022	
9 December 2022	
21 March 2023	EIS Specialist Studies – Round 1 - Landscape Character and Visual Impact - Land Use and Property - Agricultural Land
24 March 2023	
2 May 2023	EIS Specialist Studies – Round 2 - Traffic and Transport - Noise and Vibration
5 May 2023	EIS Specialist Studies – Round 2 - Traffic and Transport - Noise and Vibration

Further rounds of community information webinars are planned to be undertaken during the EIS public exhibition stage.

6.3. Interactive map comment summaries



Key words featured in the interactive map comments



Official

6.4. Communication and engagement materials

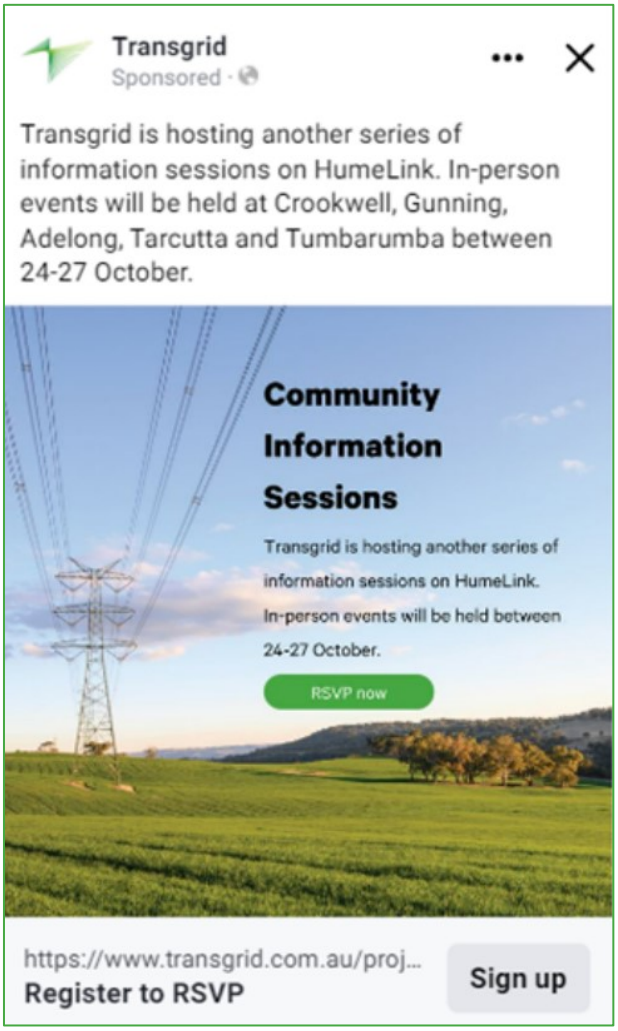
6.4.1 Samples of advertising and promotional materials

D.1 Advertisement for Community Information Sessions in Daily Advertiser local newspaper (2 September 2022)



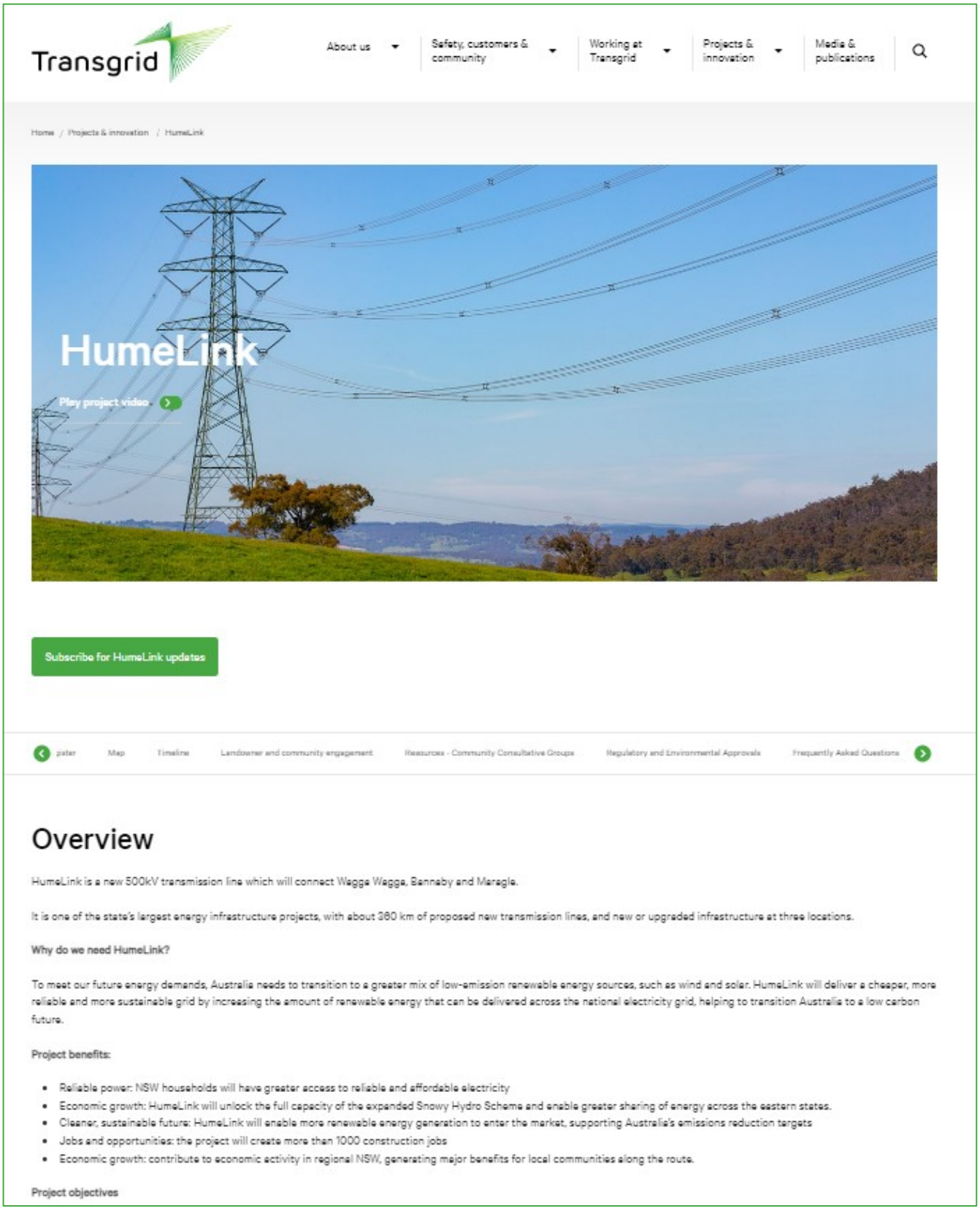
D.2 Advertisement for HumeLink EIS webinars and Community Information Sessions on Facebook





6.4.2 Samples of communication materials

D.1 HumeLink webpage screenshots



Landowner and community engagement

Easement Payments

The NSW Government recently announced its Strategic Benefits Payments (SBP) for landowners. Under the SBP scheme, private landowners hosting new high voltage transmission projects critical to the energy transformation and future of the electricity grid will be paid a set rate of $ 200,000 per kilometre of transmission hosted, paid out in annual instalments over 20 years, linked to the Consumer Price Index.
In other words, the SBP is a payment of $10,000 per kilometre of transmission line across privately-owned land, paid annually over a period of 20 years and adjusted for inflation based on the Consumer Price Index. The SBP are in addition to any compensation paid under the Just Terms Compensation Act (1991) and will apply to landowners hosting EnergyConnect. More information is available on our Easement Payments page.

Learn more

Improving engagement – Rod Stowe report

We are pleased to share Mr Stowe's report; Transgrid's response to the report, as well as Mr Stowe's response to our approach.

We will continue listen to landowners and community members with the aim of continuously improving how we communicate and provide information.

Learn more

Community Partnerships Program

Our Community Partnerships Program is designed to help not-for-profit groups to deliver initiatives that will have a tangible and lasting impact on local communities.
The first round of grants for the HumeLink project area offered funding up to $5,000 per community initiative on offer. This round closed in November 2021, the next round will open in July 2022. Click the link below to learn more about the program.

Learn more

Landowner support services

We appreciate that for many the idea of a large tower and transmission line being built on your property may cause stress, anxiety or anger. We also know that some landowners may want to talk to someone independent outside of Transgrid to discuss these concerns.
To offer independent support throughout this process, we have engaged an external service provider, Assure Program. Assure Program has independent counsellors who can provide counselling to interested landowners.
Further details on this service, as well as additional landowner resources, are available on our landowner support and advocacy page.

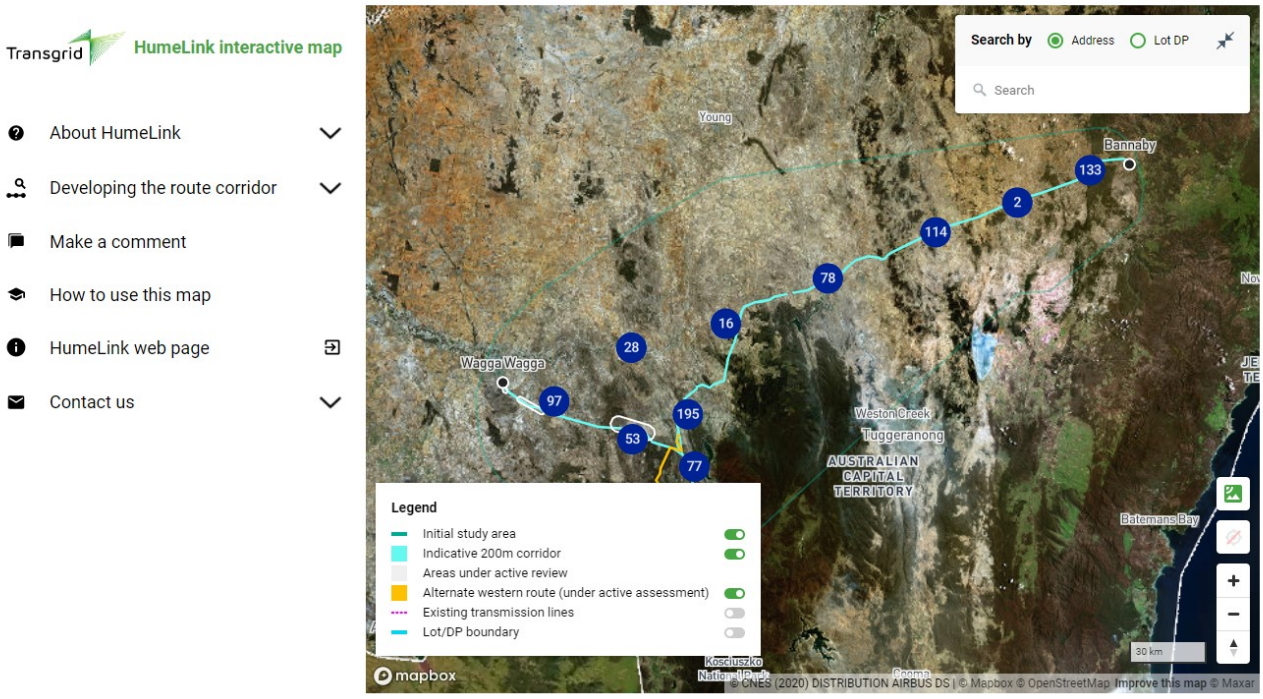
Learn more

Community Consultative Groups

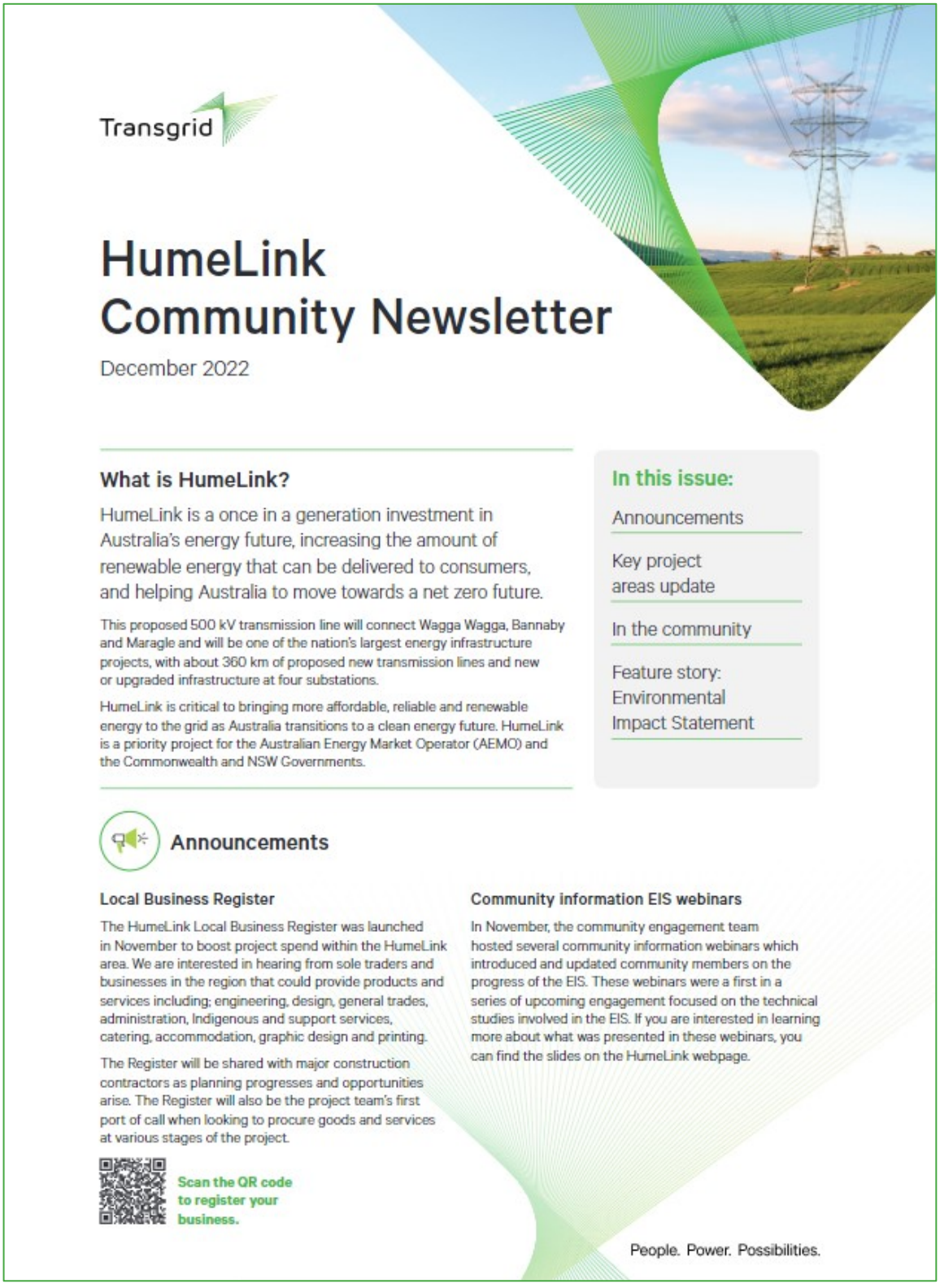
Transgrid has established Community Consultative Groups (CCGs) to encourage and facilitate community participation in HumeLink's project planning. Each CCG group is made up of representatives from local councils, community groups and organisations as well as individual community members. Members are selected through an independent application process. The CCGs provide their valuable feedback on behalf of the community, to Transgrid and the Humelink team on all aspects of the project. There are three CCGs representing communities from:

- Yass and Upper Lachlan LGAs
- Wagga Wagga and Cootamundra Gundagai LGAs
- Snowy Valleys LGA

Map


Transgrid HumeLink interactive map
About HumeLink
Developing the route corridor
Make a comment
How to use this map
HumeLink web page
Contact us
Search by Address Lot DP
Search
Young
Bannaby
133
2
114
78
16
28
Wagga Wagga
97
195
53
77
Weston Creek
Tuggeranong
AUSTRALIAN CAPITAL TERRITORY
Batemans Bay
Legend
Initial study area
Indicative 200m corridor
Areas under active review
Alternate western route (under active assessment)
Existing transmission lines
Lot/DP boundary
30 km
mapbox
© CNES (2020) DISTRIBUTION AIRBUS DS | © Mapbox © OpenStreetMap Improve this map © Maxar

D.2 HumeLink newsletter screenshot – December 2022 issue



Transgrid

HumeLink Community Newsletter

December 2022

What is HumeLink?

HumeLink is a once in a generation investment in Australia's energy future, increasing the amount of renewable energy that can be delivered to consumers, and helping Australia to move towards a net zero future.

This proposed 500 kV transmission line will connect Wagga Wagga, Bannaby and Maragle and will be one of the nation's largest energy infrastructure projects, with about 360 km of proposed new transmission lines and new or upgraded infrastructure at four substations.

HumeLink is critical to bringing more affordable, reliable and renewable energy to the grid as Australia transitions to a clean energy future. HumeLink is a priority project for the Australian Energy Market Operator (AEMO) and the Commonwealth and NSW Governments.

In this issue:

Announcements

Key project areas update

In the community

Feature story: Environmental Impact Statement

Announcements

Local Business Register

The HumeLink Local Business Register was launched in November to boost project spend within the HumeLink area. We are interested in hearing from sole traders and businesses in the region that could provide products and services including; engineering, design, general trades, administration, Indigenous and support services, catering, accommodation, graphic design and printing.

The Register will be shared with major construction contractors as planning progresses and opportunities arise. The Register will also be the project team's first port of call when looking to procure goods and services at various stages of the project.

Scan the QR code to register your business.

Community information EIS webinars

In November, the community engagement team hosted several community information webinars which introduced and updated community members on the progress of the EIS. These webinars were a first in a series of upcoming engagement focused on the technical studies involved in the EIS. If you are interested in learning more about what was presented in these webinars, you can find the slides on the HumeLink webpage.

People. Power. Possibilities.

D.3 HumeLink subscriber list electronic direct mails (EDM) screenshots



Join us online for HumeLink's landscape character, visual amenity, land use and property webinar

If you're interested in learning more about the Environmental Impact Statement (EIS), specifically the landscape character, visual amenity, land use and property technical studies then these webinars are for you.

The upcoming webinars are an opportunity to hear from key members of the HumeLink community engagement and EIS teams and ask questions.

Thank you to those who attended the recent in-person community information sessions. If you attended these events we still encourage you to join a webinar. Unlike our drop-in style events, the webinars will include a presentation and additional information about the EIS planning and approval process.

The sessions will be held online using Zoom. You can join via phone, mobile, tablet or computer.

The same presentation will be given at each session, so please only register to one event. To RSVP, simply click on the date and time below:

Tuesday 21 March, 5:30pm to 7:00pm (AEST)

Friday 24 March, 12:00pm to 1:30pm (AEST)

You can also register on the HumeLink webpage or call 1800 317 367.

We have capped the number of attendees that can register for each webinar to ensure a fair opportunity to ask questions and participate, so make sure to RSVP to your preferred date/time.

If you do not receive the zoom details within 48 hours, contact the team via humelink@transgrid.com.au

The project team also encourage you to call 1800 317 367 if you would like technical support with Zoom prior to the webinar events.

RSVP on the HumeLink webpage

Kind regards,

The HumeLink Project Team

Transgrid

Contact the project team:
Phone 1800 317 367
Email humelink@Transgrid.com.au

Find out more at:
Transgrid.com.au/humelink



The February edition of HumeLink Project Update is now live

The latest issue of HumeLink's Project Update is now available on the HumeLink website. If you live in the local area you may also receive this project update in your letterbox over the next few days.

Featured in this issue:

- the Environmental Impact Statement (EIS) release in mid-2023
- the completion of the heritage test excavation surveys
- the biodiversity offset and stewardship agreement
- the alternative (western) route option in the Tumut region
- the Local Business Register
- HumeLink's property team and landowner support
- what's coming up in 2023, including Transgrid's Community Partnerships Program
- HumeLink's upcoming community information sessions focusing on the EIS.

You can read about these updates and what's been happening on the project on the HumeLink's website or click the button below.

Read the February project update here

Kind regards,

The HumeLink Project team

Transgrid

Contact the project team:
Phone 1800 317 367
Email humelink@Transgrid.com.au

Find out more at:
Transgrid.com.au/humelink

6.4.3 Samples of consultation activities

D.1 Photographs from Community Information Sessions









Attachment 1 HumeLink Engagement Strategy

Official

Transgrid

People. Power. Possibilities.

HumeLink

Engagement Strategy 2022 – 2026

June 2023

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Document control

This HumeLink Engagement Strategy 2022-2026 is subject to annual review and approval by nominated stakeholders. This strategy has been developed in conjunction with Transgrid's Community Engagement Policy (transgrid.com.au) and with feedback from the HumeLink Community Consultative Groups.

The final Strategy will be distributed to a number of key stakeholders including the Australian Energy Infrastructure Commissioner (AEIC) and the Office of the Landowner Advocate. A copy will be available to view on the project website located at www.transgrid.com.au/projects-innovation/humelink.

The HumeLink Engagement Strategy will be reviewed and, if necessary, amended and updated:

- Formally on an annual basis by the HumeLink Community Engagement Lead
- Following major project milestones and/or events
- Upon receipt of regulatory approval conditions, licences and permits
- To achieve the Key Performance Indicators and/or
- When directed by any appropriate regulator.

Acknowledgement of Country

Transgrid and HumeLink acknowledge the Traditional Custodians and owners of the Wiradjuri, Ngunawal, Ngarigo and Gundungurra lands on which our project is proposed. We pay our respects to their elders past, present and emerging and recognise their continuing connections to the lands and waters.

1. HumeLink Engagement Strategy

1.1. Background

Australia's energy system is undergoing a once-in-a-lifetime transformation, moving away from coal-fired generation towards a greater reliance on low-cost and renewable electricity. Transmission is pivotal to this changing energy landscape.

As the share of intermittent renewable generation increases, Transgrid will play a critical role in ensuring the secure operation of the NSW power system as part of a more robust and sustainable energy market.

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to be developed and strengthened.

Transgrid's vision is 'leading the transition to a clean energy future'. In the major projects space, Transgrid is doing this with $11.1 billion capital expenditure and delivery of critical infrastructure which will strengthen, improve reliability and increase capacity of the NSW transmission network. HumeLink is one of NSW's largest energy infrastructure projects, which will connect renewable energy sources into the electricity network.

1.1.1. Transgrid culture

Transgrid places the voice of the community at the centre of our decision making. We strive to build positive and lasting relationships with our local communities, and create lasting benefits to our customers, community and the environment as part of our commitment to building a sustainable future.

We work with the communities in which we operate in a meaningful, accountable, responsive and equitable way through effective and inclusive practices, as shown in the Transgrid Community Engagement Policy, (click here to access).

We will achieve this by following the engagement principles, as developed through our membership of The Energy Charter:

- Clear purpose – we will let you know the purpose of our engagement with you and explain how you can be involved.
- Accessible and inclusive – we will engage with you as early as practicable and offer you different ways to engage with us, so there's a channel that's right for you.
- Accurate and timely – we will provide accurate information at each stage of project planning and works delivery so that you can contribute meaningful feedback and share your concerns and interests.
- Genuine – we will be open, honest and transparent with you. We will tell you what is and isn't on the table and the reasons why.
- Close the loop – we will seek to understand and act on what is important to you and your community and we will actively listen to you. We will let you know what we have heard and provide you with clear feedback on how we have responded and why.
- Share other options – we will let you know where you can go for additional information and independent advice to help resolve those issues specific to you.

1.1.2. Transgrid values

The following values are the guiding principles that inform how we do things at Transgrid. They guide our everyday behaviours and our daily decisions, and they help us achieve our vision – to lead the transition to a clean energy future:

- Safety – We put safety first
- Achievement – We make a difference
- Integrity – We act with integrity
- Service – We deliver for our customers and communities.

Transgrid values are about creating a culture where the customer is at the heart of everything we do. We continue to put safety above everything else and embed integrity and respect into all our relationships and interactions.

1.2. Purpose

The HumeLink Engagement Strategy (HES) sets the strategic engagement direction and framework for all engagement activities within the HumeLink project. It outlines ongoing engagement with communities, Indigenous people, landowners and stakeholders as part of planning and building HumeLink, if all government approvals are obtained. It also aligns to Transgrid's expectations for the delivery of best practice engagement for all communities and stakeholders along the corridor, and people more broadly interested in the project.

The development of the HES has considered and responded to feedback from stakeholders, the Landowners Advocate, Community Consultative Group and people with an interest in the project.

All 20 recommendations of the *Landowner and Community Advocate's Review* of HumeLink's engagement process have been embedded within the HES. These recommendations are now considered business-as-usual within the HumeLink project, and quality assurance has been built-in to ensure ongoing effective and best practice engagement.

HES and associated engagement plans will be reviewed as the HumeLink project progresses through planning and construction phases before becoming operational, assuming government approvals are obtained.

1.3. HumeLink Project

HumeLink is a new 500 kV transmission line which will connect Wagga Wagga, Bannaby and Maragle, cities and towns in southern NSW as shown in Figure 1.

HumeLink is a Critical State Significant Infrastructure (CSSI) project which has been identified as a priority by the Australian Energy Market Operator (AEMO) and the Australian and NSW governments. It will provide better access to cheaper renewable energy generators, and help reduce electricity prices for consumers, while meeting increasing demand for electricity.

HumeLink is also one of NSW's largest energy infrastructure projects, with about 360km of proposed new transmission lines and structures, and new or upgraded infrastructure at three substation locations.

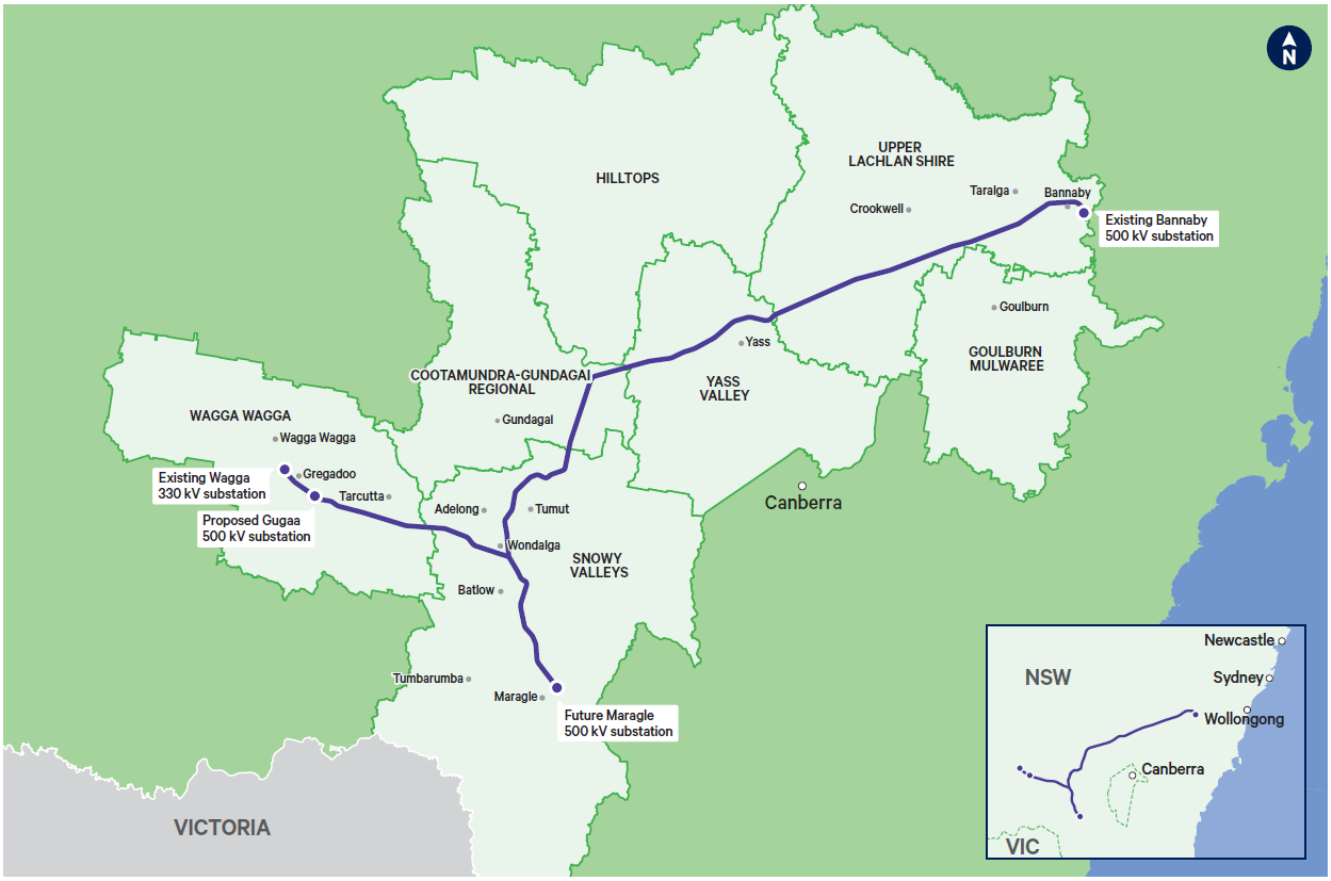


Figure 1 Overview of project location

The HumeLink project will reinforce the backbone of the east coast's transmission network, delivering cheaper, more reliable, and more sustainable electricity. It will increase the amount of renewable energy that can be delivered to consumers across the National Electricity Market (NEM), helping to facilitate the transition to a low emissions future.

The HumeLink project will also reinforce the Southern Shared Network. This network carries electricity from generators across southern NSW and imported from Victoria and South Australia to major population centres. Currently, it is heavily congested at times of high demand and will become more congested as new generators in southern NSW connect to the grid.

Benefits of the HumeLink project include:

- Provision of reliable and affordable electricity to customers.
- Reinforcing the southern transmission network, enabling greater sharing of energy between the eastern states, and unlocking the full capacity of the expanded Snowy Hydro Scheme.
- Enabling more energy from renewable generation to enter the market, supporting Australia's emissions reduction targets.
- Creating more than 1000 construction jobs and contribute to economic activity in regional NSW, generating significant benefits for local communities along the route.

The HumeLink project is on an accelerated timeline, with both regulatory and planning assessments progressing alongside concept design and contractor procurement, as shown in Figure 2.

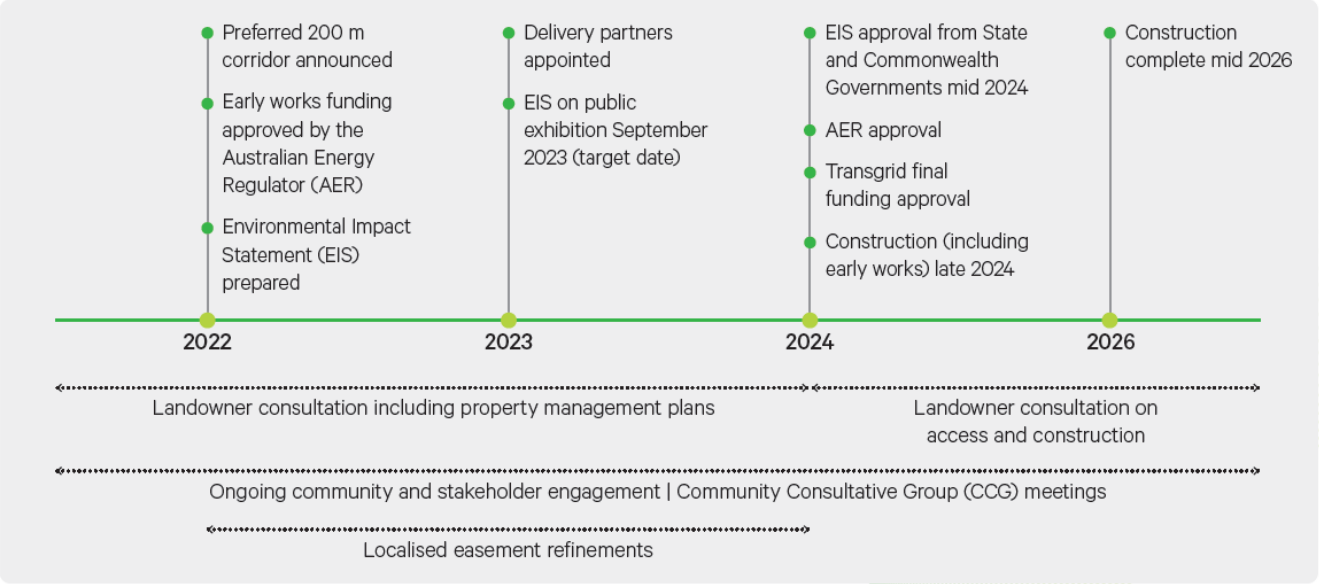


Figure 2 HumeLink project timeline

Official

2. Document relationships

Successful engagement requires Transgrid to provide meaningful, transparent and timely information to our stakeholders, community, landowners, Indigenous groups and representatives, and everyone with an interest in the HumeLink project.

2.1. Management plans

The HumeLink Community Communication and Engagement Plan covers all external facing activities planned for community and stakeholder engagement from March 2022 to September 2023 as part of the planning phase of the HumeLink project.

Attached at *Appendix D* of the *Community Communication and Engagement Plan* is the HumeLink Media and Communications Management Plan, which identifies the types of information that need to be shared, the media channels that will be used to communicate this information and the frequency with which this information will be released. It will also define the roles and responsibilities for those delivering the Media and Communications Management Plan on this project within Transgrid, and for our delivery partners.

In addition, the HumeLink Engagement Strategy is related to the following documents outlined in Table 1.

Table 1 HumeLink Engagement Strategy and relationship to other documents

Relationship	Documents
Read HumeLink Engagement Strategy **in conjunction** with the following documents:	• Transgrid Engagement Policy • Transgrid Energy Charter Engagement Principles
HumeLink Engagement Strategy **informs** Transgrid's development and implementation of the following documents:	• HumeLink Community Communication and Engagement Plan • HumeLink Media and Communications Management Plan • HumeLink Community Investment and Benefits Plan • Subsequent action plans
HumeLink Engagement Strategy **informs** HumeLink's Delivery Partners development and implementation of the following documents:	• HumeLink Community and Stakeholder Engagement Management Plans • HumeLink Community Investment and Benefits Plan • Local Industry Participation Plan [1] • Aboriginal Participation Plan.[2]

[1] Replacing the local business engagement plan
[2] Replacing the Aboriginal Engagement Procurement and Participation plan

Official

3. Engagement framework

To successfully deliver on this strategy, HumeLink will use the engagement framework that directly links to Transgrid's vision, culture and values as shown in Figure 3.

The HES sets objectives and principles for our HumeLink engagement and delivers high level direction for approach, risks, opportunities and challenges as well as identifying audiences. Transgrid and HumeLink will deliver best practice engagement and have established success statements as performance indicators.

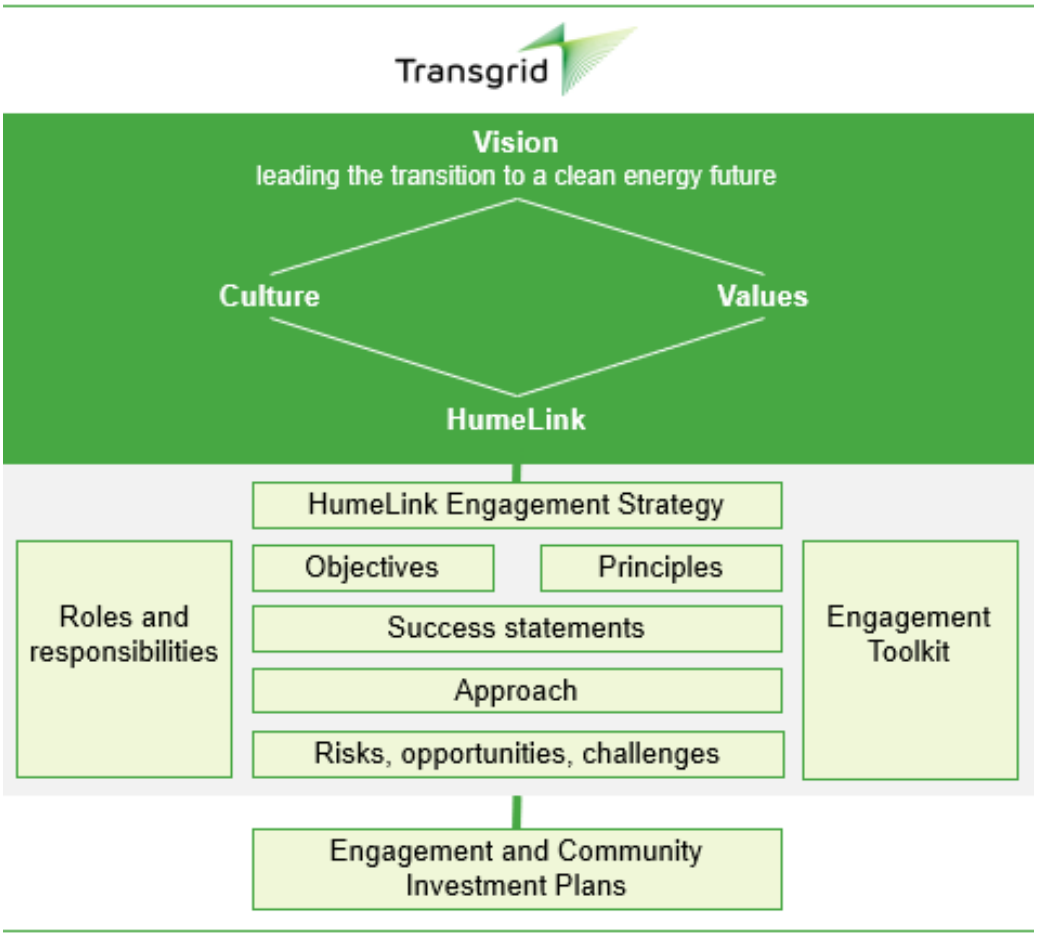


Figure 3 Project engagement framework

3.1. Engagement objectives

The HumeLink project's engagement objectives are to:

- Work in partnership with local communities and businesses
- Listen to feedback, understand community views and consider how these can deliver a better project
- Be accessible and provide engagement that works for communities and considers audiences
- Deliver lasting social, economic and environmental benefits for communities and regions
- Build awareness of HumeLink's role in providing reliability, clean energy and affordable electricity to consumers
- Build on Transgrid's positive reputation and social licence to operate.

3.2. Engagement principles

Drawing from Transgrid's culture and values, the HumeLink project's engagement principles support the delivery of best practice engagement and our commitment to continuous improvement.

We will achieve this by implementing the following engagement principles as developed through our membership of the Energy Charter, as described in Table 2.

Table 2 HumeLink Engagement Principles

Principles	Application
Clear Purpose	We will let you know the purpose of our engagement with you and explain how you can be involved.
Accessible and Inclusive	We will engage with you as early as practicable and offer you different ways to engage with us, so there's a channel that's right for you.
Accurate and Timely	We will provide accurate information at each stage of project planning and works delivery so that you can contribute meaningful feedback and share your concerns and interests.
Genuine	We will be open, honest and transparent with you. We will tell you what is and isn't on the table and the reasons why
Close the loop	We will seek to understand and act on what is important to you and your community and we will actively listen to you. We will let you know what we have heard and provide you with clear feedback on how we have responded and why.
Share other options	We will let you know where you can go for additional information and independent advice to help resolve those issues specific to you.

3.3. International Association of Public Participation engagement spectrum

The International Association of Public Participation (IAP2) has been endorsed by Transgrid as best-practice and is widely used across the industry.

The level of engagement for activities will be based on the IAP2 spectrum and will vary throughout the project. Generally, HumeLink's engagement will work mainly in the inform, consult and involve with community and stakeholders as shown in Figure 4.

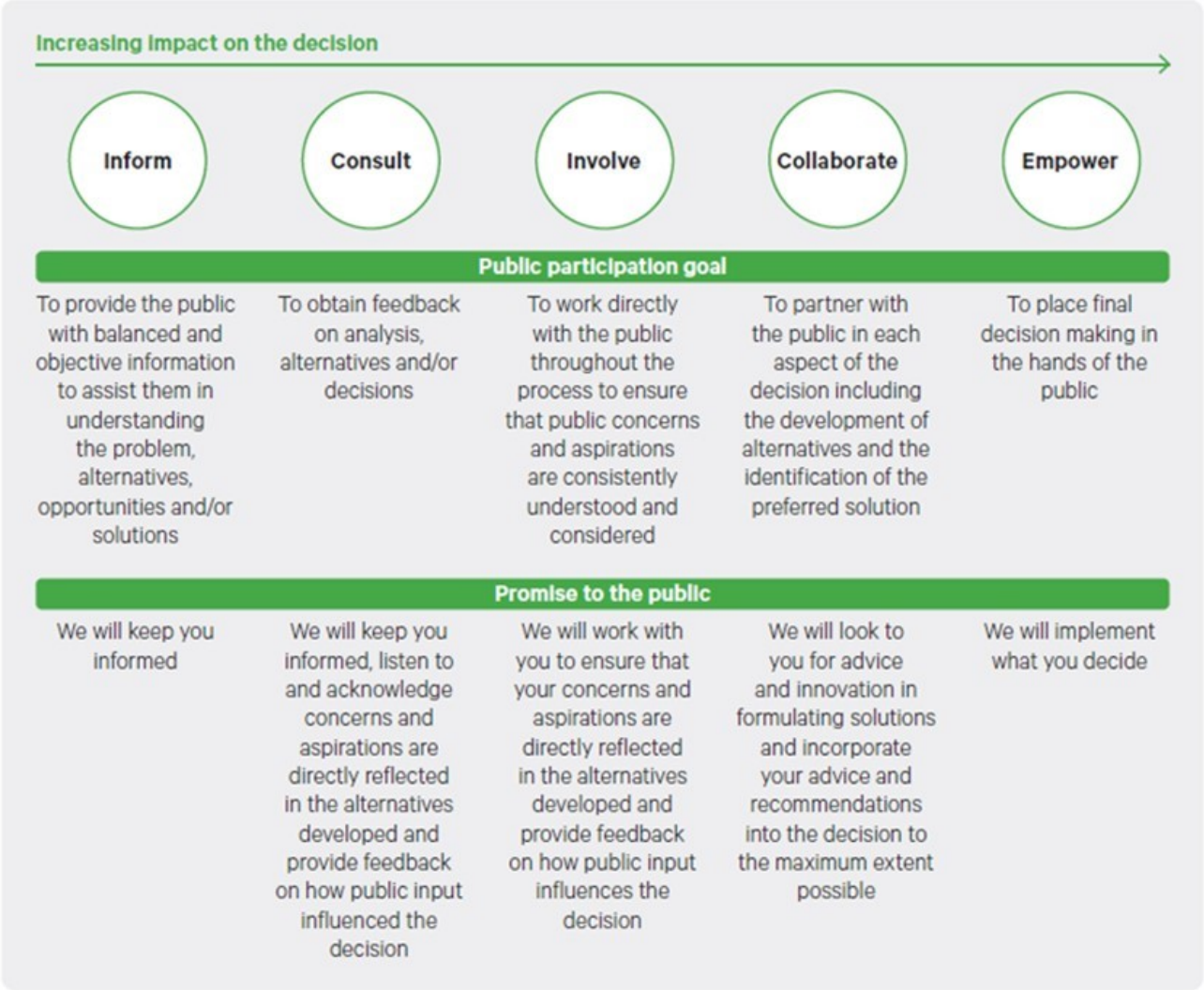


Figure 4 IAP2 Engagement Spectrum

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4. What success looks like

When setting strategic community and stakeholder objectives and outcomes for the project, the HES has considered Transgrid's requirements, Landowner Advocate recommendations and feedback from community and stakeholders along the corridor.

Our overarching approach focuses on safety, integrity, service and achievement, and maintaining social licence to operate, as well as building Transgrid's reputation as leading the transition to clean energy future.

To guide this approach, we have established the following stakeholder and community specific objectives and targets, as shown in Table 3. These objectives have also been informed by historical information and ongoing research and feedback. Specific success measures and how they will be achieved will be detailed in each of the key engagement plans and community investment plan.

Table 3 Engagement objectives and success statements

Engagement objectives	Success statements
Work in partnership with local communities and businesses.	• A trusted and respected partner with key government agencies, key local organisations and groups and local Indigenous organisations and groups • Local and regional social, economic and environmental legacies realised • Transgrid and HumeLink are seen as leading the transition to clean, renewable energy
Listen to feedback, understand community views, and consider how these can deliver a better project.	• A trusted and respectful relationship with communities, landowners, and local groups • Local and regional social, economic and environmental legacies realised • Feedback results in changes in the planning, delivery and/or operation of HumeLink • HumeLink delivers accessible engagement that is inclusive considers the diversity of communities and stakeholders • HumeLink overcame engagement access barriers
Be accessible and provide engagement that works for communities and considers audiences.	• HumeLink delivers accessible engagement that is inclusive considers the diversity of communities and stakeholders • Visuals (animations, footages, photographs, illustrations and graphics) helped people understand HumeLink • HumeLink staff and key decision makers were accessible • HumeLink overcame engagement access barriers
Deliver long-term social, economic, and environmental legacies for communities and regions.	• A trusted and respected partner with key government agencies, key local organisations and groups and local Indigenous organisations and groups • Local and regional social, economic and environmental legacies realised • HumeLink delivers accessible engagement that is inclusive considers the diversity of communities and stakeholders

Engagement objectives	Success statements
	• As part of Transgrid's operations, it works collaboratively with communities
Build awareness of HumeLink's role in providing reliability, clean energy and affordable electricity to consumers.	• A trusted and respected partner with key government agencies, key local organisations and groups and local Indigenous organisations and groups • Local and regional social, economic and environmental legacies realised • HumeLink delivers accessible engagement that is inclusive considers the diversity of communities and stakeholders • As part of Transgrid's operations, it works collaboratively with communities • Transgrid and HumeLink are seen as leading the transition to clean, renewable energy
Build on Transgrid's positive reputation and social licence to operate.	• A trusted and respected partner with key government agencies, key local organisations and groups and local Indigenous organisations and groups • Local and regional social, economic and environmental legacies realised • HumeLink delivers accessible engagement that is inclusive considers the diversity of communities and stakeholders • As part of Transgrid's operations, it works collaboratively with communities • Transgrid and HumeLink are seen as leading the transition to clean, renewable energy

5. Approach and implementation

To successfully implement delivery of our HES, we are developing evolving engagement plans for key areas and phases of the project. These plans will inform each other and, in some cases, overlap. They will include specifically tailored communication and engagement approaches and the right mix of tools and channels to enable best practice (a list of tools and channels is available at Appendix A). Detailed action plans will be developed for key activities within these primary engagement plans.

Like the HES, these engagement plans will draw from historical information and emerging trends, as well as long term objectives and outcomes for HumeLink and Transgrid. They will be reviewed annually to ensure they are updated as the project progresses.

In addition, the NSW Department of Planning and Environment (DPE) requires specific engagement plans to be developed for the Environmental Impact Statement (EIS) and construction phase of the project. The HumeLink project engagement plans that will be developed and implemented to deliver on the HES are shown in Figure 5.

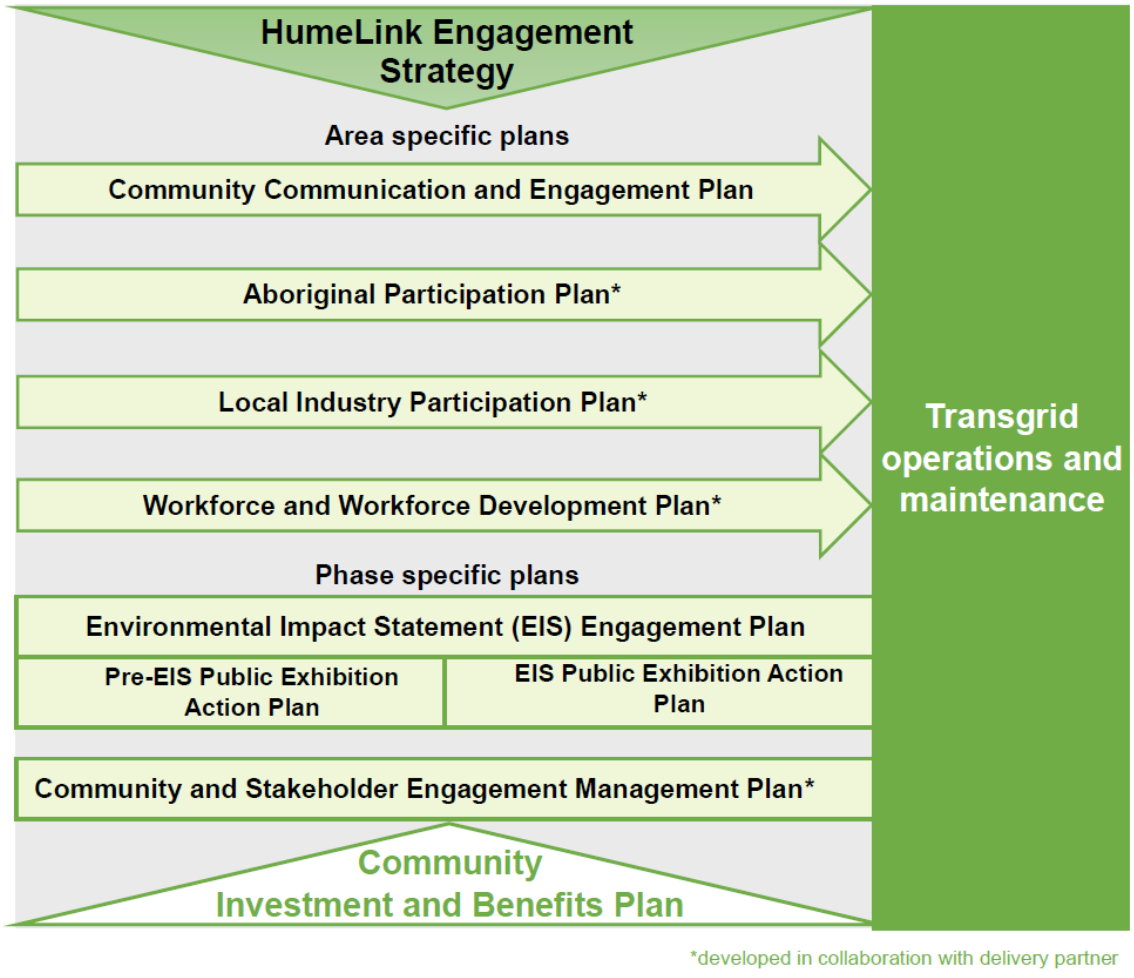


Figure 5 HumeLink project engagement plans

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6. Stakeholders

Throughout the life of the HumeLink project and in the operational phase, Transgrid recognises the importance of building respectful relationships within communities across NSW. Working with local communities, Indigenous communities, and stakeholders delivers better project outcomes and lasting social, economic and environmental benefits.

The engagement level applied to each community and stakeholder group is based on the IAP2 public participation goals and is expected to change throughout the HumeLink project depending on level of interest and specific topics at hand.

The HES provides a high-level matrix of stakeholder groups, engagement levels and key relationship owners. More detailed stakeholder and community identification and planning is contained within the appropriate engagement plans that follow on from the HES.

Stakeholder identification will continue throughout the life of the project and the following Table 4 will be updated as appropriate.

Table 4 Stakeholder groups and levels of engagement

Stakeholder or community group	Entities with interest in HumeLink	Inform	Consult	Involve	Transgrid relationship owner
Elected officers	Commonwealth and NSW Ministers and Commonwealth and NSW Members of Parliament				Government Relations
Commonwealth and NSW Government Agencies	Departments, agencies and organisations				• Government Relations • Engagement • Environment
Local Government	Councils and Joint Organisations of Councils				• Government Relations • Engagement • Environment
Local business chambers, businesses, suppliers and Indigenous businesses	Business and progress associations, businesses, Indigenous businesses, supply chain				• Procurement • Engagement • Delivery partners
Tourism and Recreation	Tourism associations, major tourism and recreational facilities operators and landowners, Airport operators				• Engagement • Environment
Local Indigenous groups, organisations	Local Aboriginal Land Councils, Registered Aboriginal Parties, Indigenous groups, businesses and individuals				• Yura Ngura Indigenous Advisory • Environment
Communities	Communities' members				Engagement

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Stakeholder or community group	Entities with interest in HumeLink	Inform	Consult	Involve	Transgrid relationship owner
Indigenous communities	Traditional owners and communities' members				• Yura Ngura Indigenous Advisory • Engagement
Impacted landowners	Landowners impacted by the 200m refined corridor (easement acquisition)				• Engagement • Property
Community Consultative Groups	Local groups				• CCG Secretariat • Engagement
Local groups	Landowner action groups, environmental groups				Engagement
Community groups	Community driven groups				Engagement
Energy Regulator/ Operators	Australian Energy Market Operator Australian Energy Regulator Australian Energy Market Commission Energy Security Board				• Project Director • Regulation • Engagement
Peak industry groups / associations	Australian Energy Infrastructure Commissioner The Energy Corporation of NSW Energy Networks Australia Infrastructure Partnerships Australia Clean Energy Council Business Council of Australia Snowy Hydro Forestry Corporation, NSW Farmers Association and local branches				• Project Director • Government Relations • Engagement
Unions	Electrical Trade Union Construction, Forestry Maritime, Mining and Energy Union				Government Relations
Construction Contractors	Construction companies until Principal Contractor/s are confirmed				• Procurement • Engagement
Education	Educational and training organisations, universities, and schools				Engagement
Media	Media outlets				Media
Utilities	Existing utility and service providers in the region including Telstra, Water NSW, local water utilities and other communications providers				Project Director
Energy customers	Consumers of electricity distributed by Transgrid				Government Relations

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7. Engagement risks, opportunities and challenges

Engagement with the community and stakeholders presents risks, opportunities, and challenges for Transgrid and HumeLink. While significant improvements have been made from lessons learnt earlier in the project, the nature of a CSSI project with cost and time pressures presents ongoing engagement challenges and risks.

It is imperative for Transgrid to ensure all engagement activities align with the principles of the HES and that this is clearly demonstrated to communities and stakeholders. Risks that are held in the HumeLink risk register, are regularly monitored and reviewed to ensure the team is proactively managing them.

Risks, opportunities, and challenges HumeLink will be subject to ongoing and rigorous scrutiny in terms of quality of engagement, cost, timeliness of delivery, operations, and feasibility. Engagement risks, challenges and opportunities, which are captured in detail within the register, however some whole of project life focus areas, as shown in Table 5, include:

- Reputation and social licence variance due to engagement activity
- Project cost increases or time delays due to engagement activity
- Engagement fatigue, apathy, and experience
- Complaints, enquiries, and correspondence management.

HumeLink takes an open approach to managing risks and continues to work with the Landowner Advocate, Australian Energy Infrastructure Commissioner and key stakeholders to seek feedback. As representatives of a cross section of landowners, community and other stakeholders, the three CCGs also provide a forum for seeking feedback on engagement risks, opportunities and challenges.

Robust mitigation approaches provide the best opportunity to deliver high quality outcomes with input and insight from key stakeholder groups and local communities. This approach addresses communities feeling disenfranchised and opposed to the project. It also reduces the potential to not meet regulatory requirements which could result in a lack of approval to proceed with the project.

Table 5 Risks and risk mitigation

Whole of project life risks → / Engagement objectives for risk mitigation ↓	Reputation and social licence due to engagement	Project cost increases or time delays due to engagement	Engagement fatigue, apathy and experience	Complaints, enquiries, and correspondence management
Work in partnership with local communities and businesses	✓	✓	✓	✓
Listen to feedback, understand community views and consider how these can deliver a better project	✓	✓	✓	✓
Be accessible and provide engagement that works for communities and considers audiences	✓	✓	✓	✓

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Whole of project life risks → / Engagement objectives for risk mitigation ↓	Reputation and social licence due to engagement	Project cost increases or time delays due to engagement	Engagement fatigue, apathy and experience	Complaints, enquiries, and correspondence management
Deliver lasting social, economic and environmental benefits for communities and regions	✓		✓	
Build awareness of HumeLink's role in providing reliability, clean energy and affordable electricity to consumers	✓	✓		✓
Build on Transgrid's positive reputation and social licence to operate	✓	✓	✓	✓

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8. HumeLink Community and Stakeholder Engagement Team

While the whole HumeLink project team, including contractors, has a role to play in engaging with stakeholders and communities throughout the project, the Community and Stakeholder Engagement Team is focussed on managing communications with the community, and especially landowners, to ensure the effective and accurate dissemination of HumeLink project information.

The HumeLink Community Communication and Engagement Plan (CCEP) is the document that most directly supports the delivery of the HES, by covering all external facing activities planned for community and stakeholder engagement, from March 2022 to September 2023, as part of the planning phase of the HumeLink project.

8.1. Training and induction

Representatives of the HumeLink project team may be called upon to undertake or take part in community and stakeholder engagement activities. As part of the induction to the HumeLink project, team members will receive community and stakeholder engagement awareness training. This training will be specific to HumeLink and will align with Transgrid's engagement policies, plans and training.

More detailed information on what is covered in the training awareness program, is available in the CCEP.

9. Engagement toolkit

The engagement plans and any additional plans required during the HumeLink project will draw from a community engagement toolkit to deliver engagement outcomes specific for activities and programs.

Historical information and emerging trends have been considered when building this toolkit, which will continue to evolve over the life of the project. It is based on stakeholder analysis, current practice, legislative requirements, and recommendations from the Landowner Advocate Report.

This toolkit will be reviewed regularly to ensure it is effective and new items added if required.

A list of the toolkits tools and channels can be found at Appendix A.

Appendix A Engagement tools and channels

The following table provides guidance of likely engagement levels to be achieved by the tools and channels within the toolkit.

Tools and channels	Inform	Consult	Involve	Collaborate	Empower
1800 number	X	X			
Advertising in local and social media	X	X			
Agreements, MOUs, partnerships					
Agricultural shows	X	X			
Animations and 3D	X	X			
Booklets	X				
Briefings (community and stakeholders)	X	X			
Briefings (Indigenous groups)	X	X			
Briefings (internal)	X	X			
Briefings (political and government)	X	X			
Briefings (media)	X	X			
Briefing notes and government correspondence	X				
Campaigns	X	X	X		
Case studies	X				
Collateral distribution	X				
Community Consultative Groups	X	X	X	X	
Community workshops	X	X	X	X	
Community information sessions, pop ups, webinars	X	X			
Community events	X	X			
Dashboard	X				
Diagrams and illustrations	X				
Direct emails	X				
Direct phone calls	X				
Doorknocking	X	X			
Digital portal (incorporating interactive map)	X	X	X		
Electronic direct messages	X	X	X		
Email inbox	X				
Factsheets	X				
Frequently Asked Questions	X				
Guides	X				

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Tools and channels	Inform	Consult	Involve	Collaborate	Empower
Image library	X				
Infographics	X				
Information packs	X				
Interactive map (part of digital portal)	X	X	X		
Internal engagement	X	X	X		
Key messages	X				
Letters	X				
Mail	X				
Maps	X				
Media events	X				
Media holding statements	X				
Media releases	X				
Meetings (community and stakeholders)	X	X	X		
Meetings (Indigenous groups)	X	X	X		
Meetings (political and government)	X	X	X		
Meetings (businesses)	X	X	X		
Narrative	X				
Newsletters/updates	X	X			
Notifications (generally construction)	X				
On-Country meetings	X	X	X		
Photographs and Footage	X				
Presentations	X	X	X		
Public displays	X				
Research	X	X	X		
Roadshows	X	X			
Social media (Transgrid Facebook, HumeLink LinkedIn)	X	X			
Third party endorsements	X				
Training/Capacity building activities	X	X	X		
Transgrid Community Partnership Program					
Transgrid corporate sponsorship					
Videos	X				
Webinars	X	X			
Website	X				
What we heard Summaries	X				

Tools and channels	Inform	Consult	Involve	Collaborate	Empower
Workshops (community and stakeholders)	X	X	X		
Workshops (Indigenous groups)	X	X	X		
Workshops (businesses)	X	X	X		
Workshops (government)	X	X	X		
Yarning circles	X	X	X		



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Appendix D Mitigation measures

Appendix D Mitigation measures

Table D-1 details the mitigation measures that would be implemented to avoid or minimise potential impacts from the project.

Table D-1 Summary of proposed mitigaton measures

Reference	Impact	Mitigation measure	Timing	Relevant location
Biodiversity				
B1	Biodiversity conservation significance	Impacts to matters of biodiversity conservation significance will be avoided to the greatest extent practicable during finalisation of the design and construction methodology for the project. Micro-siting of the transmission line infrastructure and associated work sites and other areas of disturbance will occur to avoid or minimise impacts wherever practicable. Site features with the highest biodiversity conservation significance, in particular recorded threatened species, and their habitat, will be given the highest priority for impact avoidance. This will also include micro-siting to avoid or minimise prescribed impacts (as described in the BDAR) where possible (ie avoiding impact to rocky habitats or caves and waterways). Micro-siting of infrastructure requiring sub-surface work, such as transmission line structure footings, will be undertaken as part of the detailed design stage of the project, to minimise prescribed impacts where possible (ie avoiding impact to breeding habitat features, GDEs, aquatic habitats and supporting aquifers). Spatial data (refer to *Technical Report 1 - Biodiversity Development Assessment Report* for species polygons for species credit species) and buffered threatened species locations will be provided to the design and construction teams and considered in detailed design. Associated mapping will be included on sensitive area plans and provided to the construction workforce.	Detailed design and construction	All locations
B2	Biodiversity conservation	Where native vegetation disturbance activities are required in areas that have not been previously subject to biodiversity survey, additional survey will be carried out prior to work occurring in any such areas to inform detailed design. Priorities for additional survey will be based on potential conservation value (identified through vegetation and habitat mapping for threatened species), and geographic and landform/habitat coverage data gaps. Additional biodiversity survey will be conducted to assess the condition of vegetation where threatened species habitat has conservatively been assumed to be present. The surveys will be carried out by a suitably qualified ecologist and will allow for additional impact reduction opportunities.	Detailed design	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
B3	Hazard tree clearing	Opportunities for individually assessing and selectively clearing hazard trees will be considered further during detailed design to minimise impacts. Hazard tree inspections would be undertaken by an appropriately qualified arborist prior to the commencement of construction in accordance with Transgrid's Maintenance Plan – Easement and Access Tracks.	Detailed design and construction	Hazard tree zone
B4	Biodiversity conservation along access tracks	Existing tracks and clearings will be used, where possible, to limit the construction of new tracks. Where this is not possible, the design will seek to minimise impacts to native vegetation, including cut and fill. Design and micro-siting of new access tracks will seek to avoid or minimise impacts to habitat trees and rocky habitats (ie rock outcrops, large boulders, piled rock, and rock features that provide potential sheltering and breeding habitat for fauna, including threatened species). Access track corridors will be established with consideration to terrain to minimise cut/fill and vegetation clearing.	Detailed design and construction	All locations
B5	Biodiversity conservation within protected areas and conservation lands	Design and micro-siting of project infrastructure including transmission line structure benches and access tracks will avoid and/or minimise impacts within protected areas (ie nature refuges) and conservation lands (ie established BioBank and Biodiversity Stewardship sites and Conservation Agreement sites) occurring within the project footprint.	Detailed design	Conservation Agreement site situated adjacent to Bago State Forest or any established BioBank and Biodiversity Stewardship sites within the project footprint

Reference	Impact	Mitigation measure	Timing	Relevant location
B6	Booroolong Frog habitat	Where Booroolong Frog habitats have been identified the following avoidance measures will be implemented: • avoid installing waterway crossings • avoid disturbance within 50 m of the top of bank of the waterway (including riparian vegetation). Where avoidance is not possible: • Waterway crossing designs should avoid instream structures to minimise the potential for hydrological change, erosion and sedimentation impacts of downstream environments. • Location of waterway crossings will be determined in consultation with a suitably qualified Ecologist to avoid or minimise impacts to potential habitats or ecological features. • Develop site specific erosion and sedimentation control plans to ensure the potential for erosion and sedimentation impacts are minimized as far as practicable, including monitoring the success of erosion and sediment control measures. A suitably qualified ecologist will be engaged to undertake monitoring surveys for the species at the crossing site and in downstream receiving environments, in accordance with the Biodiversity Management Plan (BMP) and in consultation with the BCD.	Detailed design and construction	Leech Gully (and associated first and second order tributaries), Gilmore Creek and Adjungbilly Creek
B7	Surface water, soils and groundwater	The key measures proposed to avoid, manage and/or mitigate impacts to surface water, and groundwater and soils will involve: • Preparation of Soil and Water Management Plans (SWMPs) as part of the Construction Environmental Management Plan (CEMP) to manage water quality impacts during construction of the project. • Preparation of Erosion and Sediment Control Plans (ESCPs) by a certified professional in erosion and sediment control and Water Quality Monitoring Program (WQMP) within the SWMPs. • Consideration of appropriately designed scour protection at new stormwater management points. The SWMP will include a combination of the following plans: • ESCPs • WQMP • Excavation Dewatering Plans • Emergency Spill Plans • Unexpected Contaminants Finds Protocol.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
		ESCPs will be developed for the activities and areas that are considered higher risk. The plans will detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004) and Volumes 2A (DECC, 2008a) and Volume 2C (DECC, 2008b), commonly referred to as the 'Blue Book' • *Best Practice Erosion and Sediment Control* (IECA, 2008) • *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018).		
B8	Riparian corridors	To the greatest extent practicable: • Transmission line structures will be located and constructed to minimise impact to vegetated riparian zones (VRZs) • The final transmission line easement will target narrow crossing points of waterways and riparian areas clear of vegetation. Shrub or ground stratum native vegetation within vegetated riparian zones will be protected to the greatest extent practicable, with vegetation clearing ideally limited to the tree stratum only, with trunk bases being retained in-situ. Where threatened species are known to occur, work methods will avoid or minimise impacts by limiting clearing wherever possible and delineating their habitat outside the final disturbance area as no-go zones. Work near waterways will be undertaken to avoid impacts such as herbicide drift/overspray, erosion and damage to the banks. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated.	Detailed design and construction	Transmission line corridor - within riparian corridors

Reference	Impact	Mitigation measure	Timing	Relevant location
B9	Waterway crossing (access tracks)	The following factors will be considered during the detailed design and micro siting process for waterway crossings to minimise potential impacts to aquatic environments, wherever practicable: • Any existing crossings will be re-used or upgraded in preference to establishing new crossings. • Disturbance to waterways (bed, banks and associated riparian zones), will be avoided or minimised. • The crossing design and construction work sites will minimise disturbance to any native vegetation, including native instream, fringing, and riparian vegetation within the access track alignment. • Waterway crossings will be constructed perpendicular to the flow of the water and be positioned away from channel bends (where erosive forces are typically greatest). Preferably crossings will be located in straight stream sections with well-defined channel geometries and shallow stream gradients, in stable dry reaches. • Micro-siting will avoid direct and indirect (erosion or sedimentation) impacts to riverine features such as riffles and rapids and sensitive habitat features (ie snags, coarse woody debris, instream macrophytes, boulders). • Where instream structures are required, considerations to potential flooding and erosive effects will be made in the design and construction of the crossing.	Detailed design and construction	Transmission line corridor - access track waterway crossing
B10	Waterway crossing (access tracks)	Crossing structures will be designed so that the existing nominal flow velocity, low flow conditions and fish passage are maintained wherever possible. This will include the following considerations: • Minimise the impact of essential instream structures by mimicking natural flows (DPI, 2005b). • Following Fairfull (2013), for waterway crossings incorporating culverts, a minimum of 300 mm of water should pool through the structure, with a centrally placed low-flow cell being preferable. • In line with Cotterell (1998), it is recommended that flow over or through instream crossing structures are designed such that they maintain water velocity of 0.3 m/s or less, which is likely to facilitate passage for native species of fish (velocities exceeding 1 m/s, are likely to prevent upstream migration of native fish).	Detailed design	Transmission line corridor - access track waterway crossing

Reference	Impact	Mitigation measure	Timing	Relevant location
B11	Waterway crossing (access tracks)	Any sections of stream or waterway banks that are impacted or modified by the project will be reformed or remediated to resemble the pre-work condition and form wherever possible or alternatively to a stable design form, as appropriate following the completion of construction work. This may include revegetation to stabilise bank sediments. Waterway banks impacted by the project will be reinstated such that bank stability at the crossing location is the same or better than prior to construction. Stabilising materials such as rock armouring, hydro mulch, jute matting, or other suitable geotextile materials may be utilised where necessary. Any temporary stream crossings will be removed and rehabilitated at the completion of their operational use.	Construction and operation	Transmission line corridor -access track waterway crossing
B12	Waterway crossing (access tracks)	The need for and location of waterway crossings at identified locations (V9-14 - Derringullen Creek, V9-28 - Gilmore Creek, as well as V9-13 - Yellow Creek and V9-12) will be confirmed during detailed design by the construction contractors. This may include consultation with DPI Fisheries. Crossing design would preference a single span bridge structure at Derringullen Creek and Gilmore Creek (aligning with the recommended crossing types identified by NSW DPI Fisheries for CLASS 1 streams).	Detailed design and construction	V9-14 - Derringullen Creek, V9-28 - Gilmore Creek, V9-13 - Yellow Creek, V9-12 - unnamed stream
B13	Waterway crossing (access tracks)	In the event that any further or alternative waterway crossings are required in areas mapped as Key Fish Habitat (KFH) or indicative threatened species distribution mapping (DPI 2022a), an aquatic ecological assessment will be undertaken at the proposed crossing location. The assessment approach will be consistent with that used for the EIS and will address any potential impacts to threatened aquatic species or KFH. This assessment may be desktop based if suitable levels of information are available but may also recommend a field inspection if threatened aquatic species or sensitive aquatic habitat features are considered to have a moderate or higher likelihood of occurring, in order to guide micro-siting and design/mitigation measures to minimise impacts to aquatic environments.	Detailed design and construction	Access track waterway crossing
B14	Waterway crossing (access tracks)	In addition to standard erosion and sediment control measures, the following procedures and considerations will be incorporated into construction methodologies for waterway crossings, where appropriate and practicable: • Minimise disturbance to native vegetation, including instream, fringing and riparian vegetation within the indicative disturbance area. This may include the demarcation of areas of native vegetation to be retained during work. • Any coarse woody debris or boulders located within instream work sites will be temporarily relocated during construction and then returned to the watercourse, at locations where scour risk can be avoided.	Construction	Transmission line corridor -access track waterway crossing

Reference	Impact	Mitigation measure	Timing	Relevant location
		• Waterway crossing work will be constructed during no or low flow conditions and under calm weather conditions. Work will also be timed to occur outside of any locally high seasonal flow periods. • Silt curtains or coffer dams will be deployed around instream work sites where required, to protect against any impacts to water quality or indirect impacts to retained vegetation. These measures will be situated so to avoid blocking fish passage wherever practical and removed as soon as they are no longer required. • Flow diversion measures will be installed on bunded waterway crossings as appropriate or where construction during no or low flow conditions is not feasible. Flow diversion measures may include pumps to ensure that water can be moved from one side of blockages to the other, with screened inlets to prevent the entrapment of aquatic fauna and outlet structures that are designed to avoid scouring of the channel. Where waterways are bunded or flow obstructed, all obstructions to flow will need to be removed as soon as practical after watercourse crossing construction has been completed. • Appropriate erosion and sediment controls that take into account the potentially flood prone nature of the land will be employed to protect against any impacts to water quality or indirect impacts to retained vegetation. • Waterway bed and bank material excavated during construction will be stockpiled outside of the active channel and avoid riparian vegetation. Any material excavated from the bed of waterways will be stockpiled separately from other materials and returned to the waterway bed following the completion of construction work. • If the stockpiling of sediment or soil is required, it will be located as far away from waterways as practicable and managed so that it is secure against flooding and runoff to prevent any sediment entering waterways. Adequate erosion and sediment control measures will be in place to protect stockpiled sediment against runoff during rainfall or flooding. • Only excavated natural materials (ENM) or virgin excavated natural materials (VENM) will be used as fill during reclamation work, ie no contaminated material, building or demolition rubble will be used as fill in any stream crossings. • Chemicals will be stored in adequate bunding (in accordance with Australia Standard 1940 – The storage and handling of flammable and combustible liquids) as far away from streams as practicable and appropriately protected against flooding or runoff. Spill kits will be made available, and a spill response plan developed. • Plant refuelling will occur as far away from streams as possible and appropriate spill prevention measures (such as diversion bunds/cut off drains upslope and drip trays and spill kits) will be implemented when refuelling.		

Reference	Impact	Mitigation measure	Timing	Relevant location
B15	Waterway crossing and access tracks	Regular monitoring/inspections of waterway crossing and access track conditions will be undertaken during operation. Consideration of the maintenance and inspection recommendations detailed in *Fish passage in streams: Fisheries guidelines for design of stream crossings* (Cotterell 1998) to inform the monitoring/inspection details are recommended. This may include monitoring/inspections following random events, eg flooding. This will review: • the crossing structures, access tracks and associated erosion and sediment control measures to determine if they are continuing to operate satisfactorily • any maintenance requirements in order to prevent impacts to aquatic environments • any issues that require intervention or rehabilitation eg bank erosion as a result of, or in proximity to, crossing locations.	Operation	Transmission line corridor -access track waterway crossing
B16	Connectivity strategy	As a part of the BMP, a Connectivity Strategy will be developed following design refinement and pre clearing. The core objectives of the strategy will be to outline the final location of the proposed mitigation measures identified within the BDAR. The Connectivity Strategy will be implemented to maintain connectivity in areas identified as facilitating fauna movement (as identified in *Technical Report 1 - Biodiversity Development Assessment Report*). Consideration of connectivity corridors will occur as a minimum at: • Key riparian crossings • Areas of the transmission line joining proposed biodiversity stewardship sites (ie Donna Valley Biodiversity Stewardship Site) and or conservation reserve estate (ie Tarlo River National Park, Bango Nature Reserve, Mudjarn Nature Reserve and Minjary National Park) • Transmission line structure locations that occur in woodland vegetation at strategic locations (i.e. vegetation corridors with moderate to high landscape connectivity, and with moderate to high levels of fauna activity/ movement). The final locations of connectivity corridors and minimum width requirements will be identified as part of a Connectivity Strategy developed in consultation with BCD (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Figure 13-15*). Access tracks will avoid connectivity corridors and favour existing access wherever possible. Construction will avoid and minimise any disturbance of connectivity corridors, where practicable. Connectivity measures such as fauna sensitive structures (ie under transmission glider poles), vegetation stepping stones, or reduced clearing will be considered in at least six locations within the project footprint, where gliders have been observed using the area.	Detailed design and construction	Transmission line corridor at strategic locations (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Figure 13-15*)

Reference	Impact	Mitigation measure	Timing	Relevant location
B17	Bird-strike	As a part of the BMP, conductor line-marking techniques will be considered at specific locations identified in the BDAR during design refinement to minimise bird strike. Use of fauna deterrent devices, most likely consisting of the "flapper" variety, will be considered. Positioning and exact diverter model will also be considered during detailed design and will be developed as part of the Connectivity Strategy. At a minimum, these will be used at sites recommended for specific corridors (refer to *Technical Report 1 - Biodiversity Development Assessment Report*) where flapper devices are considered warranted based on distribution, and nature of avifauna records, and nearby suitable waterbird habitat (within 1 km).	Detailed design	Transmission line corridor – at sites recommended for specific corridors (as identified in *Technical Report 1 - Biodiversity Development Assessment Report; Attachment 21*)
B18	Biodiversity management	A BMP will be prepared in consultation with BCD and approved by DPE prior to construction. The BMP will be prepared by a qualified ecologist and include a plan for implementing, evaluating and reporting on the effectiveness of all mitigation measures outlined in the BDAR, including: • Measures to minimise impacts to biodiversity, including measures to reduce disturbance to sensitive flora and fauna procedures for clearing of vegetation, including pre-clearing inspections and procedures for the relocation of flora and fauna • Preparation of a fauna handling and rescue procedure to be implemented during construction and operation for the ethical handling of injured or displaced fauna. Further, the fauna handling and rescue procedure would include an incident reporting protocol for fauna relocations, rescue and rehabilitation, euthanasia and/or fatality. • Procedures for the demarcation and protection of retained vegetation, including vegetation adjacent to construction areas and weed management • Vegetation clearing procedures for a two staged habitat removal process required for removal of key habitat features (hollow-bearing trees, habitat trees, and bushrock) identified in the BDAR and/or pre-clearing inspection. Including procedures to record the effort and outcomes of the habitat removal process • Measures to protect retained vegetation • Measures to avoid and minimise impacts to Golden Sun Moth, Striped Legless Lizard and Pink-tailed Legless Lizard habitats within transmission line easements during construction and operation	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
		• A rehabilitation plan for Golden Sun Moth habitat temporarily disturbed during construction incorporating seeding without the use of fertiliser or clover. The plan would include a suitable mix of native C3 grasses including Wallaby grasses *Rytidosperma spp*. and Speargrasses *Austrostipa bigeniculata, A.scabra* and a low biomass dryland C4 grass (ie Redleg grass Bothriochloa macra). A temporary nurse crop such as sterile ryecorn could be used to stabilise the soil and suppress weeds during establishment. Planting specifications and requirements for post-care, including weed control, are to be outlined in the plan. • Retention of habitat features such as rocky outcrops, surface rock, logs, wherever practicable • Habitat supplementation measures such as nest boxes, hollow re-use / creation, re-use of timber/logs as habitat within the transmission line easement where practicable. A monitoring program will also be developed to assess the efficacy of supplementary habitat measures on an ongoing basis in accordance with a Supplementary Hollow and Nest Strategy • Proposed rehabilitation of temporary disturbance areas including management and maintenance measures • Unexpected species finds protocol to be implemented if threatened ecological communities, flora and fauna species, not assessed in the BDAR, are encountered during pre-clearing inspections • A description of biosecurity protocols for plant and equipment movement between sites, including species specific measures • Education of construction teams regarding the presence of native fauna and risks of vehicle collision, particularly early in the morning and late in the afternoon/at night; implementation of speed limits on sealed and unsealed tracks and roads • Outline monitoring and compliance management requirements • Approach to relocation of nests by suitably qualified ecologist where found within construction work sites (i.e. nests found in hazardous areas will be translocated to nearby safe areas, direct handling of eggs and chicks will be avoided where possible). This could include potentially new poles/nest platforms • Details on the pre-clearing and clearing supervision process • Approach to avoid building during raptor nesting periods • Site specific monitoring of Booroolong Frog habitats within and adjacent to proposed work locations to inform appropriate construction controls and contingency measures. This plan will also the guide the re-use of hollows, logs, limbs and other habitat features encountered during clearing to be retained for placement within adjacent vegetation or on the maintained easement within shrub retention areas, in accordance with the revegetation plan.		

Reference	Impact	Mitigation measure	Timing	Relevant location
		The BMP will include a program to monitor, evaluate and report on the outcomes of a biodiversity monitoring program, as relevant. The monitoring program will be developed to target specific species considered to be most at risk of significant impacts, as determined during the detailed design phase. The BMP will stipulate objectives for monitoring, and how baseline data will be captured and represented.		
B19	Biosecurity and hygiene protocols	A Biosecurity Management Plan will be developed as a part of the BMP, to be implemented during construction. The plan will include: • Protocols for the identification of priority weed species, relevant pests and diseases of concern, mandatory reporting obligations and management of Emergency, Control and Biosecurity zones as per the NSW *Biosecurity Act 2015*. • Weed and pest animal management and monitoring requirements would also be outlined within the plan where relevant. • Locations, timing and methods for removing soil and plant matter from vehicles and machinery and sourcing clean soil and materials free of contaminants for construction work. Clean down stations (water or air, dependent on the identified biosecurity risk) will be constructed at suitable locations to clean down vehicles and employee shoes to stop the spread of weeds, pathogens (eg amphibian chytrid fungus, Phytophthora cinnamomic, exotic rust fungi and Epizootic Haematopoietic Necrosis Virus (EHNV)) and the introduction of new species. The biosecurity plan would address any Property Management Plan requirements where relevant.	Detailed design and construction	All locations
B20	Weed management	Weed control strategy during the operational stage of the project will be guided by existing Transgrid operational weed management procedures. During maintenance activities, general biosecurity duty obligations will be implemented as per existing Transgrid procedures. Biosecurity risks within the works footprint, such as weeds, would also be assessed and control measures implemented, as required, to manage existing or emerging issues.	Operation	All locations, as relevant

Reference	Impact	Mitigation measure	Timing	Relevant location
B21	Alternative roosting and/or nesting habitat for threatened fauna	Nest boxes will be provided for alternative roosting and/or nesting habitat for threatened fauna displaced during clearing in accordance with a Supplementary Hollow and Nest Strategy. The strategy will include the following requirements: • survey of tree hollows and nests within the proposed clearing extents • identify the size, type, number and location of nest boxes required based on the results of the ecological surveys and active hollow resources in adjacent areas • appropriately sized nest boxes will be installed within the vicinity of hollow-bearing trees (subject to landowner agreement and suitable trees being present) no more than two weeks prior to clearing of the tree • nest boxes will also include the re-use of existing hollows salvaged prior to or during clearing where practicable measures to address and manage nests (such as raptor nests) prior to clearing.	Construction	All locations where hollow bearing trees are being removed
B22	Pre-clearing survey	Pre-clearing surveys will be completed prior to clearing at each location by a suitability qualified and experienced ecologist. The proposed clearing extents will be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist will: • survey the proposed clearing extent • identify any fauna that will require relocation prior to clearing • confirm the location and mark out the extents of any biodiversity exclusion zones • confirm that hollow-bearing trees within and adjacent to the clearing extents are prominently marked/tagged • confirm that nest boxes are in place (where required) in suitable locations adjacent to areas to be cleared, or suitable locations for installation have been identified • survey and confirm the presence of raptor nests within and adjacent to the clearing extents • document, mark and record the location of threatened flora/fauna • document, mark and record other habitat features (eg rock piles) to be retained if possible. The results of the pre-clearing surveys will be used to update and confirm the accuracy of sensitive area maps.	Detailed design and construction	Transmission line corridor (at relevant sites)

Reference	Impact	Mitigation measure	Timing	Relevant location
B23	Biodiversity exclusion zones	Biodiversity exclusion zones for retained vegetation and threatened species habitats will be confirmed by a suitably qualified ecologist and identified as 'No disturbance' zones prior to the commencement of clearing or any site activity that could damage the vegetation within the exclusion zone. These areas will be identified as a no-go zone within approved plans and on-site demarcation will be required. High visibility protection fencing will be erected on site including signage clearly identifying these areas as no-go zones. Requirements for the protection and management of no-go zones will be addressed as a part of the site induction. Biodiversity exclusion zones will be physically marked and demarcated, and included on sensitive area maps and project GIS/GPS systems, prior to clearing. Further information regarding priorities for biodiversity exclusion zones are detailed in *Technical Report 1 - Biodiversity Development Assessment Report*.	Detailed design and construction	Transmission line easement (at relevant sites)
B24	Biodiversity management training	All relevant project personnel involved in vegetation clearance, including relevant sub-contractors will be trained on biodiversity management protocols and the requirements for the project, through inductions, toolbox talks and targeted training, and provided with sensitive area maps (showing clearing boundaries and exclusion zones) and updates as required.	Construction	All locations
B25	Features of high biodiversity conservation significance	Features of high biodiversity conservation significance within the operational easement, including biodiversity exclusion zones identified during construction and retained habitat for threatened species, will be recorded in Transgrid's GIS. The GIS information will be reviewed during the planning of all maintenance or other future activities that could cause disturbance.	Construction and operation	All locations, as relevant
B26	Vegetation clearing and maintenance	Update and implement existing procedures and guidelines for operation and maintenance of the project that address the following: • vegetation clearing and maintenance commitments in the BDAR and EIS • avoiding access and disturbance in biodiversity exclusion zones identified during the construction • avoiding access and disturbance in areas of high biodiversity conservation significance • avoiding maintenance of vegetation that does not need to be maintained during operation. Provide training to relevant Transgrid operational workers and vegetation maintenance contractors regarding the operational and maintenance guidelines and procedures.	Operation	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
B27	Revegetation of disturbed areas	All disturbed lands/areas must be managed throughout the construction work (in accordance with the relevant Managing Urban Stormwater (Landcom, 2004) (Blue Book) or comparable best practice guidelines, including: • vegetation removal, restoration, and management • stockpiling, erosion and sediment management • stabilisation / rehabilitation of disturbed lands/areas must be undertaken within suitable timeframes • temporary erosion and sediment controls must be maintained (and not removed) until rehabilitation measures are providing effective stabilisation of disturbed lands/areas. Disturbed areas (including areas not required for operation) will be stabilised/rehabilitated to a standard either: • as agreed with the landowner • in accordance with the relevant Managing Urban Stormwater (Blue Book) or comparable best practice guidelines.	Construction	All locations
B28	Vegetation clearing	Works for clearing and construction of access tracks will be carried out in such a manner that the least practicable disturbance to actual ground cover and contours is caused. Trees will be removed as close as possible to ground level and root balls will be left in situ wherever practicable. Areas of particular focus for minimising ground disturbance include the following: • Steep or Highly Erodible lands where slopes are in excess of 18 degrees from the horizontal. • Protected Riparian Land (PRL) defined as land within 20 m of the bed or bank of a prescribed stream. Generally, named watercourses are classed as protected riparian land; however, some unnamed watercourses may be classed as protected riparian land. • Waterfront land (40 m from the top of bank) • In areas where large rock outcrops are prevalent on the easement. Hazard trees identified from the LiDAR assessment will be flagged for removal, and any adjacent and important habitat trees and features identified for retention will be clearly marked and included in maps within the CEMP to avoid disturbance during the felling activities.	Construction	Transmission line corridor - Protected Lands or waterfront land

Reference	Impact	Mitigation measure	Timing	Relevant location
B29	Re-use of felled timber	Logs and tree hollows that could provide fauna habitat (the total length of wood at least 10 cm in diameter and at least 0.5 m long) will be relocated to adjacent woodland and/or suitable woodland locations where available/feasible. The opportunity to stockpile and supply felled trees for KFH rehabilitation or improvement work will be discussed with DPI Fisheries. Trees within the boundaries of State forests, Crown Lands, Travelling Stock Reserves, public roads or within 40 m of the bank of any river will be disposed of strictly in accordance with the requirements of the appropriate authorities. These requirements will be determined by the contractors before carrying out such work.	Construction	Transmission line corridor
B30	Access track construction	Access tracks will be used as necessary for the construction work and as far as is practicable, vehicle traffic shall be confined to these tracks. Track construction will be carried out to cause minimum disturbance to soil and vegetation both on and adjacent to the track. Tracks will be routed to follow the natural contour of the land as far as practicable to minimise the amount of cut and fill and soil disturbance. For any temporary access tracks, the disturbed surfaces and formed areas will be revegetated in accordance with the approved CEMP or *Managing Urban Stormwater: Soils and Construction - Volume 2C Unsealed Roads* (DECC, 2008a). In addition, other erosion control mechanisms will be put in place during the initial track construction work to contain any sediment that may erode from the disturbed surfaces.	Construction	Access tracks
B31	Light	Directional lighting will be used for any permanent lighting required (ie substation) to minimise light spill as much as possible in accordance with *Australian standard AS4282:2019*. Artificial lighting required during construction will be directed towards the work site and minimise light spill, to the extent practicable.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
B32	SAII entities	Impacts to SAII entities are to be addressed through the following measures: • Additional surveys scheduled for completion in spring 2023 to confirm presence/absence within habitat areas where species presence is assumed. • Route refinement and design avoidance during the detailed design to avoid and minimise impacts wherever practicable. Design refinements have been identified and will be incorporated into the project design where practicable to avoid impacts to the following four SAII entities: • *Glycine latrobeana* • *Diuris ochroma* • *Prasophyllum innubum* • *Pterostylis oreophila*.	Detailed design	All locations
Aboriginal heritage				
AH1	Impact to Aboriginal sites	The Aboriginal community consultation process for this project will continue until completion of construction.	Detailed design and construction	All locations
AH2	Impact to Aboriginal sites	The finalisation of the project design and construction methodology, and associated final disturbance areas, will be developed to avoid harm to sites of moderate or above Aboriginal heritage significance as far as practical. The objective is to further reduce potential impacts through transmission line structure location and design refinement of proposed infrastructure and construction methodology. Avoidance and minimisation of harm to sites and PADs will be prioritised.	Detailed design	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
AH3	Impact to Aboriginal sites in unassessed areas of the project footprint	Additional assessment will occur in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW* (2010b) for areas where ground disturbing activities are required in locations outside of the previously assessed area. Where required, additional heritage surveys will be carried out with the RAPs prior to ground disturbing activities occurring in any such areas (including areas where only visual inspection has been undertaken). If no Aboriginal objects are found or if Aboriginal objects are found and they would not be impacted, then a letter report will be prepared by an archaeologist that documents the findings and gives clearance to proceed. Where Aboriginal objects, scarred trees or area of PAD are located in unassessed areas and would be directly impacted, addendum report/s to *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report* will be prepared. The report/s will: • detail findings of the survey activities • detail where test excavation is required • outline any additional mitigation strategies beyond those required • be presented to the RAPs for comment. Final reports will be provided to RAPs and to Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Detailed design	All locations (outside of the previously assessed area)
AH4	Impact to Aboriginal sites of cultural value	Identified Aboriginal sites of cultural value, will be avoided by the project where feasible. Further consideration of the potential to avoid direct or indirect impacts on the identified Aboriginal sites of cultural value will be carried out during detailed design.	Detailed design	Aboriginal sites of cultural value
AH5	Impact to Aboriginal sites – PADs	An archaeological subsurface test excavation program will be carried out in parts of any PADs where project activities would have direct impact and a test excavation program has not already been completed in the area of impact. Direct impacts include grading of tracks and construction work sites, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	PAD areas not already tested
AH6	Impacts to areas of high Aboriginal archaeological sensitivity	Where detailed design confirms there would be direct impacts in areas with high archaeological sensitivity that have not been previously subject to test excavations, a desktop assessment will be completed to determine the level of previous impact from past ground disturbing activities. If it is determined that the area has undergone low previous impact then an archaeological subsurface test excavation program will be carried out. Direct impacts include grading of tracks and construction areas, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	Areas of high sensitivity not already tested where project activities would have direct impact

Reference	Impact	Mitigation measure	Timing	Relevant location
AH7	Impacts to areas of moderate Aboriginal archaeological sensitivity	A field and desktop assessment will be completed in areas assessed as having moderate archaeological sensitivity where detailed design has confirmed project activities would have direct impact and a test excavation program has not already been completed in the area of impact. This is to determine the level of previous impact from past ground disturbing activities. If it is determined that the area has undergone low previous impact then an archaeological subsurface test excavation program will be carried out. Direct impacts include grading of tracks and construction areas, excavation for transmission line structure construction and tree removal that includes the root ball.	Detailed design	Areas of moderate sensitivity not already tested where project activities would have direct impact
AH8	Impact to Aboriginal sites – Modified trees	Harm to modified trees (including those of cultural significance) will be avoided where possible through design development and construction planning. Modified trees will only be removed to directly facilitate construction of permanent infrastructure and/or to meet Vegetation Clearance Requirements for the transmission line. If the removal of a scarred tree (a type of modified tree) cannot be avoided, the tree will be subject to 3D scanning. Reports will be provided to RAPs and Heritage NSW. Following this, the scarred trunk will be salvaged.	Detailed design	Modified trees
AH9	Impact to Aboriginal sites – Isolated Finds, Artefact scatters and PADs	All portions of artefact scatters and isolated finds that will be directly impacted will require surface collection and salvage prior to construction commencement in those areas. Additionally, based on the outcomes of the test excavations, salvage excavations will occur in accordance with the Code of Practice.	Detailed design	Directly impacted sites and PADs
AH10	Indirect impact to adjacent heritage items	The locations of known Aboriginal heritage sites within and adjacent to the project footprint and the relevant protocols to avoid and manage any potential harm to the items will be communicated through the Heritage Management Plan to all relevant construction workers prior to construction commencing in that area.	Detailed design and construction	Transmission line.
AH11	Impact to Aboriginal sites	Cultural heritage awareness training will be carried out for all construction workers working on the project prior to the construction workers participating in construction activities. The training shall cover sites of heritage significance within and adjacent to project work sites and protocols that must be complied with to minimise and manage potential impacts to those sites.	Construction	All locations
AH12	Unexpected finds	If at any time during construction, any items of potential Aboriginal heritage archaeological significance, or human remains are discovered, they will be managed in accordance with an unexpected finds protocol that is aligned with the protocol in Attachment 6 of *Technical Report 2 – Aboriginal Cultural Heritage Assessment Report*.	Construction	All locations
AH13	Retrieved archaeological material	Retrieved archaeological materials will be stored in appropriate facilities confirmed in consultation with the RAPs.	Construction	As relevant

Reference	Impact	Mitigation measure	Timing	Relevant location
AH14	Post construction impacts to heritage items by maintenance activities	Sites of heritage significance that would remain in-situ within the transmission line easement and along access tracks will be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts which may occur during maintenance activities.	Operation	Transmission line, substations and access tracks
Non-Aboriginal heritage				
NAH1	Unexpected finds	If at any time during construction, any items of potential historic heritage archaeological significance, or human remains are discovered, they will be managed in accordance with an unexpected finds protocol that is aligned with the protocol in *Technical Report 3 – Historic Heritage Impact Assessment Report*.	Construction	All locations
NAH2	Impact to unsurveyed areas	Additional heritage surveys will be carried out prior to ground disturbing activities in areas which were previously inaccessible and/or where only visual inspection has been undertaken. Whether or not historic items are found, a letter report will be prepared by a heritage specialist for all additional surveyed areas that documents the findings. Where historic items are located and would be impacted, a draft survey addendum report/s to this report will be prepared for the survey areas. The report(s) will: • detail findings of the survey activities • detail where test excavation is required • outline any additional mitigation strategies beyond those required. Final reports will be provided Heritage NSW for their information prior to the commencement of ground disturbing activities in these locations.	Detailed design	All locations (outside of the previously surveyed heritage survey area)
NAH3	Post construction impacts to heritage items	Features/items of heritage significance that would remain in-situ within the transmission line easement and along access tracks will be mapped and recorded within GIS systems managed by Transgrid to reduce the potential for inadvertent impacts to occur during maintenance activities.	Operation	All permanent work
Land use and property				
LP1	Direct land use impacts	The location of infrastructure, work sites and access tracks (temporary and permanent) will be confirmed in consultation with landowners. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where possible.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
LP2	Property impacts	A property management plan will be developed for directly impacted properties in consultation with landowners and stakeholders. The property management plans will outline the protocols that will be implemented to address landowner concerns during construction. This may include: • the process for rectification of any damage to property infrastructure caused by construction • the process for rehabilitation and stabilisation of disturbed areas following the completion of construction • measures to minimise disruption to agricultural practices during construction • any fencing and gate requirements • specific biosecurity protocols.	Detailed design and construction	All locations
LP3	Agricultural impacts	Alternative technologies which could enable weed control close to the transmission lines will be considered.	Detailed design and construction	All locations
LP4	Biosecurity	Biosecurity controls will be implemented to minimise the risk of off-site transport or spread of disease, pests or weeds. Controls will be in accordance with Transgrid's *Biosecurity Procedure and Biosecurity Environmental Guidance Note* and include development of specific controls if high biosecurity risks are identified. Appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction via the project. The specific controls applicable to a property will be identified in consultation with the affected landowner. The effectiveness of these controls will be monitored in a manner and time interval consistent with the level of risk on each property. In the event of new infestations of notifiable weeds as a result of construction activities, the relevant control authority will be notified as per *Biosecurity Act 2015* (NSW) and Biosecurity Regulation 2017.	Construction and operation	All locations
LP5	Access impacts	Management of access on private landowner properties required for access to infrastructure for maintenance, including opening and closing of gates, will be done in accordance with landowner requirements.	Operation	Transmission line
LP6	GPS impacts	If adverse effects on agricultural precision farming (using GPS) is 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 landowners.	Operation	Transmission line

Reference	Impact	Mitigation measure	Timing	Relevant location
Economic				
EC1	Local employment	A Local Industry Participation Plan, an Australian Industry Participation Plan, a Workforce and Workforce Development Plan and an Aboriginal Participation Plan will be prepared and implemented.	Detailed design and construction	All locations
EC2	Potential business impacts	Liaison will occur with local councils, interest groups, economic development organisations, local chambers of commerce and State government to: • notify local businesses of the goods and services required by the project, service provision opportunities and compliance requirements of businesses to secure contracts • encourage and support local business in meeting the requirements of the project for supply contracts • assist qualified local businesses to tender for provision of goods and services to support the construction of the project, where possible.	Detailed design and construction	All locations
Social				
SO1	Accommodating temporary construction workers	Prepare and implement a Worker Accommodation Strategy for the construction workers during the construction period.	Detailed design and construction	All locations
SO2	Impacts on local services and social cohesion from introduction of temporary workers	Information will be provided to the construction workers that includes: • information on community services and recreation facilities, events and tourism activities • details on how to access health services including dedicated telehealth services organised by Transgrid • a company contact if help is needed • Code of Conduct to minimise the incidence of risk drinking and drug behaviours.	Detailed design	All locations
SO3	Impacts on emergency services	Emergency services will be regularly updated on work plans and access routes in the event of an emergency.	Construction	All locations
SO4	Opportunities for long-term investment	Any opportunities for appropriate long-term use for the worker accommodation facilities will be identified in consultation with councils.	Detailed design	Worker accommodation facility

Reference	Impact	Mitigation measure	Timing	Relevant location
Landscape character and visual impact				
LV1	Vegetation retention	Opportunities for the retention and protection of existing trees within the disturbance area would be identified during detailed construction planning. Identified trees of high conservation significance would be retained and protected where practicable.	Detailed design	All locations
LV2	Vegetation retention	Temporary and permanent access would be designed to minimise vegetation removal, changes to landform, and visual impacts where practicable.	Detailed design	All locations
LV3	Construction lighting	Lighting at construction compounds and worker accommodation facility would be designed and operated in accordance with *AS 4282 2019 Control of the obtrusive effects of outdoor lighting*.	Detailed design and construction	Construction compounds and worker accommodation facility
LV4	Vegetation protection	The Tree Protection Zone of retained trees within or immediately adjacent to the disturbance area would be managed in accordance with *AS 4970-2009 Protection of Trees on Development Sites* where practicable to minimise the impact of the works on the long-term health of these trees.	Detailed design	All locations
LV5	Visual changes near residences	For residences where the project is predicted to have a moderate to high visual impact, opportunities for screening vegetation would be investigated. Appropriate visual screening or other options (for example planting of vegetation) would be confirmed in consultation with the affected landowner and implemented where practicable. Vegetative screening would be maintained by the landowner.	Detailed design and operation	Transmission line
LV6	Operational lighting	Lighting at the substations would be designed and operated in accordance with *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting*.	Operation	Substations

Reference	Impact	Mitigation measure	Timing	Relevant location
Noise and vibration				
NV1	Construction noise	Where receivers are predicted to be noise affected and near construction compounds or fixed work areas with long durations (ie several months), path control, such as hoarding or earth bunds will be investigated. Practical measures will be implemented where required. Positioning of site structures will also be considered to act as barriers between noisy work and receivers where practical.	Detailed design and construction	• Wagga 330 kV substation compound (C01) • Memorial Avenue compound (C14) • Bowmans Lane compound (C15) • Tumbarumba accommodation facility (AC1)
NV2	Construction noise	An out-of-hours work protocol that details how the project will identify, assess and approve out of hours work outside standard construction hours that are likely to generate noise levels that exceed the relevant noise management levels at sensitive receivers will be developed and implemented. The protocol will include provisions to: • carry out additional assessments for work proposed outside standard construction hours, to confirm noise levels at potentially affected sensitive receivers and determine suitable mitigation measures to minimise noise levels • notify and engage with potentially noise affected receivers about upcoming work outside standard construction hours and address any associated complaints. • identify appropriate respite for noise affected receivers (where required). The out-of-hours work protocol will not apply to the operation of the worker accommodation facility.	Detailed design and construction	All locations
NV3	Construction noise and vibration	If blasting is required, a Blast Management Plan will be developed to minimise the potential for impacts. Maximum instantaneous charge calculations will be carried out for specific sites where blasting is required. Individual blast designs will be based on meeting the criteria rather than restrictions on maximum instantaneous charge. All blasts, including initial trial blasts will be monitored to obtain data which can be used to confirm site constants and compliance with blasting criteria. Landowner notification and consultation requirements will be identified in the Blast Management Plan.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
NV4	Construction noise	Where construction is likely to result in exceedances of NMLs at sensitive receivers, mitigation and management measures will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: • select quieter plant and equipment and use alternative construction methods to minimise noise levels • plan and schedule concurrent noisy activities to minimise the number of items of noisy plant operating at one time and cumulative noise levels • install screens or use barriers to mitigate noise from stationary noise sources • maximise the offset distance between noisy plant and sensitive receivers • orient noisy plant and equipment away from sensitive receivers • use noise source controls, such as residential class mufflers, to reduce noise from all regularly used plant including cranes, excavators and trucks • use non-tonal reversing alarms in place of traditional beeper reversing alarms during out-of-hours where noise impacts are predicted • turn off machinery when not in use • confirm equipment is maintained in accordance with manufacture's requirements to minimise generation of excessive noise • operate machinery in a manner which reduces occurrence of maximum noise level events, such as excavator bucket impacts, material drop heights, steel on steel impacts and dragging materials across hard surfaces • provide awareness training regarding noise mitigation measures to be implemented as part of regular toolbox meetings • notify and consult with potentially noise affected receivers about upcoming noisy activities • confirm that noise affected receivers outside standard construction hours and highly noise affected sensitive receivers are managed with consideration to the CNVG additional mitigation measures such as notifications, verification, and respite where appropriate.	Construction	All locations
NV5	Construction noise	Monitoring will be carried out for noise intensive activities that have the potential to cause noise exceedances at sensitive receivers, to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures have been implemented.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
NV6	Construction noise	All construction vehicle movements will adhere to the following measures: • out-of-hours vehicle movements will be minimised where possible • construction delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible • use of engine compression brakes will be avoided at night and in residential areas • site access points and roads/flight paths will be located as far as possible away from sensitive receivers • traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements • construction inductions will include driver behaviour requirements to minimise vehicle noise emissions.	Construction	All locations
NV7	Construction vibration	Where vibration intensive work is required within the recommended minimum working distances and is considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels will be investigated and implemented, where feasible • vibration monitoring will be undertaken at the start of work to determine actual vibration levels at the receiver • work will be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.	Construction	All locations
NV8	Operational substation noise	The design and layout of the proposed Gugaa 500 kV substation will comply with the NPfI criteria. The design will consider the following measures to mitigate potential noise impacts: • positioning of transformer barriers • selection of equipment with consideration of sound power levels • acoustic modelling of noise levels at surrounding receivers from all noise-generating substation equipment.	Detailed design and operation	Proposed Gugaa 500 kV substation

Reference	Impact	Mitigation measure	Timing	Relevant location
NV9	Operational transmission line noise	Receivers potentially noise affected by operational transmission line noise will be reviewed once the final project transmission line route, conductor arrangement and any property acquisitions are known. For each residence where potential operational noise levels are predicted to exceed project trigger levels, noise monitoring to confirm actual operational noise levels would be carried out: • at representative locations within six months of the commencement of operation; and • at the request of the landowner of the residence at any time within two (2) years after the commencement of operation. The noise monitoring will occur during weather/atmospheric conditions conducive to generating the corona effect. For residences where the monitoring identifies corona discharge noise levels above 35 dB(A) LAeq, 15min at the reasonably most affected point of the residence, consultation will be undertaken with the landowner of the affected residence to identify solutions. Once the appropriate solutions have been agreed with the landowner, these will be implemented within 12 months.	Detailed design and operation	Transmission lines
Soils, geology and contamination				
SC1	Salinity	Prior to ground disturbance within areas mapped as moderate to high risk saline soils, an inspection will be undertaken for the presence of saline soils. Areas of known or suspected salinity will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW DECC, 2008c) and the *Salinity Training Manual* (DPI, 2014) to manage salinity impacts. Erosion controls will be implemented in accordance with The *Blue Book* (Landcom 2004). Prior to construction, materials will be selected to withstand acidic or high saline soil and groundwater environment (where applicable). During construction, existing areas of waterlogging and poor drainage will be avoided, where possible, when building access tracks and permanent structures.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
SC2	Soil contamination	Disturbance to AECs identified as having a moderate risk or greater will be avoided or minimised where practicable during construction. Where disturbance cannot be avoided, potential impacts will be minimised during finalisation of the design and construction methodology, where practicable. AECs identified as having a moderate risk that will be disturbed will be further assessed prior to construction. The investigations will be undertaken in accordance with the assessment of site contamination NEPM 2013. Any remediation required for the project will be undertaken based on a site-specific Remedial Action Plan. The Remedial Action Plan will define remedial goals and objectives, performance criteria for remedial effort and remediation methodology. A validation report will be prepared after remedial effort and be in accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020b).	Detailed design and construction	All locations
SC3	Acid sulfate soils and rocks	Prior to ground disturbance in areas of potential acid sulfate soil or rock occurrence, testing will be carried out to determine the presence of actual and/or potential acid sulfate soils or rocks. If acid sulfate soils or rocks are encountered, they will be managed in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998).	Detailed design and construction	All locations
SC4	Soil contamination – chemical spills and runoffs	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. Environmental spill kits containing spill response materials suitable for the work being undertaken will be available with extras available to be carried in vehicles. A spill response procedure will be developed and implemented. All staff will be trained in emergency spill procedures.	Construction and operation	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
SC5	Naturally Occurring Asbestos	An Asbestos Management Plan will be prepared in accordance with the NSW Government Code of Practice *How to Manage and Control Asbestos in the Workplace* (SafeWork, 2020). The Asbestos Management Plan will include the following measures: • management or isolation of areas mapped as medium to high risk of NOA, where direct disturbance of NOA is confirmed to be required for project construction works • placement of suitable signage around the work areas • list of appropriate personal protective equipment, including Respiratory Protective Equipment • implementation of dust suppression controls including wetting surfaces, covering disturbed surfaces and the use of sealed air-conditioned vehicles to minimise potential asbestos impacts to workers • decontamination of the workers' coveralls, personal protective equipment, equipment and work site • procedures for the disposal of NOA material or waste, if required • implementation of air monitoring using pumps and sample filter grid cowls for asbestos fibres and dusts if it is suspected that exposure to NOA dust during work might exceed safe levels of airborne asbestos. The air monitoring pumps, and reporting, must be undertaken by a licensed asbestos assessor.	Detailed design and construction	All locations
SC6	Soil contamination	The contractor will undertake compliance monitoring, keep a record of waste volumes and waste types and keep a stockpiles register where excavations and stripping of surface soil contamination occurs. The contractor will keep all records during construction for waste disposal and for the importation of materials such as engineering fill and excavated natural materials (ENM) or virgin excavated natural materials (VENM) soils. Engineering fill materials for use on site will be validated to confirm they meet the classification of VENM or ENM prior to being transported to site.	Construction	All locations
SC7	Unexpected contamination	The discovery of any unexpected contamination during construction will be managed in accordance with an Unexpected Contaminants Finds Protocol which will be prepared prior to construction.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
Surface water and groundwater				
SW1	Water quality, erosion risk – erosion and sedimentation	An ESCP will be developed and implemented in consultation with a Certified Professional in Erosion and Sediment Control during construction for activities and areas that are considered higher risk. The plan will detail the processes, responsibilities and measures to manage potential soil and water quality impacts in accordance with the principles and requirements in: • *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), and Volumes 2A (DEC, 2008b) and 2C (DECC, 2008a), commonly referred to as the 'Blue Book' • *Best Practice Erosion and Sediment Control* (IESCA, 2008) • Transgrid's Environmental Guidance Notes • Guidelines for controlled activities (Riparian corridors (DPE, 2022c) and Watercourse crossings (DPE, 2022b)).	Construction	All locations
SW2	Water quality and geomorphology	Design of scour protection will be included for any infrastructure that is within a waterway channel. The design will incorporate features that minimise impact on flow conditions and natural functioning of the waterway, where possible. For work within or near waterways consider and adhere to the following guidelines • Guidelines for controlled activities (Riparian corridors (DPE, 2022c) and Watercourse crossings (DPE, 2022b)) • *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003) • *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013).	Detailed design and construction	Waterways
SW3	Surface and groundwater quality - monitoring	Water quality monitoring will be implemented to establish baseline water quality conditions in waterways of high sensitivity that may be impacted by nearby construction and to detect any changes in water quality that may be attributable to the project during construction. The frequency, location and duration of sampling will be detailed in a monitoring program. Monitoring locations will include: • at a minimum two monitoring locations (one located upstream and one downstream of the transmission line crossing) for waterways with a Strahler 4th order or higher within the SDWC where construction activities within 200 metres of the waterway will be carried out and could result in impacts • monitoring for total dissolved solids, total suspended solids, total nitrogen, and total phosphorus.	Detailed design and construction	All locations
SW4	Water supply	Water supply options and management will be undertaken in accordance with agreements between the construction contractors and relevant water users and suppliers.	Detailed design and construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
SW5	Groundwater flow paths, levels and users	Alternative construction methodologies will be investigated and implemented as required to minimise impacts to GDEs and registered groundwater bores, if identified to be directly impacted during detailed design. Make good provisions will need to be made to the groundwater user(s) for bores that will be affected.	Detailed design and construction	All locations
Hydrology and flooding				
HF1	Drainage design and stormwater management	Suitable on-site drainage design and stormwater management strategies and plans will be implemented to limit adverse flood impacts on surrounding properties during construction.	Detailed design and construction	All construction compounds
HF2	Impact of earthworks to establish new access tracks on flooding	The detailed design will consider the potential impacts on flooding associated with earthworks for new access tracks and the need for cross drainage culverts or bridge structures. The cross drainage infrastructure will be sized appropriately to minimise adverse flood impacts.	Detailed design	Access tracks
HF3	Impact on flooding at the Snowy Mountains Highway construction compound (C02)	Overland flow up to the 5% AEP event across the southern extent of the Snowy Mountains Highway compound (C02) is to remain unobstructed from bulk filling, site infrastructure and/or stockpiling. Selective placement of sensitive or vulnerable infrastructure (eg electrical equipment, buildings, machinery, stockpiles, pedestrianised areas etc) will be considered in flood prone areas.	Detailed design	Snowy Mountains Highway compound (C02)
HF4	Impact on flooding and drainage at construction compounds and Bannaby 500 KV substation	Existing drainage and overland flowpaths will be maintained at the Maragle substation compound (C05), Gregadoo Road compound (C06) and Bannaby 500 kV substation. Where filling is required, suitable drainage design and stormwater management strategies and plans will be implemented to limit adverse flood impacts on surrounding properties. Selective placement of sensitive or vulnerable infrastructure (eg electrical equipment, buildings, machinery, stockpiles, pedestrianised areas etc) will be allocated to areas away from drainage lines. On site detention will be incorporated where increases in site stormwater discharges exceed predevelopment flows and will be designed in accordance with the Blue Book (Landcom, 2004).	Detailed design and construction	Maragle substation compound (C05), and Gregadoo Road compound (C06) and Bannaby 500 kV substation
HF5	Impact on flooding and drainage at Gugaa 500 kV substation	Suitably sized cut-off drains and cross drainage culverts will be designed and constructed to maintain existing flood behaviour around and downstream of the substation footprint.	Detailed design and construction	Proposed Gugaa 500 kV substation

Reference	Impact	Mitigation measure	Timing	Relevant location
Hazards and risks				
HR1	Protection zones and landscaping	APZs will be managed in accordance with *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers requirements* (NSW RFS 2019) (PBP), and associated criteria.	Detailed design, construction and operation	Substations and project buildings within construction compounds and the temporary accommodation facility
HR2	Easement management	Vegetation within the proposed transmission line easement will be managed in accordance with Transgrid's existing vegetation management standards consistent with the clearance requirements principle identified in *AS/NZS7000:2016 Overhead Line Design*.	Detailed design, construction and operation	Transmission line easements
HR3	Ancillary buildings	The final location of the telecommunications hut will need to be assessed with a visual inspection to confirm potential bushfire risk.	Detailed design	Telecommunications hut
HR4	Access	Access to substations and project buildings within the bushfire survey area will be established in accordance with: • *Planning for Bushfire Protection 2019* requirements (NSW RFS 2019) criteria • Access requirements will be in accordance with *NSW Fire Trail Standards* (NSW RFS 2016) and *Fire Trail Construction and Design Maintenance Manual* (Soil Conservation Science 2017).	Construction and operation	Access tracks to substations and project buildings within bushfire survey areas
HR5	Bush Fire Emergency Management and Evacuation Plan (BFEMEP)	The project will be designed and constructed in accordance with a BFEMEP. The BFEMEP will be prepared by a suitably qualified person and will include: • Bushfire Emergency Evacuation Plan • Bush Fire Risk Management Plan (BRMP) protocols during construction, considering activities during days with fire danger rating 'high' or greater • bushfire response and notification measures to report fires at the earliest opportunity • bushfire mitigation measures including maintaining APZs and mechanisms for the handling and use of any dangerous goods • bushfire risk induction and training for personnel, including risks and management measures associated with construction equipment and activities • fire reporting, emergency areas, on-site refuges, and evacuation procedures and is to be consistent with *Development Planning: A guide to developing a bush fire emergency management and evacuation plan* (NSW RFS, 2014). The BFEMEP will be consistent with relevant Australian standard and development plans and guides.	Detailed design, construction and operation	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
		For the Special Fire Protection Purpose (SFPP), the BFEMEP will include planning for the early relocation of occupants in the event of a potential bushfire or other emergency situation. A copy of the BFEMEP will be provided to the Local Emergency Management Committee for its information prior to occupation of the development.		
HR6	Aviation safety	The detailed design of the transmission line structures with coordinates and elevations will be provided to relevant stakeholders (including Airservices Australia, Department of Defence and ALA owners along the transmission line route). The notification will be made as early as possible.	Detailed design	All locations
HR7	Aviation safety	Consultation with CASA will be undertaken to confirm whether obstacle lighting and marking of the transmission line structures are required. The provision of markers on cables and structures within three nautical miles (5.6 kilometres) of the final transmission line route will be considered with the appropriate stakeholders.	Detailed design and construction	Transmission line route between Wagga 330 kV substation and Gugaa 500 kV substation
HR8	Aviation safety	Approval to operate construction cranes that infringe the OLS for Wagga Wagga Airport will be obtained in advance of the proposed activity. Wagga Wagga Airport management will be provided with details of the crane operations at least seven days prior to their commencement via the Notice to Airmen (NOTAM) procedure.	Construction	Transmission line between Wagga 330 kV substation and Gugaa 500 kV substation
HR9	Chemicals, fuels and hazardous substances	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of any bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on the site plans.	Construction and operation	All locations
HR10	Dangerous goods and hazardous materials	Dangerous goods and hazardous substances will be transported in accordance with relevant legislation and codes, including the *Dangerous Goods (Road and Rail Transport) Act 2008*, Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018).	Construction	All locations
HR11	Emergency response	The Wagga 330 kV substation and Bannaby 500 kV substation Emergency Response Manuals will be updated to include the modifications and required revised emergency response procedures.	Detailed design and operation	Wagga 330 kV substation and Bannaby 500 kV substation
HR12	Emergency response	An Emergency Response Manual will be prepared for the proposed Gugaa 500 kV substation and will include emergency response procedures.	Detailed design and operation	Proposed Gugaa 500 kV substation

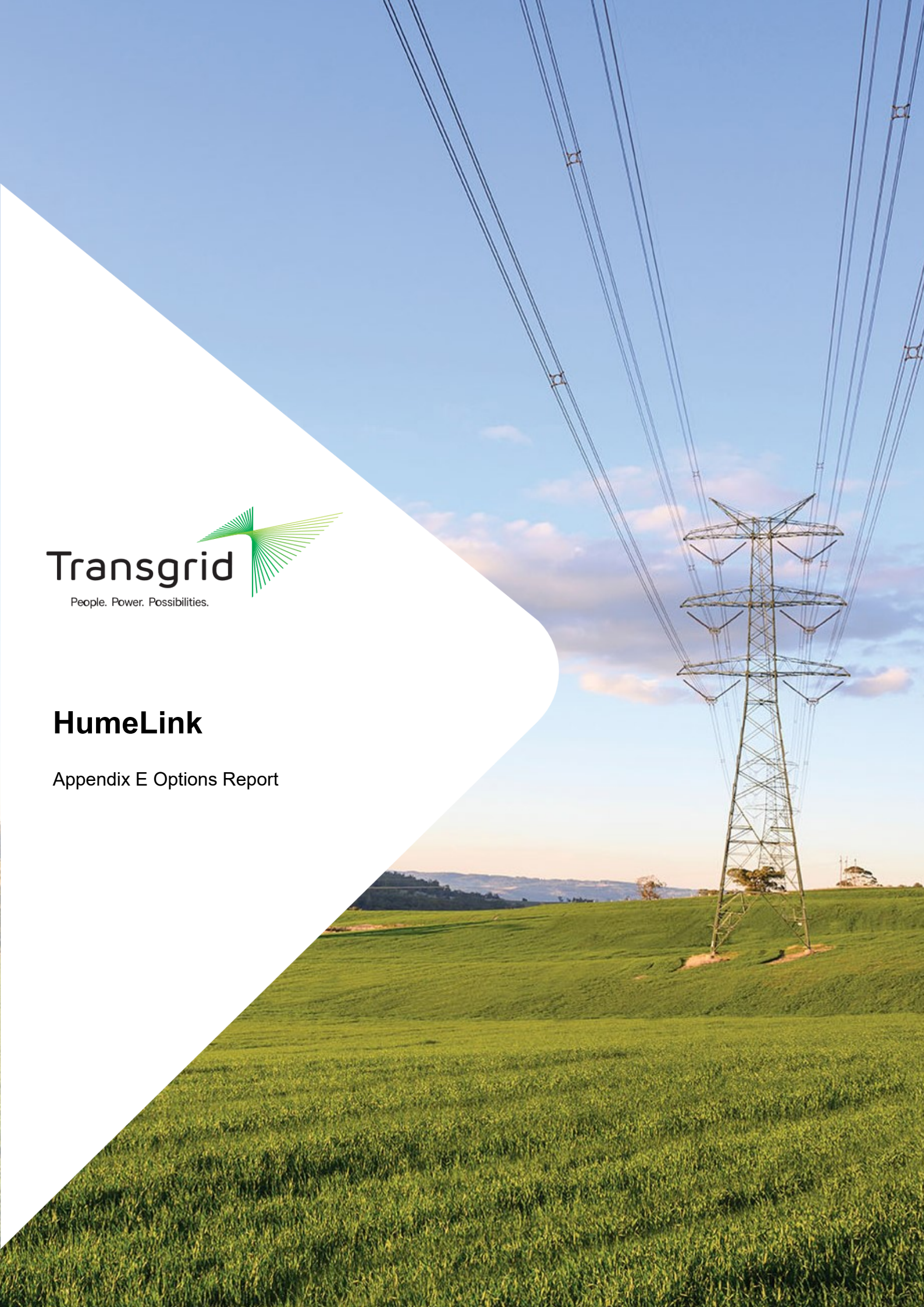
Reference	Impact	Mitigation measure	Timing	Relevant location
HR13	Electric and magnetic fields	The detailed design for the transmission line and substations will be developed to comply with the following criteria: • Magnetic fields: 2,000 milligauss being the ICNIRP guideline 'Reference Level' • Electric fields: 9.1 kV per metre, ensuring compliance with the ICNIRP guideline 'Basic Restriction'.	Detailed design	Transmission line and substations
Traffic, transport and access				
TT1	Road safety – design	Access tracks, access connections and road upgrades required to facilitate the movement of project related traffic will be designed according to relevant Austroads guides.	Detailed design	Access tracks and roads
TT2	Impact to road network during OSOM deliveries	Prior to commencement of transportation activities, the validity of the previously undertaken haulage route studies will be confirmed in consideration of final haulage route conditions and applicable route restrictions for the period during which transportation of such components is planned.	Detailed design	Transportation route
TT3	General construction impacts	Traffic controls will be aligned with *Traffic Control at Work Sites – Technical Manual Version 6.1* (TfNSW, 2022). Traffic controls will be confirmed in consultation with the relevant road authority.	Detailed design and construction	All locations
TT4	Road maintenance	Prior to construction, road dilapidation surveys will be carried out for all local roads to be used during construction. The surveys will assess the current condition of the road surface. At the completion of project construction, a subsequent road condition assessment will be prepared to assess the damage to roads accessed by project related traffic. Damage caused by the project will be rectified in consultation with the relevant road authority.	Detailed design and construction	Access routes
TT5	Impact on rail operation	All project activities in rail corridors will be undertaken in accordance with the permission granted by the appropriate rail authority. Stringing of transmission line over rail tracks will be scheduled during rail maintenance periods or in a duration which permits sufficient gap between scheduled freight or passenger services to undertake the work.	Construction and operation	All locations
TT6	Temporary lane/road closure	Road closures will be undertaken with the approval of the appropriate road authority and under the relevant road occupancy licence to be obtained prior to construction. Where feasible, road closures will be planned outside of the traffic peak to minimise the impact on the road network.	Construction	All locations
TT7	Road safety – driver related	A Code of Conduct applicable to all construction workers will be developed and implemented which will define acceptable driver behaviour. The purpose of the Code of Conduct is to promote road safety and ensure that the impacts of construction-related vehicle movements on local roads and the local community are minimised. The Code of Conduct will be developed as part of a wider suite of documents under work health and safety requirements.	Construction	Roads providing access to project

Reference	Impact	Mitigation measure	Timing	Relevant location
TT8	Community and stakeholder consultation	Community and stakeholder communication strategies will be established and implemented to notify the affected communities, visitors, emergency services and relevant road and rail authorities in advance of any disruptions to traffic, anticipated delays, disruptions to property access and changes to travel routes. The strategies will be developed including details on communication channels, frequency of communication and response measures in relaying information to the community and stakeholders.	Detailed design and construction	All locations
Air quality				
AQ1	Dust emissions	The following measures will be considered and implemented where practicable and appropriate to manage dust: • use water sprays or surfactants as required for dust suppression • provide adequate water supply on site for dust suppression • locate dust generating activities away from receptors • protect stockpiled materials from wind erosion to minimise dust generation and position stockpiles as far as practicable away from any nearby receptors • implement measures to minimise the tracking of dust generating material onto paved roads • cover the loads of potential dust producing materials • minimise the extent of ground disturbance as far as practicable • stabilise disturbed areas as soon as practicable • plan and schedule vegetation clearance and grubbing activities to minimise areas of open and exposed soil. The effectiveness of the installed controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	All locations
AQ2	Vehicles and machinery emissions	All vehicles and machinery will be maintained in accordance with manufacturer's specifications.	Construction	All locations
AQ3	Vehicle movements	Dust generation from project-related traffic movements on unsealed roads and access tracks (routes) in proximity to sensitive receivers will be visually monitored. Where dust from project-related traffic movements is impacting or has the potential to impact the sensitive receivers, measures to minimise dust emissions and potential associated amenity impacts will be implemented where practicable and appropriate.	Construction	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
AQ4	Operation of concrete batching plant(s)	Measures will be implemented at concrete batching plants to minimise emissions to air as far as possible, and will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air may include: • all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay • cement silos and hoppers will be fitted with dust filters • all inspection points and hatches will be fully sealed • all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor • the cement silo will be fitted with emergency pressure alert and automatic cut off overfill protection • transfer of cement from storage to batching will occur via sealed steel augers • regularly inspect monitoring of dust emissions and apply additional controls as required.	Construction	Concrete batching plant(s)
AQ5	Crushing/screening activities	To minimise dust emissions during crushing/screening activities, the following measures (as a minimum) will be considered and implemented where practicable and appropriate: • fit screen covers will be fitted to the crushing/screening equipment • control dust emissions from screening activities using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis and maintain as required to ensure operational efficiency • where practicable, install wind breaks in appropriate locations adjacent to the dust generating equipment and processes • prior to screening, dampen the rocks during dry weather conditions. The effectiveness of the implemented controls will be monitored, and additional controls implemented as required to address any performance issues identified.	Construction	Crushing/screening plant(s)
Climate change and greenhouse gas				
CC1	GHG emissions	The use of SF_6 will be minimised where possible, including through the investigation of alternatives.	Detailed design and operation	Substations

Reference	Impact	Mitigation measure	Timing	Relevant location
CC2	GHG emissions	Options that will be considered during ISC rating design review include energy efficient and passive design features for substation and worker accommodation facility buildings including air conditioning, lighting, low-flow fittings and solar power.	Detailed design	Substations and worker accommodation facility
CC3	GHG emissions	Options to minimise transport distances between construction compounds, accommodation facilities and work sites will be considered, for example utilising vehicle pooling / mini buses and sourcing equipment and materials locally where practicable.	Detailed design	All locations
CC4	GHG emissions	GHG emissions and associated activity data will be tracked and recorded to assist in identifying key emission sources and appropriate targeting of mitigation measures, as well as to provide learnings for other projects and demonstration of IS Rating compliance.	Construction and operation	All locations
CC5	GHG emissions	SF_6 emissions will be minimised through leakage detection monitoring programs, maintenance and end of life dismantling procedures.	Operation	Substations
Waste				
W1	Resource management	The resource management hierarchy principles established under the WARR Act of avoid, reduce, reuse, or recycle with disposal as the last resort will be applied to further development, construction and operation of the project.	Detailed design, construction and operation	All locations
W2	Stockpiling of wastes	Stockpiled wastes, where required, will be: • appropriately segregated to avoid mixing and contamination • appropriately signposted • appropriately stored in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) • less than three metres in height with an appropriate height to length batter ratio • located as far away as reasonably practicable from sensitive receivers, ecological areas and waterways.	Construction	All locations
W3	Storage and transport of waste	All waste will be assessed, classified, managed, and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA 2014b). Waste will be appropriately transported, stored and handled according to their waste classification and in a manner that prevents pollution of the surrounding environment. All waste related documentation such as waste classifications, transfer and disposal documentary evidence will be held by the proponent for a minimum of seven years from the date the waste is generated.	Construction and operation	All locations

Reference	Impact	Mitigation measure	Timing	Relevant location
W4	General waste management	The reuse of spoil and soils sourced from construction will be considered under an NSW EPA approved resource recovery order where the materials are sourced from within the project footprint and suitable from both a contamination and geotechnical perspective. Where a NSW EPA Resource Recovery Order exists for waste generated by the project, the opportunity to reuse that waste will be considered prior to disposal. The orders will need to be reviewed during construction and operation for validity and applicability.	Construction and operation	All locations
W5	Hazardous waste	Hazardous waste will be managed by appropriately qualified and licensed contractors, in accordance with the requirements of the *Environmentally Hazardous Chemicals Act 1985* and the EPA waste disposal guidelines.	Construction and operation	All locations
Cumulative impacts				
CI1	Occurrence of cumulative impacts	Coordination and engagement with proponents and/or construction contractors of relevant future projects will occur during detailed design and construction to confirm the potential cumulative impacts and timing of activities that have potential cumulative impacts. Coordination and engagement will include: • providing regular construction program updates • identifying potential conflict points with other relevant future projects, eg proximity of work sites, or shared construction access routes and traffic management requirements • developing mitigation strategies in order to manage conflicts that may arise.	Detailed design and construction	All locations
CI2	Occurrence of cumulative impacts	Engagement with the Department of Defence and Transport for NSW will be carried out during detailed design and construction to confirm the potential for cumulative impacts from the RAAF Base Wagga Redevelopment and work associated with the *Tumut to Hume Highway (Snowy Mountains Highway and Gocup Road) Corridor Strate*gy (Transport for NSW, 2016). Mitigation strategies will be developed if potential cumulative impacts are identified.	Detailed design and construction	All locations



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Appendix E Options Report

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Project Options Report

HumeLink

May 2023

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Executive Summary

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including City of Wagga Wagga, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley.

HumeLink would involve construction of a new substation east of Wagga Wagga (referred to as the proposed Gugaa 500kV substation) as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the declared South West Renewable Energy Zone (REZ) as well as the candidate Wagga Wagga and Tumut REZs. The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

HumeLink has been identified as a staged actionable project in the 2022 Integrated System Plan (ISP) (AEMO, 2022). HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

The purpose of this Options Report is to:

- describe the analytical and decision-making processes adopted to identify the HumeLink strategic solutions, technical options, area of interest, study corridor[1], potential transmission line routes[2], and finally the 200 metre refined corridor
- explain the justification for corridor changes through the course of the project's development
- describe the criteria for site selection of permanent and temporary infrastructure, such as substations and construction ancillary facilities

[1] An area between 1-5 km wide within which transmission line route options and new substation sites will be identified between Wagga Wagga, Bannaby and Maragle for investigation.
[2] The location of the transmission line structures along the middle of the transmission line easement.

Official

- inform the development of the Environmental Impact Statement (EIS) and engagement with communities and stakeholders.

The development of the preferred transmission line corridor options involved a comprehensive process ranging from an assessed regulatory test of strategic options (RIT-T process), through to more detailed route and corridor refinement process.

The key steps in the development of the preferred transmission line corridor included the following:

- strategic solution and technical option identification and assessment through the RIT-T process
- identification of the HumeLink area of interest
- identification of high-level constraints through desktop analysis and community engagement processes
- corridor refinements and analysis of route options
- selection of a 200 metre refined corridor

In response to community requests, options to underground the transmission lines were assessed and considered as a way to help minimise potential social and environmental impacts of the project. Undergrounding options were ultimately discounted as they were not consistent with the regulatory rules that require Transgrid to propose the most efficient option for consumers based on the capital cost of the solution, the ongoing operational costs, the market benefits, the expected reliability, and the costs associated with the impact on landowners, the community, and the environment. This is further detailed in *Concept Design and Cost Estimate – HumeLink Project – Underground* (GHD, 22 August 2022).

The key steps in the site selection process for the new substation included:

- identification of the area of interest based on the project objectives and strategic network requirements
- constraints analysis and identification of suitable sites
- refinement of potential sites including preliminary site inspections and landowner discussions
- multicriteria process to short-list sites.

Potential construction compound and worker accommodation facility locations were identified in consideration of size, constructability, environmental sensitivity, land availability and proximity to sensitive receptors. The final selection and requirements of construction compound sites and temporary worker accommodation would be a major consideration of the construction contractors.

The identification of the HumeLink strategic solutions, technical options, area of interest, study corridor, potential routes, and a narrowed 200 metre refined corridor to accommodate a transmission line easement is an iterative process. At every step in the development of new transmission infrastructure, Transgrid seeks to avoid and minimise impacts to the environment and community.

Glossary

Term	Definition
200 metre refined corridor	Area developed through the refinement of the study corridor, generally 200 metre in width. The transmission line easement will be located within the refined corridor.
AEMO	Australian Energy Market Operator – manages the National Electricity Market.
AER	Australian Energy Regulator – part of the Australian Competition and Consumer Commission and enforces the regulatory rules established by the Australian Energy Market Commission.
AHIMS	Aboriginal Heritage Information Management System – contains information for over 100,000 recorded Aboriginal sites and over 14,000 archaeological and cultural heritage assessment reports
Area of interest	The area of interest is the broad geographical region where a project would occur to meet a specific need. Considerations for the area of interest include: • network solution requirements, particularly key connection nodes and any need for optionality • an area broad enough to allow reasonable flexibility to deviate from straight line solutions. For HumeLink, the area of interest includes a broad area between substation nodes at Wagga Wagga, Maragle, and Bannaby.
Double circuit	A double circuit transmission line has two independent circuits on the same structure with each circuit made up of three sets of conductors.
EEC	Endangered Ecological Community
FCNSW	Forestry Corporation of New South Wales
HumeLink	The development of new high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.
ISP	Integrated System Plan, a nationally coordinated, long-term electricity grid investment plan, which recommends immediate, short- and long-term infrastructure investment for the system of generating, transporting and consumption of electricity in the NEM. The most recently published version of the ISP is the 2022 ISP, published in June 2022. AEMO is obliged to publish a new version of the ISP every two years.
MCA	Multi-criteria analysis
NPWS	National Parks and Wildlife Service
NEM	National Electricity Market, covers the five eastern and southern States (Queensland, New South Wales, Victoria, South Australia, Tasmania) and the Australian Capital Territory and allows electricity to flow and be traded across regions.
PACR	Project Assessment Conclusions Report
PADR	Project Assessment Draft Report
PCT	Plant Community Type

Term	Definition
Project footprint	The area that would be directly affected by the construction and operation of the project. It includes the location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation (i.e. the combined construction footprint and operational footprint). The HumeLink footprint includes the 200 metre refined corridor, substations, construction compounds, worker accommodation facilities, and access tracks.
PSCR	Project Specification Consultation Report
REZ	Renewable Energy Zone, a geographical area identified as suitable for a combination of renewable energy generation (such as wind and solar), storage (such as batteries and pumped hydro) and high-voltage transmission to deliver electricity to the homes, businesses and industries that need it.
RFS	Rural Fire Service
RIT-T	Regulatory Investment Test – Transmission
Route	Generic term used to describe a path between two points. For the purpose of this report, it is used both at the local level and over the broader area of interest for the project.
Single circuit	A single circuit transmission line has three sets of conductors.
Study corridor	An area between 1-5 kilometre wide within which transmission line route options and new substation sites will be identified between Wagga Wagga, Bannaby and Maragle for investigation.
Tier 1 and Tier 2 constraints	Criteria considered during the corridor identification and route options assessment processes. These included technical, environmental, property, community and cost considerations. Constraints include no-go areas, areas to be avoided, or where impacts should be minimised.
Transmission line easement	The area over which Transgrid will secure a legal 'right of way' from landowners to construct, operate and maintain the transmission lines. The easements for the 500 kV transmission lines would typically be 70 m wide. However, a number of locations may require wider easements of up to 110 metres wide at transposition locations and up to 130 metres wide where the new transmission line would parallel the relocated section of existing 330 kV transmission lines. The easement provides a right of access to construct, maintain and operate the transmission line and other operational assets.
Transmission line route	The location of the transmission line structures along the middle of the transmission line easement.

1. Introduction

1.1. Strategic Context of the Project

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including City of Wagga Wagga, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley.

HumeLink would involve construction of a new substation east of Wagga Wagga (referred to as the proposed Gugaa 500 kV substation) as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the declared South West Renewable Energy Zone (REZ) as well as the candidate Wagga Wagga and Tumut REZs. The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

HumeLink has been identified as a staged actionable project in the 2022 Integrated System Plan (ISP) (AEMO, 2022). HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

1.2. Purpose of this Report

The purpose of this report is to describe:

- the community and stakeholder consultation undertaken during the development of the HumeLink preferred corridor, including opportunities to provide input and feedback on project options
- the analytical feedback and decision-making processes adopted to identify the HumeLink area of interest, study corridor[3] and potential transmission line routes[4]
- explain the justification for corridor changes through the course of the project's development
- describe the criteria for site selection of permanent and temporary infrastructure, such as substations and construction ancillary facilities
- establish a project footprint which will form the basis for the environmental assessment, as well as for the commencement of land access and property negotiations.

[3] Initially, an area between 1-5 kilometre wide within which transmission line route options and new substation sites will be identified between Wagga Wagga, Bannaby and Maragle for investigation.

[4] The location of the transmission line structures along the middle of the transmission line easement.

2. Objectives and Guiding Principles

The key objectives and guiding principles in developing the project to identify the project footprint as the basis of assessment in the EIS included:

- delivering a key element of the ISP
- minimising property impacts
- minimising environmental impacts
- providing appropriate opportunity for community consultation and stakeholder input
- delivering a project that is technically feasible and meets transmission network planning requirements and risk considerations
- providing best value for money for consumers.

3. Technical Options

3.1. RIT-T

Once identified in the ISP, projects are developed through the Regulatory Investment Test for Transmission (RIT-T), where approval is sought from the Australian Energy Regulator (AER). The RIT-T process compares credible options and tests whether the net cost to the market (and therefore ultimately to consumers) would be higher under the 'do nothing' path, than if investment were to go ahead.

The RIT-T process involved a process of consultation over a minimum of 12 weeks, initiated by publishing the Project Specification Consultation Report (PSCR)[5] containing information and data on the proposal, followed by a Project Assessment Draft Report (PADR)[6] if the proposed transmission investment is going to proceed, and a Project Assessment Conclusions Report (PACR)[7] after another six-week consultation period (AER, 2020).

3.2. Strategic Solutions

The PSCR for HumeLink was released in June 2019. This report identified five potential strategic solutions that could be used to reinforce the Southern Shared Network. Potential strategic solutions included:

1. installing new high-voltage direct current lines between Maragle, Bannaby and Sydney
2. using the existing 330 kV network with minor line upgrades
3. rebuilding the existing 330 kV lines
4. building new 330 kV or 500 kV double circuit transmission lines from Maragle to Bannaby
5. installing new 500 kV transmission lines between Wagga Wagga, Maragle and Bannaby substations.

The installation of new 500 kV transmission line between Wagga Wagga, Maragle and Bannaby was determined as the only feasible strategic solution by Transgrid. It was deemed the most economically beneficial, with lower technical risks than other options (ie more diverse paths that would mitigate the risk of high impact events affecting multiple circuits).

5 PSCR available at: https://www.transgrid.com.au/media/chvf0ahp/transgrid-pscr_reinforcing-nsw-southern-shared-network.pdf
6 PADR available at: https://www.transgrid.com.au/media/xrzd0jv4/transgrid-hume-link-padr-amended.pdf
7 PACR available at: https://www.transgrid.com.au/media/rxancvmx/transgrid-humelink-pacr.pdf

3.3. Technical Options

Four technical options were considered, with three different voltage scenarios for each option. The four technical options are:

- Option 1 – two new transmission lines between Maragle and Bannaby
- Option 2 – new transmission lines between Maragle and Bannaby via Wagga Wagga
- Option 3 – new transmission lines in a “loop” between Maragle, Bannaby and Wagga Wagga
- Option 4 – new transmission lines in a “loop” between Maragle, Bannaby and Wagga Wagga plus additional capacity between Bannaby and Sydney.

These are shown in Figure 3-1.



Figure 3-1 Technical options

Each technical option considered three different voltage scenarios:

- Scenario A – construction and operation at 330 kV with a high-capacity conductor
- Scenario B – construction to 500 kV and initial operation at 330 kV, with the optionality to augment substation equipment in the future to operate to 500 kV
- Scenario C – construction and operation at 500 kV.

The PADR concluded that the 500 kV options connecting Maragle and Bannaby via Wagga Wagga (i.e. Technical Option 2C and Technical Option 3C) would provide the greatest net benefits of all options. Technical Option 2C would involve four new 500 kV transmission lines while Technical Option 3C would involve three new 500 kV transmission lines in a loop (refer to the schematics from the PADR in Figure 3-2 and Figure 3-3).

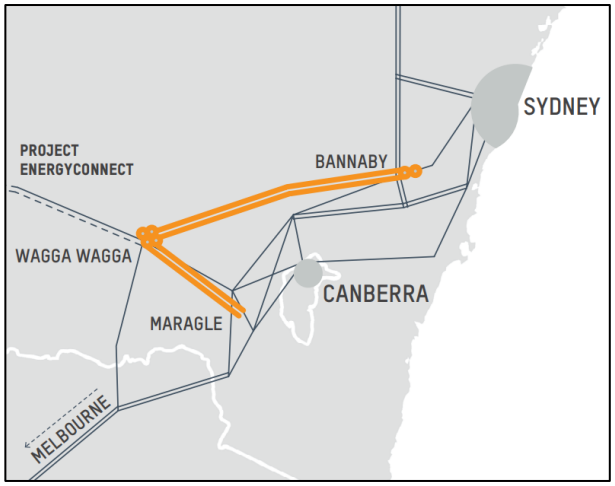


Figure 3-2 Technical Option 2C (500 kV)

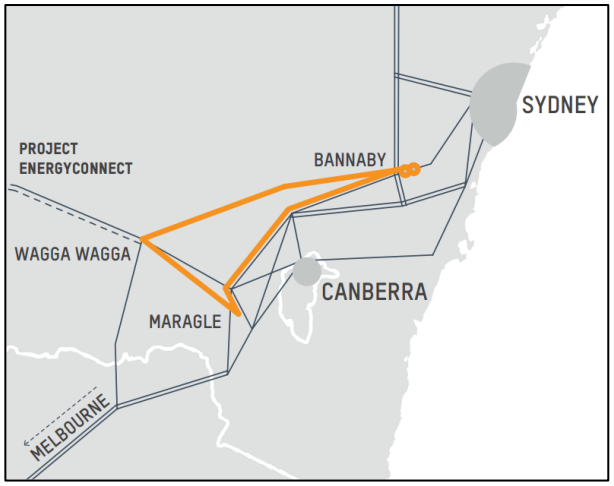


Figure 3-3 Technical Option 3C (500 kV)

3.4. Preferred Technical Option

The PACR for HumeLink was published in July 2021 (Transgrid, 2021). The PACR concluded that Technical Option 3C provides the greatest net benefit of all options considered across all four scenarios investigated. Technical Option 3C was found to have approximately 23 per cent greater estimated net benefits than the second ranked option (Technical Option 2C). Technical Option 3C would provide more route diversity than Technical Option 2C, reducing the risk of events such as lightning strikes, bushfires or extreme wind impacting power supply in the network. All lines in Technical Option 3C are proposed to be constructed in a double-circuit configuration to minimise the overall costs to consumers, which was identified as a refinement in the PACR compared to the PADR.

The RIT-T process concluded with the publication of an addendum to the PACR in December 2021 to provide greater detail on one of the options considered (Technical Option 1C). Technical Option 3C remained the preferred option.

The preferred option is expected to:

- deliver net benefits of approximately $491 million to 2045/46 (in present value terms)
- lower generator fuel costs required to meet demand in the NEM
- reduce the need for new dispatchable generation investment
- avoid capital costs that would otherwise be required to enable greater integration of renewables in the NEM
- provide significant 'competition benefits' by increasing the efficiency of bidding in the wholesale market and improving the bidding behaviour of generators who may have market power.

This preferred option is generally consistent with the assumptions related to HumeLink in the 2022 ISP, including its network topology and operating capacity.

The changes to the preferred network infrastructure solution identified in the PACR informed changes to the HumeLink study corridor. This is described in further detail in Chapter 5.

3.5. Considerations for Undergrounding

Underground options are typically more expensive than transmission lines, and therefore do not provide value for money. However, underground solutions have been considered and assessed for HumeLink to help minimise potential social and environmental impacts of the project.

Undergrounding offers the following potential benefits:

- reduced visual and noise impacts
- no impact to aerial operations
- generally lower electromagnetic fields
- decreased bushfire risk from the transmission lines
- lower risk of damage to the transmission lines due to external factors (e.g. extreme weather, falling trees, wildlife, bushfires, vehicles).

Some of the factors which contribute to the considerations of benefits or limitations for undergrounding include:

- underground lines are substantially more expensive than overhead
- cable joints are required at regular intervals along the length of any underground sections
- differences in reliability and fault restoration
- limited supply of underground expertise
- shorter asset life expectancy of underground cables.
- construction differences between overhead and underground installations
- operational differences between overhead and underground installations

- underground cables require narrower easements.

These factors are discussed further in Appendix B.

Delivery of underground lines is not economically feasible based on current cost assumptions and known technical challenges.

However, in response to community feedback, Transgrid agreed to undertake a joint undergrounding feasibility study together with the community to investigate the feasibility of undergrounding the transmission line as an alternative to overhead lines.

GHD Pty Ltd (GHD) was engaged to investigate concept designs for transmission network options for HumeLink using underground cables, with expert advice on high voltage direct current projects provided by Stantec (GHD, 2022b).

GHD investigated four potential routes to underground HumeLink. The routes differed from those considered for overhead transmission line, as it would not be feasible to build an underground line in the same place as an overhead line due to topography and other engineering constraints.

A Multi-criteria analysis (MCA) was undertaken of each route using GHD's GIS-based 'InDeGO' Method (Infrastructure Development – Geospatial Options). The MCA identified the current route (at the time of initiation of the analysis) as the least constrained route. The cost associated with several undergrounding options was assessed and compared to the cost of the proposed overhead configuration.

The cost of undergrounding the HumeLink transmission lines was estimated to be around three times more than the entire project's current cost. The additional cost would need to be passed on to commercial, industrial and private electricity consumers.

Undergrounding transmission lines would also mean a significant delay in completion of the project by up to five years. This delay would threaten the timely connection of the new renewable energy and the related essential new interstate connections to the grid as HumeLink bridges EnergyConnect (which connect South Australia) and the Victoria-NSW Interconnector West. AEMO's 2022 ISP identifies HumeLink as an actionable project that is to be progressed urgently and delivered by 2026 to secure the network as the ageing power stations are decommissioned. A significant delay would put the energy security and stability of large parts of Eastern Australia at potential risk of failure.

The findings of the review were documented in the report *Concept Design and Cost Estimate – HumeLink Project – Underground* (GHD, 22 August 2022). The report is available on Transgrid's website: https://www.transgrid.com.au/media/y0mpqzvw/humelink-project-underground-report-august-2022-final.pdf

Based on the findings from the report, undergrounding HumeLink would not be consistent with the regulatory rules that require Transgrid to propose the most efficient option for consumers based on the capital cost of the solution, the ongoing operational costs, the market benefits, the expected reliability, and the costs associated with the impact on landowners, the community, and the environment.

Additionally, Transgrid is actively participating in The Energy Charter's Undergrounding Transmission engagement. The Energy Charter's purpose to identify and bring together collaborators to create a clear and consistent sources of information detailing how underground for transmission is considered.

4. Route and Corridor Development

4.1. Overview

This section describes the development of the study corridor which has resulted in the 200 metre refined corridor which comprises part of the project footprint (see Figure 6-1). The project footprint is the basis of the EIS.

The main steps in the development of the study corridor involved:

- identifying a broad **area of interest** based on key connection nodes
- identifying and mapping regional level **constraints and opportunities** within the area of interest (desktop studies)
- using a spatial mapping analysis tool to identify potential nominal routes at a macro scale
- identifying a nominal route through consideration of the project objectives
- applying a buffer to the nominal route to generate a corridor ranging from approximately one to five kilometres in width ie the **study corridor**
- route identification and corridor refinement, taking into account stakeholder, community and landholder feedback, consideration of alternatives, and constraints analysis
- generating a **200 metre refined corridor**[8], by taking into account local constraints, opportunities and landowner/stakeholder feedback.

Iterations of the corridor have been communicated to stakeholders throughout the development of the project through our online interactive map portal, stakeholder engagement materials and presentations. The study corridor was subject to numerous refinements and updates, including those based on community and stakeholder feedback. Figure 4-8 shows the study corridor as included in the HumeLink Scoping Report that was lodged with DPE in February 2022.

Once the study corridor was identified, the focus shifted to identifying potential route options. Route option assessment considered field survey information (including ecology and heritage), engineering and design development (including location of transmission structures and access tracks), community consultation, local constraints (environmental, engineering, property and community) and cost factors.

On-property site visits and engagement with landowners in multiple forums has informed our knowledge of local constraints and these have been considered throughout the route option assessment process.

In certain, highly constrained, areas where multiple routes were feasible, detailed route options assessment were undertaken. This process involved community consultation, tabulation and comparison of constraints, and desktop assessment of construction, offset, and easement acquisition costs.

Based on the above corridor refinement process, the **study corridor** was narrowed down to the **200 metre refined corridor**. The 200 metre refined corridor may be wider in some areas to account for more engineering and design information becomes available. This was used to progress landowner negotiations

[8] The 200 metre refined corridor may be wider in areas where there are physical constraints or route uncertainty.

around the need for a 70 metre transmission line easement[9], which would be located within the refined corridor. The location of the 70 metre easement will be finalised in 2024 when detailed design for the project is complete.

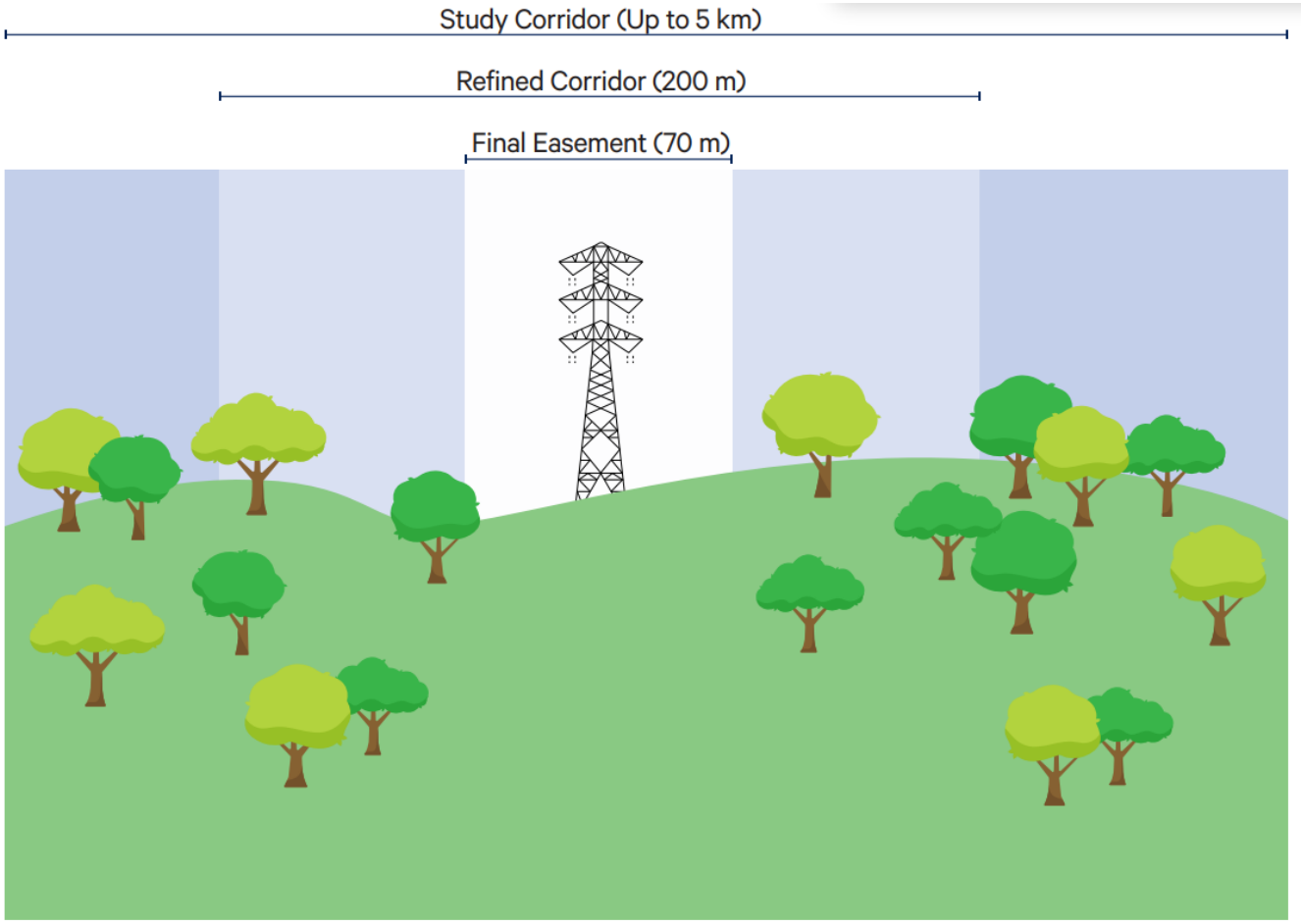


Figure 4-1 Refinement process from the study corridor to the final easement

[9] A wider easement will be required in some areas, including at the transposition locations and in a limited number of areas adjacent to existing lines where there are physical constraints or where blow out may be an issue.

Official

4.2. Key Steps

4.2.1. Development of the Area of Interest

Following the selection of the best technical option being a 500kV loop connecting Maragle and Bannaby, via Wagga Wagga (see Section 3.4), an area of interest was developed. The area of interest is the broad geographical region within which a project could be located.

One of the key aims in developing the HumeLink transmission lines routes has been to work with the community and other stakeholders to identify a solution which align with the objectives and guiding principles as described in Section 2.

The area of interest for HumeLink included three 500 kV substation node points – the future Maragle 500 kV, a location near Wagga Wagga (now the proposed Gugaa 500 kV) and Bannaby 500 kV – and covered a broad area to allow for consideration of a range of potential route options between these nodes (refer to Figure 4-2).

The proposed Gugaa 500 kV substation was nominally scoped as being approximately 10 kilometres south-east of the Wagga 330 kV substation along existing transmission line 'Line 51'.

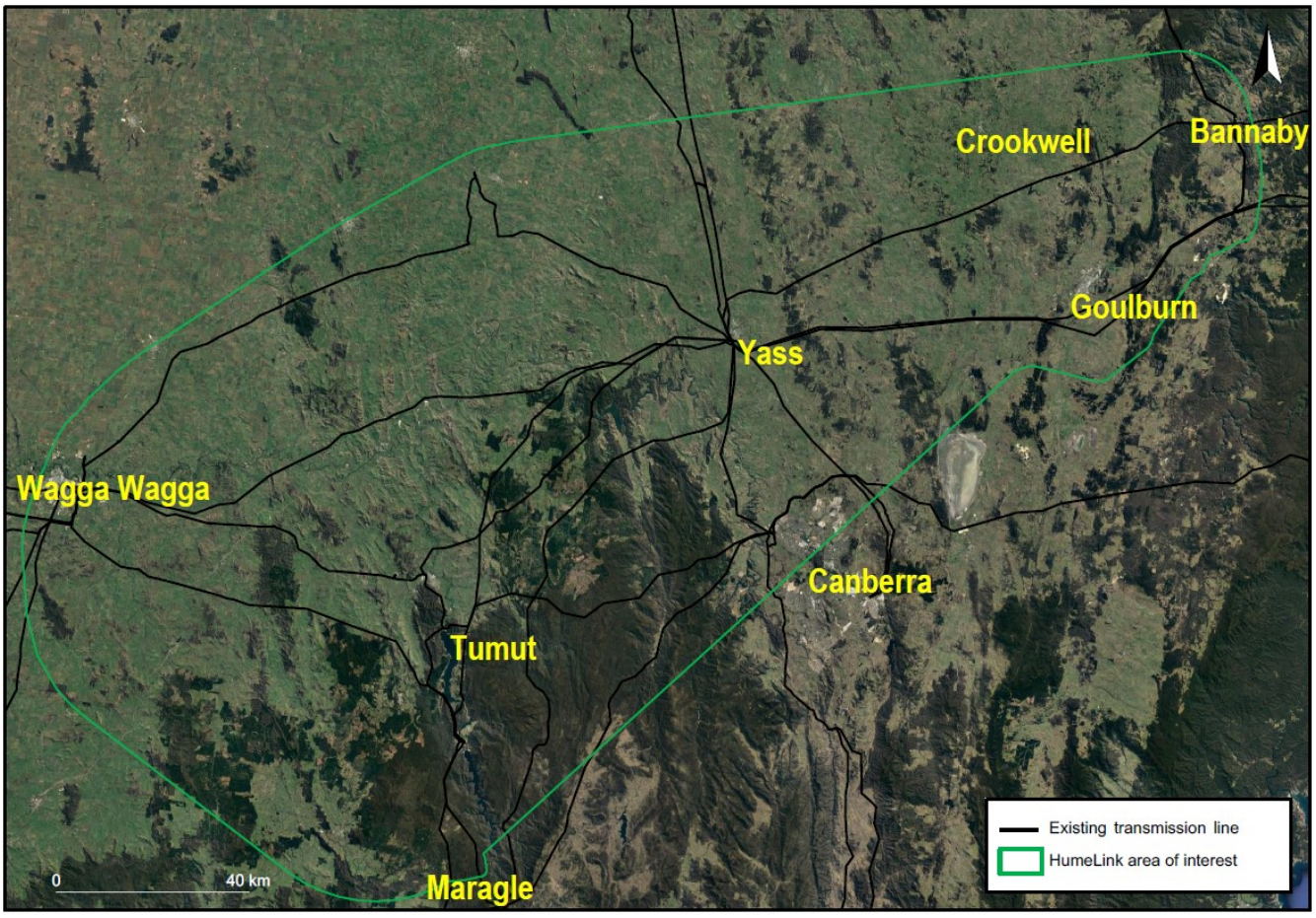


Figure 4-2 HumeLink area of interest

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4.2.2. Constraints and Opportunities

The first steps in the corridor identification process were mapping constraints and identifying opportunities.

The constraints were grouped as:

- Tier 1 constraints, no-go areas to be avoided
- Tier 2 constraints, to be avoided if possible and impacts minimised.

Tier 1 constraints included:

- wilderness protection areas
- wetlands protected by international agreements (JAMBA, CAMBA, ROKAMBA)
- areas of very high Indigenous significance and world heritage places
- Commonwealth Defence land
- built-up areas (towns and dense residential areas)
- licensed airstrips
- areas of multiple transmission lines north of Lower Tumut Switching Substation.

Tier 2 constraints included:

- wetlands not listed as Tier 1 constraints
- ecological conservation areas (including national parks and nature reserves)
- endangered ecological communities (EECs) and, more broadly, plant community types (PCTs)
- heritage conservations areas and places
- Commonwealth land (non-Defence)
- areas subject to exclusive use Native Title determinations
- forested areas
- intensive agricultural activities and horticultural use
- unlicensed airstrips
- active industry (mining, wind and solar farms, industrial use)
- water crossings greater than 800 metres
- residences.

Tier 1 and Tier 2 constraints are shown on Figure 4-3 in red and purple respectively. Individual residences and detailed PCT mapping were not included in the corridor-level mapping, but were considered in the local route selection process.

High to very bushfire risk areas as defined by a study undertaken by Eco Logical Pty Ltd in 2019 (ELA, 2019), are shown in Figure 4-4. In 2019, when the study corridor identification process was initiated, Network Planning reliability requirements meant that the two HumeLink 500kV circuits were to be separated by five kilometres in areas with high to very high bushfire risk. Many of the high to very high bushfire risk areas fall in state forests, nature reserves, and national parks.

Community and stakeholder engagement was carried out to gain an understanding of key concerns throughout the area of interest. Key landowner concerns included impacts to:

- visual amenity
- property value
- prime agricultural land and farming operations.

Transgrid consulted with the Department of Primary Industries – Agriculture, who confirmed that there is no formal definition of prime agricultural land. Agricultural land was therefore not included as a constraint at the corridor level, except where land was zoned for intensive agricultural/horticultural use. Detailed information provided by landowners on farming operations was considered in the local route selection process.

Private landowners broadly expressed a preference for routes across public land.

While there are existing transmission lines in national parks throughout NSW, most predate the creation of the parks. National Parks and Wildlife Services (NPWS) have advised that new works, facilities or operations will not be permitted unless they are consistent with the purposes of reservation of the park and the plan of management. NSW National Parks Association (NSW NPA) has also raised concerns around potential environmental impacts of the proposed alignment through protected areas, including, National Parks, Nature Reserves, State Conservation Areas and Regional Parks. Forestry Corporation of New South Wales (FCNSW) expressed a preference for routes that avoided or minimised impacts to plantations.

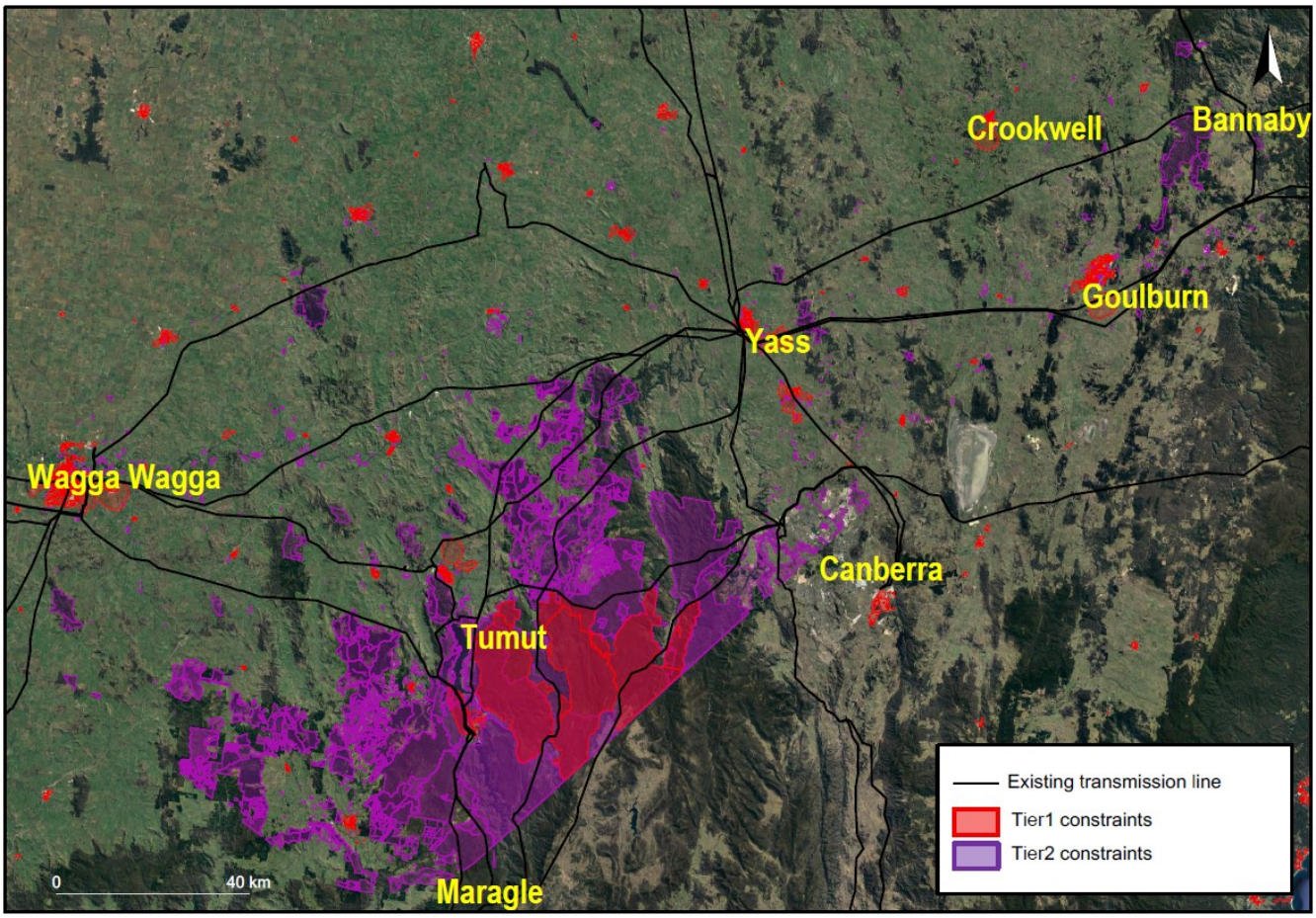


Figure 4-3 Key Tier 1 and Tier 2 constraints

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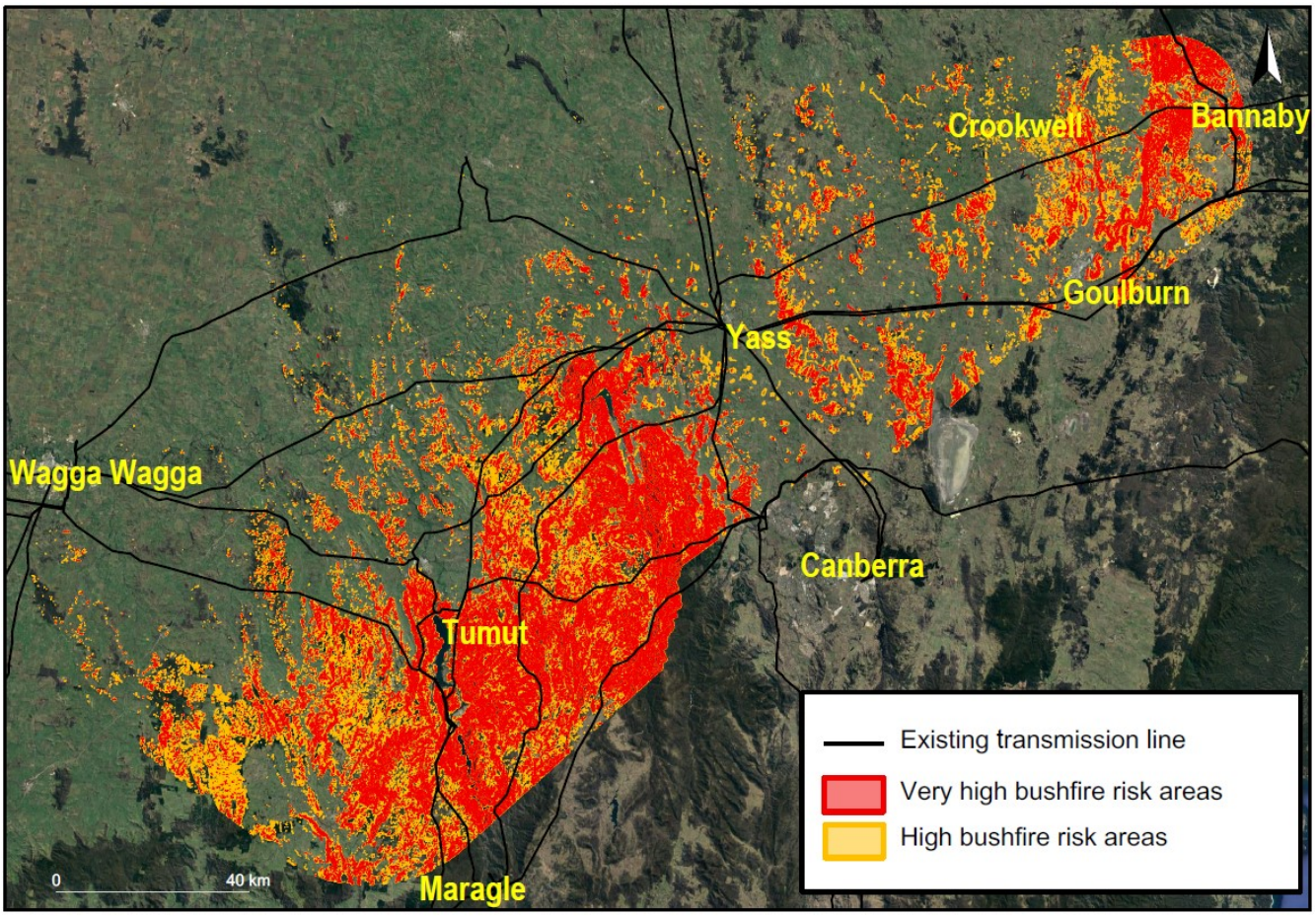


Figure 4-4 High and very high bushfire risk areas

Opportunities identified for HumeLink to minimise impacts from the project included:

- minimising overall transmission line length to reduce costs, impacts and construction time
- paralleling existing transmission lines to:
  - utilise existing access tracks
  - avoid introducing new areas of visual impact
  - avoid introducing new impacts to existing land uses
  - potentially overlap existing cleared easements to minimise environmental and property impacts
- targeting areas of existing disturbance, such as roads, tracks and property boundaries to reduce environmental and property impacts
- where network risks allow, constructing double circuit 500 kV structures to reduce the required easement width from 80 metres to 70 metres.

4.2.3. Corridors

4.2.3.1. Identification of Corridors

A study to identify potential corridors between the substation nodes was carried out by Aurecon in 2019. The study applied the Tier 1 and Tier 2 constraints and opportunities identified through the desk top assessment and community engagement process as inputs to Aurecon's Route Planning Assessment Tool (RPAT) model (the RPAT Model). RPAT is a GIS-based, multi-criteria risk assessment framework where agreed social, environmental and engineering factors are coded, rated and incorporated into a constraint cost model (CCM).

The RPAT Model was used to generate a long list of nominal route options between the Bannaby 500 kV substation, future Maragle 500 kV substation and Wagga Wagga (now the proposed Gugaa 500 kV substation), from which a preferred nominal route would be selected and used to create the study corridor.

The RPAT Model used a 'cost per kilometre' to weigh distance travelled while avoiding Tier 1 constraints and minimising impacts to Tier 2 constraints. The initial options generated by the RPAT Model were reviewed during a workshop with Transgrid in October 2019. The following additional considerations were added during the workshop to ensure the options met the project objectives and constraint criteria:

- discarding longer route options (to minimise impacts and costs)
- avoiding the urban fringe of towns, such as Yass and Tumbarumba (Tier 1 criteria to avoid built-up areas)
- providing for sufficient separation of circuits in areas where route diversity is required due to bushfire and/or lightning strike risk (Tier 2 criteria to minimise network operational risks)
- adding wind and solar farms into mapping and applying an appropriate setback (Tier 2 criteria to minimise impact on active industry).

Following the first internal workshop, Aurecon re-ran RPAT to generate revised route options. Aurecon divided the options into shorter sections, provided a detailed comparative analysis section-by-section taking into account the Tier 1 and Tier 2 constraints, and facilitated a second internal workshop where the results of the analysis were presented and assessed. Manual adjustments of the options were made to reflect the outcome of the discussions and generate a short list of nominal route options.

4.2.3.2. Selection of Initial Study Corridor

The short list of options was subject to a broad internal technical review and the feedback provided by the design, network planning, environmental, community and stakeholder engagement, and property teams was used to select a preferred nominal route.

In order to generate a study corridor for the project, a buffer was applied to the preferred nominal route. The corridor ranged in width from one to approximately five kilometres depending on the level of uncertainty and the extent of constraints in the area.

Figure 4-5 shows the initial HumeLink study corridor that was published in April 2020.



Figure 4-5 Initial HumeLink study corridor (April 2020)

4.2.4. Study Corridor Refinements

Ongoing study corridor development to select the 200 metre refined corridor was an iterative process undertaken over approximately a year and a half involving consultation with landowners and stakeholders, site visits, design development and improvement in constraints information through field studies and environmental assessment. Table 4-1 summarises changes to the study corridor and the rationale for the decisions. These are shown in Figure 4-6 to Figure 4-8.

Table 4-1 Study corridor refinements

Description of change	Rationale for change
May 2020 refinements	Refer to Figure 4-6
Shifted corridor for the double circuit 330 kV line between the proposed Gugaa 500 kV substation and Wagga 330 kV substation south of Line 51	The need for the Line 51 cut-in (ie connection) to the proposed Gugaa 500 kV substation was eliminated. As a result, the double circuit 330 kV line was likely to run on the south side of Line 51 rather than on the north side. The shift was limited to 200 metres as it was expected that the new line would parallel the existing one.

Description of change	Rationale for change
Shifted corridor south-east between Line 51 and Line 990	The study corridor was shifted south-east to avoid an area with smaller lots and higher residential density. The study corridor was still up to 3.5 kilometre wide in this area to allow for different route options to be identified subject to the outcomes of field studies and stakeholder engagement.
Narrowed corridor in the proposed Gugaa 500 kV substation area	The study corridor was narrowed to reflect progress in the assessment of potential sites for the proposed Gugaa 500 kV substation.
May 2021 refinements	Refer to Figure 4-7
Shifted from western side of Yaven Creek to the western edge of Green Hills State Forest	This shift increased the distance through public land (State forest). The land introduced was primarily plantation impacted by the 2019-2020 bushfires, so the change would not affect current plantation output nor result in a significant increase in environmental impacts. A five kilometre separation distance was maintained between the transmission lines to meet the Network Planning requirement. Further details on the routes considered in this area are described in Section 4.3.
Introduced a corridor option crossing Blowering Dam	Following further assessment of route options in the Tumut area and constraints associated with the Tumut Airport, a route was identified over Blowering Dam. The route options identified in this area are described further in Section 4.3.3.
September 2021 refinements	Refer to Figure 4-8
Removed Gugaa to Gobarralong section (1)	This section of the corridor was no longer required with a double circuit configuration. The transmission line route would now run from Gugaa to Bannaby via Wondalga.
Removed Maragle to Line 51 via Bago and Green Hills State Forests (2)	This section of the corridor was no longer required with a double circuit configuration. The transmission line route would now run from Gugaa to Maragle via Wondalga. The corridor via Bago State Forest was selected rather than the corridor through Green Hills State Forest as it minimised overall transmission line length and maximised the opportunity to parallel existing lines.
Added section paralleling Line 51 north of Green Hills State Forest (3)	This section was required to accommodate the change to a double circuit configuration. This decision also increased the opportunity to further parallel existing lines.
Added Gilmore Valley crossing (4)	This section was required to accommodate the change to a double circuit configuration and was only relevant to the Blowering corridor.
Added Tumut North (5)	This corridor was added as a further alternate to the two options previously identified ie the Tumut and Blowering corridor options. This was because further investigation of a double circuit transmission line configuration north of Blowering Dam identified a number of constraints including very close proximity to a number of residences. The Tumut North option avoids the Tumut Airport, Minjary National Park and Mudjarn Nature Reserve.
Narrowed corridor in Bago State Forest (6)	The western portion of the corridor accommodated a route option that minimised the need for access track construction.

Description of change	Rationale for change
Modifications in the Bannaby area (6)	The corridor was narrowed north of Chatsbury to maximise paralleling. The corridor was narrowed in the Bannaby area to reflect an option that minimised ecological impacts and bushfire risk.
Widened corridor south of Line 990	The corridor was slightly widened to accommodate potential route options in the vicinity of wind turbine locations associated with the proposed Jeremiah Wind Farm.
Narrowed corridor south-east of Bango Nature Reserve	The revised corridor accommodated a route that reduces potential impacts on the approved Rye Park Wind Farm infrastructure and its biodiversity offset area.



Figure 4-6 May 2020 study corridor refinements

Official

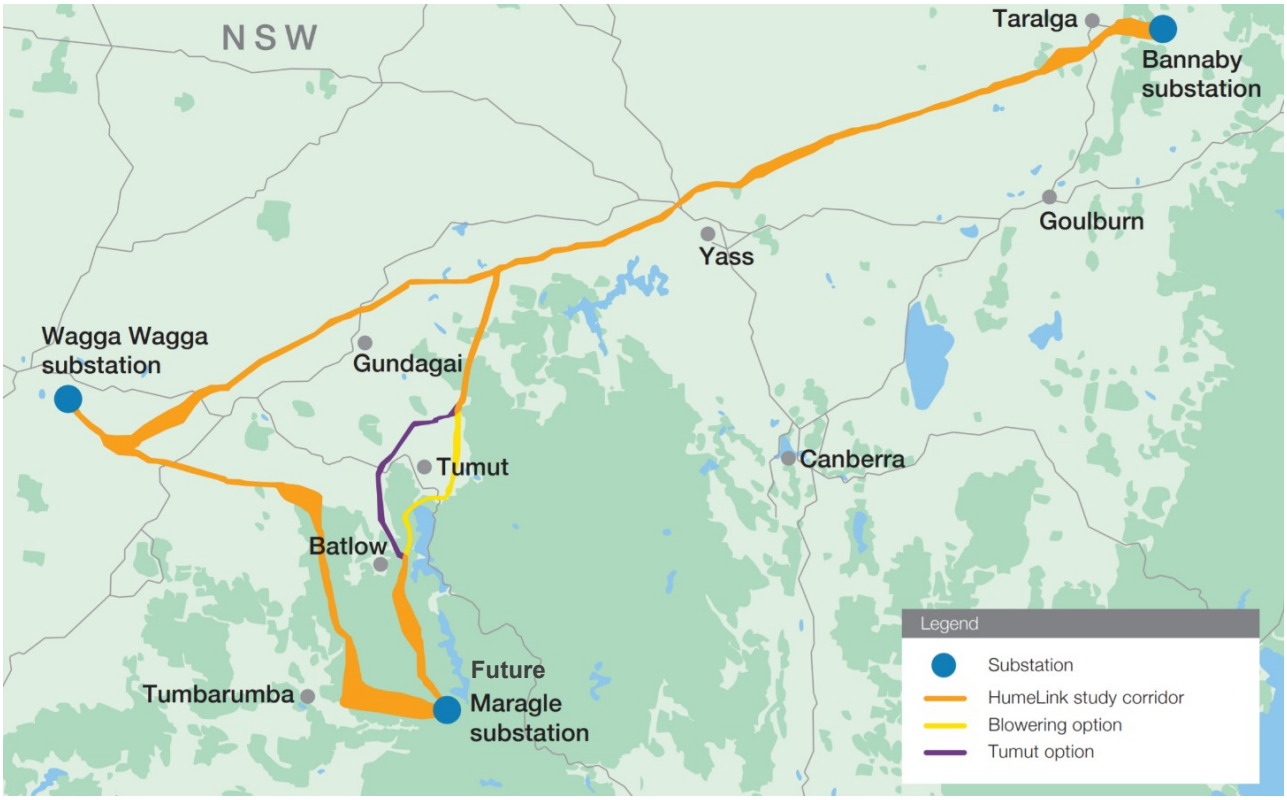


Figure 4-7 May 2021 study corridor refinement

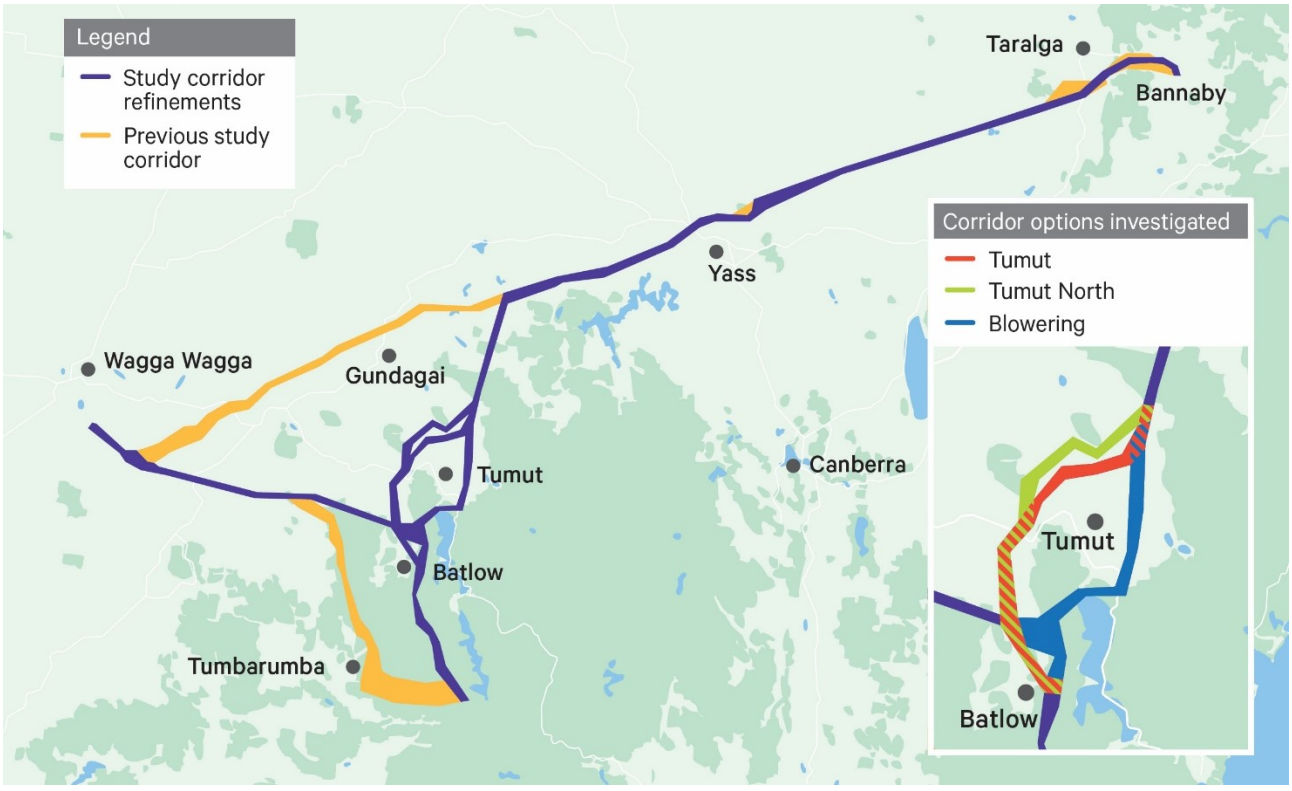


Figure 4-8 September 2021 study corridor refinements

Official

4.3. Localised Route Refinements

As the project progressed and detailed engagement occurred with landowners and the community, more information was obtained in relation to local constraints and opportunities. As the environmental studies for the EIS also progressed, they also provided more information. This engagement and additional information have been used to refine the study corridor to a narrower corridor and identify a 200 metre refined corridor as the project footprint to be assessed in the EIS.

In some parts of the corridor, several route options were developed and evaluated to avoid specific impacts and minimise the overall impacts of the project on the community and environment.

Further details are provided on the following localities:

- Bannaby
- Pejar Dam
- Tumut
- Green Hills North
- Yass to Maragle.

4.3.1. Bannaby

The southern edge of the HumeLink corridor in the Bannaby area originally followed the northern edge of Tarlo River National Park and the Line 61 easement. The corridor extended 1.0 to 4.4 kilometres north from Line 61, to allow for flexibility in identifying potential routes as constraints mapping progressed. The western edge of the corridor was set to avoid the Taralga Wind Farm, while the eastern edge followed the Line 5A6/5A7 easement to the Bannaby substation and continued south along the Line 35/36 easement.

Key concern raised by landowners in the Bannaby area included impacts to:

- visual amenity
- farming operations
- property value
- biodiversity, through clearing of the easement and creation of new access tracks.

Many landowners along the route expressed a preference for a route paralleling Line 61.

Before narrowing the corridor in September 2021, Transgrid assessed several routes in the Bannaby area. These included the Bannaby 1, Bannaby 2, and Bannaby 3 routes discussed below.

Bannaby 2 was removed from further consideration following the November meeting between Transgrid and the Bannaby Residents Action Group (BRAG) when both parties agreed it was not a preferred option due to the proximity to dwellings and local heritage items, although it did have the lowest ecological impact. In March 2022, Transgrid progressed further assessment of three options in the Bannaby area to follow up on concerns raised by the BRAG:

- **Bannaby 1:** BRAG requested that Transgrid undertake more detailed analysis of this option that was previously identified by the project team. Bannaby 1 parallels the existing transmission lines and goes through Tarlo River National Park.
- **Bannaby 1 National Park detour:** Bannaby 1 National Park detour was identified as a hybrid option that parallels the existing transmission lines but avoids the Tarlo River National Park.
- **Bannaby 3:** Transgrid's current and preferred option. Transgrid believes Bannaby 3 best minimises the overall impact on the environment, properties, and communities, and is most cost effective.

Figure 4-9 shows the four options considered in the Bannaby area and Table 4-2 presents the comparison of the four routes.



Figure 4-9 Route options considered in the Bannaby area

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Table 4-2 Comparison of route options in the Bannaby area

Factors	Bannaby 1	Bannaby 1 National Park detour	Bannaby 2	Bannaby 3
Engineering & network resilience				
Line length	16.6 km	16.9 km	16.0 km	17.3 km
Distance paralleling	15.2 km	8.3 km	0 km	1.6 km
Design or construction complexity	Extended substation footprint required if entering from the south	Extended substation footprint required if entering from the south	No significant engineering constraints	No significant engineering constraints
Distance through high to very high bushfire risk	6.9 km	6.7 km	4.3 km	3.1 km
Environment				
PCT area	77 ha	85 ha	53 ha	67 ha
Conservation areas	2.3 km in Tarlo River National Park	None	None	None
AHIMS sites and other heritage items/places	None	None	LEP listed Bannaby Shearing Shed. Also crosses non-listed historical cricket pitch and sawmill site.	None
Community				
Number of private landowners	15	17	15	16
Property				
Distance on public land	2.2 km	0 km	0 km	0 km
Distance on private land	14.3 km	16.9 km	16.0 km	17.3 km
Number of residences within 300m	2	2	6	2
Number of residences within 500m	6	6	9	5
Land use considerations	N/A	N/A	N/A	N/A

Based on the comparison of the three options, Transgrid's preferred option was identified as Bannaby 3. The analysis undertaken showed that Bannaby 3 is expected to have:

- lower impact on native vegetation and associated threatened species
- lower network risk, due to shorter distance through high to very high bushfire risk areas.

Of note, both of the Bannaby 1 route options:

- provide no material reduction in the number of private landowners affected
- shifts impacts to other landowners.

Further consultation was undertaken with DPE in December 2022 at which time DPE advised that a route option that impacted Tarlo National Park would not be supportable. This reaffirmed Bannaby 3 as Transgrid's preferred option.

Further detail on the Bannaby area route refinement decision is available on Transgrid's website at: https://www.transgrid.com.au/media/fh1npnsp/03-transgrid_a4_factsheet_humelink-_-route-selection_bannaby_01-04-2022.pdf

4.3.2. Pejar Dam

Pejar Dam is a recreational area located in the Upper Lachlan Shire LGA and managed by Goulburn Council. There is an existing 330 kV transmission line that crosses over the dam. The HumeLink transmission lines need to deviate from paralleling the existing transmission line to maintain the required technical separation distance from the Crookwell 2 wind turbines.

Landowners expressed concerns about impacts to:

- visual amenity
- farming operations
- property value.

The two route options are shown in Figure 4-10 and compared in Table 4-3.

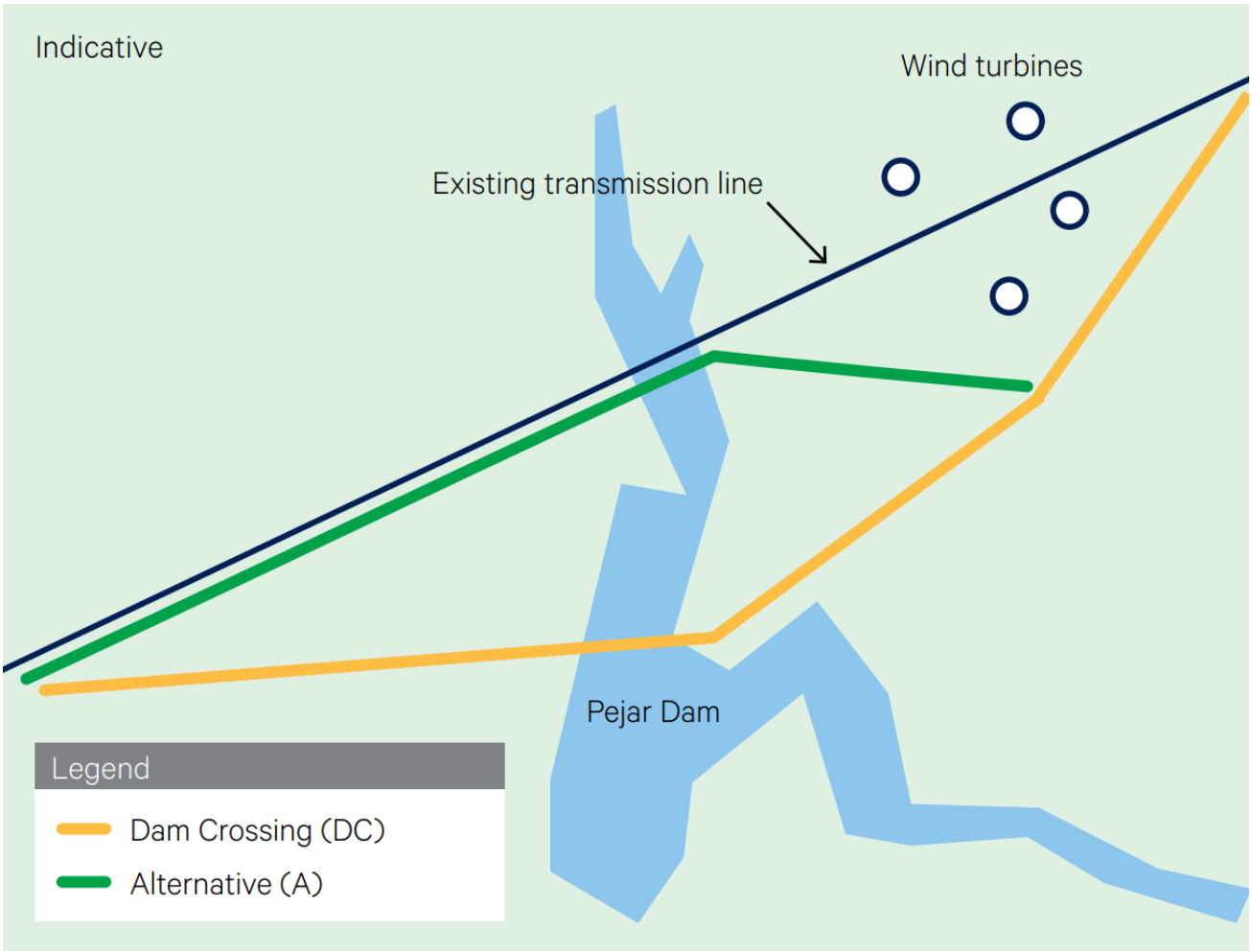


Figure 4-10 Route options considered in the Pejar Dam area

Table 4-3 Comparison of Pejar Dam route options

Factors	Dam Crossing	Alternative
Engineering and network resilience		
Line length	7.8 km	7.8 km
Distance paralleling	0 km	4.4 km
Design or construction complexity	No significant engineering constraints	No significant engineering constraints
Distance through high to very high bushfire risk	N/A	N/A
Environment		
PCT area	1 ha	10 ha
Conservation areas	None	None
AHIMS sites and other heritage items/places	1	None

Factors	Dam Crossing	Alternative
Community and Stakeholder Engagement		
Number of private landowners	5	6
Property		
Distance on public land	0.6 km	1.1 km
Distance on private land	7.2 km	6.7 km
Number of residences within 300m	0	1
Number of residences within 500m	2	1
Land use considerations	Impacts amenity of Pejar Dam for the public	Paralleling minimises disruption to farming operations

Based on the assessment, it was determined that the Alternative route that parallels the existing Line 3H is the preferred option.

The Dam Crossing route option crosses the middle of the dam and would result in negative impacts on the amenity and recreational users of the dam (which includes a boat ramp and picnic area). Although this alternative would result in a higher impact on Plant Community Types (including threatened ecological communities) and associated higher biodiversity offset costs, this is outweighed by the impact on dam users and the general community.

Further detail on the route refinement decision at Pejar Dam is available on Transgrid's website at: https://www.transgrid.com.au/media/jkbhdnbf/04-transgrid_a4_factsheet_humelink-_-route-selection_pejar_01-04-2022.pdf

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4.3.3. Tumut Area

The Tumut area is highly constrained for new overhead transmission infrastructure. While there are existing transmission lines in the area, a number of residences are located in close proximity to them. The Tumut Airport obstacle limitation surface (OLS) is also a significant constraint, as are the presence of unlicensed private airstrips and agricultural operations. This section outlines the route selection process undertaken by Transgrid in the Tumut area and the independent assessment of a community-proposed alternative maximising the distance on public land, undertaken by GHD (GHD, 2022a).

Transgrid considered three routes in the Tumut area (shown previously in Figure 4-8):

- Tumut
- Blowering
- Tumut North.

Key concerns raised by landowners in the Tumut area included:

- visual amenity
- impacts on farming operations
- impact of transmission lines on firefighting, both aerial and ground-based
- bushfire hazard posed by transmission lines
- impact on property values and the opportunity to subdivide in future
- biodiversity.
- landowners expressed a preference for routes on public land and for undergrounding of sections on private land.

The initial HumeLink study corridor proposed an indicative Tumut route between the Gilmore Valley and north of Wyangle which aimed to maximise paralleling of existing transmission lines. However, in consultation with various stakeholders including Snowy Valleys Council and RFS, it was determined that the route encroached on the proposed runway extension at Tumut Airport and would infringe on the revised OLS. The runway extension was proposed to increase firefighting capacity in the regional area. Further independent studies were initiated by Transgrid which confirmed the potential infringements on the OLS.

As a result, an alternative route was required. While the terrain in the Blowering Dam area is challenging, there is an existing transmission line present in this area. The crossing area was inspected for any unresolvable technical issues and a feasible route was identified for further consideration and assessment.

When the RIT-T process determined that a double circuit configuration should be progressed, the potential impacts from the Blowering route on landowners increased and the project team considered it prudent to investigate a new alternative further north, called Tumut North that would move the transmission line further away from residences. However, the Tumut North route was constrained by the Tumut Airport OLS, Minjary National to the west and Mudjarn Nature Reserve to the east.

Because of the infringement with the Tumut Airport OLS, the Tumut route option was not considered further as it was not viable. Table 4-4 compares only the indicative Tumut North and Blowering route options.

Table 4-4 Tumut area route comparison

Factors	Tumut North	Blowering
Engineering and network resilience		
Line length	51.1 km	53.3 km
Distance paralleling	8.8 km	45.8 km
Design or construction complexity	Potential for transmission line structures on alluvial soil in the vicinity of the Tumut River	Complex stringing methodology required for long span across Blowering Dam Longer construction time required at two transmission line structure locations due to steepness of terrain Outage for Line 097B would likely need to be in autumn or spring, constraining construction schedule
Distance through high to very high bushfire risk	3.9 km	7.2 km
Environment		
PCT area	368 ha	384 ha
Conservation areas	None	An access track would be located in Kosciuszko National Park 0.4 km in FMZ 3A Harvesting Exclusion Zone
AHIMS sites and other heritage items/places	None	No AHIMS sites 3.5 km in the Snowy Mountain Scheme area
Community		
Number of private landowners	46	44
Property		
Distance on public land	0 km	7.8 km
Distance on private land	51.1 km	45.5 km
Number of residences within 300m	1	11
Number of residences within 500m	10	7
Land use considerations	Requires a decrease in load when using one airstrip Constrains aerial operations in some areas north of Tumut	Prevents use of one airstrip Constrains aerial operations at the southern end of Gilmore Valley

4.3.4. Green Hills North

Landowners expressed concern about the impact of transmission lines on firefighting, potential access and egress issues, and the potential risk of ignition posed by the HumeLink infrastructure. FCNSW shared concerns about the impact of transmission lines on aerial firefighting operations. Transgrid must consider bushfire risk to network operations and to assets.

Other key landowner concerns in the area included impacts on:

- visual amenity
- proximity to residences
- farming operations, particularly aerial operations
- property value
- EMF.

Transgrid compared two route options at the northern end of Green Hills State Forest:

- Paralleling Line 51 – route initially considered in the RIT-T process to minimise line length and maximise paralleling
- Green Hills North – alternative route considered to maximise distance from residences and minimise the number of private landowners affected.

The two options are shown in Figure 4-11 and compared in Table 4-5.



Figure 4-11 Route options considered at the northern end of Green Hills State Forest

Table 4-5 Comparison of route options at the northern end of Green Hills State Forest

Factors	Paralleling Line 51	Green Hills North
Engineering and network resilience		
Line length	12.3 km	14.1 km
Distance paralleling	12.3 km	0 km
Design or construction complexity	No significant engineering constraints	No significant engineering constraints
Distance through high to very high bushfire risk	2.4 km	13.1 km
Environment		
PCT area	18.5 ha	15.9 ha
Conservation areas	None	None
AHIMS sites and other heritage items/places	None	None

Factors	Paralleling Line 51	Green Hills North
Community and Stakeholder Engagement		
Number of private landowners	9	2
Property		
Distance on public land	1.9 km	11.7 km
Distance on private land	10.4 km	2.4 km
Number of residences within 300m	3	0
Number of residences within 500m	2	0
Land use considerations	Minimises disruptions to aerial operations	Reduces the net harvestable area of softwood plantation
Distance through plantation	1.9 km	11.7 km

The assessment found the alternative route through northern end of Green Hills State Forest to be the preferred option as it reduces impact to private landowners. While this option is associated with higher costs and poorer network resilience, on balance, the benefits to landowners are considered to outweigh these impacts. The alternative route removes all five of the residences from within 500 metres of the indicative transmission line.

Further detail on the route refinement decision at the northern end of Green Hills State Forest is available on Transgrid's website at: https://www.transgrid.com.au/media/fvmoghsb/05-transgrid_a4_factsheet_humelink-_-route-selection_green-hills_01-04-2022.pdf

4.3.5. Route Maximising Distance on Public Land (Yass to Maragle)

In response to community requests for an assessment of a route that maximises distance on public land, Transgrid engaged GHD to conduct an independent assessment of a transmission line route between Maragle and Yass. This report was one of several inputs considered in the assessment of route options.

The GHD assessment involved:

- establishing a project-specific geographic information system (GIS) with all possible route options and available GIS data layers provided by Transgrid and other relevant publicly available data
- segregating routes into smaller segments to enable more detailed assessment and cost calculation.
- based on GIS review, identifying constraints within approximately 500 metres of each route and rate relevant constraints in terms of their potential enviro-social impact using a numerical rating system
- completing a multi criteria analysis (MCA) using GHD's GIS-based methodology known as the 'InDeGO' method (Infrastructure Development – Geospatial Options) to quantitatively assess the preferred route subject to the least constraints. InDeGO assigns a score to each route based on the length of the route that overlays relevant constraints and the rating of the constraint. The higher the score, the higher the enviro-social impact
- calculating construction costs for each route using the Australian Energy Market Operator (AEMO) transmission cost database (TCD) tool, which is aligned to the Association for the Advancement of Cost Engineering (AACE) guidelines
- calculating biodiversity offsetting costs for each route completed by Niche (2022) with reference to the Biodiversity Assessment Method (BAM) using the BAM credit calculator to determine credit number estimates for both species and ecosystem impacts
- calculating property acquisition costs for each route
- identifying the optimal route based on the MCA results and cost estimation.

The following three possible route options were assessed:

- Maragle to Yass via Tumut North
- Maragle to Yass via Blowering
- Wondalga to Maragle to Yass via Kosciusko National Park.

The three route options are shown in Figure 4-12.

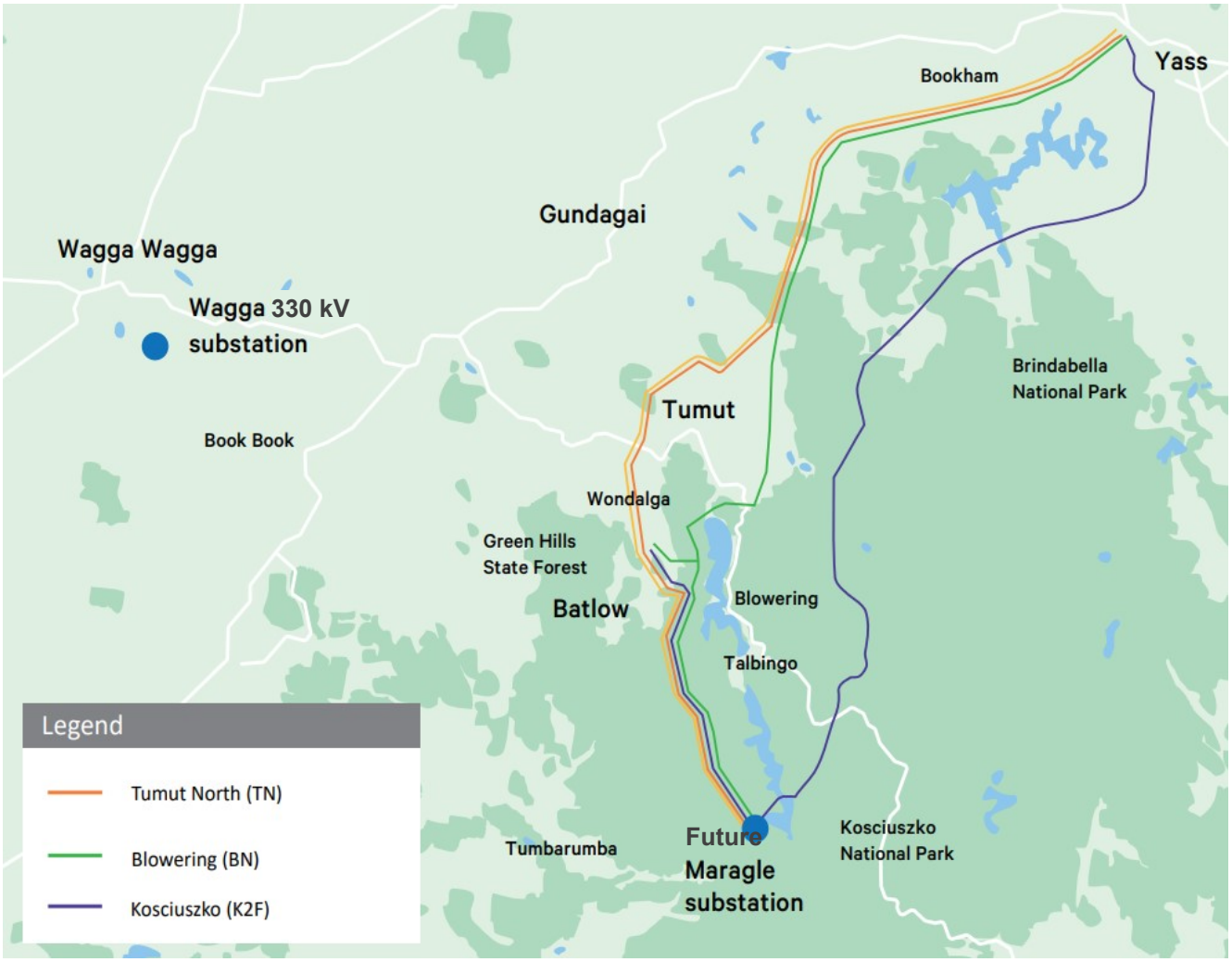


Figure 4-12 Routes considered in the Tumut area

A summary of the comparative assessment is presented in Table 4-6.

Table 4-6 Comparative summary of findings

Factors	Tumut North	Blowering	Kosciuszko
Engineering and network resilience			
Line length	158.5 km	160.9 km	193.0 km
Distance paralleling	33.3 km	0 km	181.5 km
Design or construction complexity	Alluvial soil in the vicinity of the Tumut River	Long spans required in the vicinity of Blowering Dam	Rugged, densely forested terrain, higher altitude (ice loading)

Factors	Tumut North	Blowering	Kosciuszko
Distance through high to very high bushfire risk	24 km	27 km	59 km
Community and Stakeholder Engagement			
Number of private landowners (new)	84 (0)	82 (0)	56 (38)
Property			
Distance on public land	37.7 km	44.9 km	93.5 km
Distance on private land	120.8 km	116.0 km	99.5 km
Number of residences within 300m	4	13	15
Number of residences within 500m	3	11	11
Land use considerations	Affects aerial operations on some holdings		Reduces the net harvestable area of softwood plantation
Distance through plantation	15.3 km	15.3 km	26.6 km
MCA result			
Total score	962,300	1,005,680	1,384,240
% increase on lowest score (Tumut North)	Base	4.51%	43.85%
Cost estimates			
Construction ($M)	487.64	510.48	615.64
Biodiversity offsetting ($M)	196.90	227.72	321.24
Property acquisition ($M)	27.06	26.69	30.27
Total ($M)	711.60	764.89	967.15

The Tumut North route was selected as it minimised network risk and construction complexity and was less constrained, avoiding residences and minimising environmental impacts.

The assessment identified the Tumut North option as the optimal route for HumeLink, as it:

- has fewer enviro-social impacts, with a total InDeGO score 43,380 less than the next lowest scoring Blowering option, and 421,940 less than the Kosciuszko option
- is the least cost option; estimated at $53.29 million less expensive than the next highest cost Blowering option, and $255.55 million less than the Kosciuszko option
- The Wondalga to Maragle to Yass via Kosciuszko National Park route option is the least optimal route due to:
    - substantial environmental impacts associated with the route traversing the national park and potential impacts on the Burrinjuck Dam heritage site
    - much higher costs largely due to the complexity of construction through the alpine region, the cost of acquiring State Forest and national park land, and the cost of offsetting the biodiversity impacts of the route.

The outcome of GHD's independent assessment was consistent with the outcome of Transgrid's internal route options assessment even though different criteria and considerations were applied. Tumut North was progressed as the preferred route as it had the lowest impact, best network resilience, and lowest cost.

Further detail on the Tumut area route refinement decision is available at Transgrid's website: https://www.transgrid.com.au/media/dfofpvae/02-transgrid_a4_factsheet_humelink-_-route-selection_tumut_01-04-2022.pdf

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4.3.6. Green Hills and Bago State Forests (2023)

Members of the community prepared an alternate alignment for HumeLink from Maragle to Wondalga through Green Hills and Bago State Forests to move the infrastructure from private to public land. Initial high-level investigations suggested that this alternative could be feasible and that further consideration was warranted.

Following further engagement with key stakeholders including FCNSW, the route was further refined. The current alternative western route under consideration is shown in Figure 4-13.

This route option is undergoing additional feasibility analysis. Any detailed assessments would be conducted separately and are not included in the EIS.



Figure 4-13 Suggested alternate route from Maragle to Wondalga through Green Hills and Bago State Forests

Official

5. Substation Site Identification

5.1. Site Options

As Scenario C (constructing and operating 500 kV transmission lines) has been selected as part of the preferred technical option, this requires a 500 kV connection point in the Wagga Wagga area. The existing Wagga 330 kV substation at Gregadoo does not have sufficient space for new infrastructure to connect to the HumeLink 500 kV transmission lines. The need for a new 500/330 kV substation for the project was therefore identified. Table 5-1 sets out the steps in the site selection process.

Table 5-1 Site selection process

Step	Description
Definition of the need	Transgrid's Network Planning identified a broad area for consideration based on project objectives and strategic network requirements. In particular, suitable sites needed to be: • No further than 15 km from the existing Wagga 330 kV substation • Relatively close to Transgrid's existing transmission line, Line 51
Review initial criteria, constraints and opportunities	• Desktop review of existing information – identify Tier 1 and 2 constraints and potential opportunities • Preliminary site inspections and landholder discussions
Identification of a long list of potential sites	Apply key location requirements to screen for potential sites
Short-listing of potential sites	Apply multi-disciplinary criteria to short-list potential sites (refer to Table 5-2).

Having regard to the network requirements, a general area of interest was defined which included a 15-kilometre buffer around the existing Wagga 330 kV substation (indicated by the yellow circle on Figure 5-1).

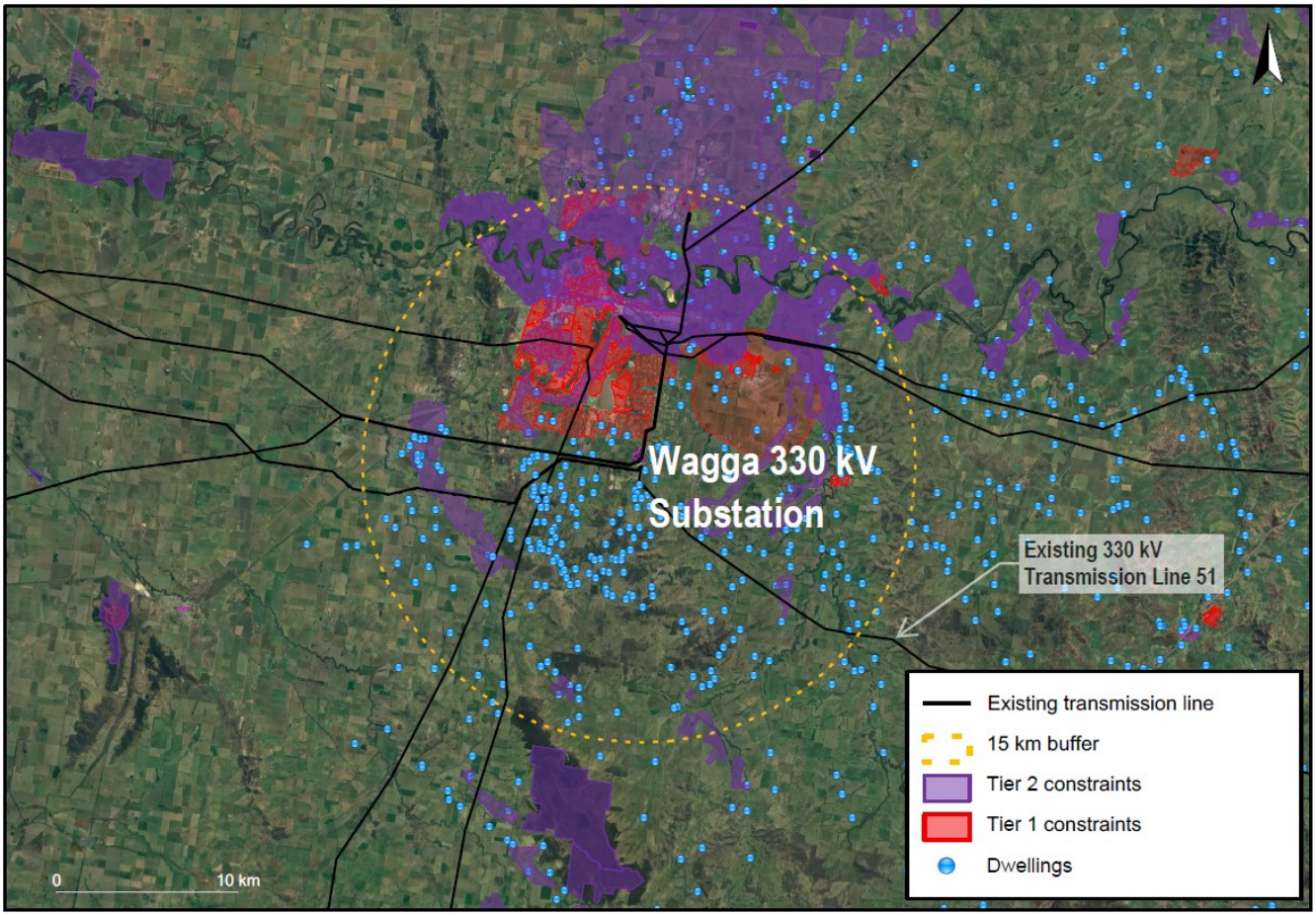


Figure 5-1 General area of interest with Tier 1 and Tier 2 constraints and opportunities

5.2. Evaluations and Site Selection

A refined area of interest was then used to identify a long-list of potential substation sites. The following two requirements were considered further:

- identify areas where the topography would make construction of the site less feasible
- the landholding can accommodate the ultimate arrangement of the substation (in this case, a site of 50 hectares with an approximate footprint of 700 metres by 700 metres would be required).

By considering the above, eight potential site options were identified in the area shown in Figure 5-2.

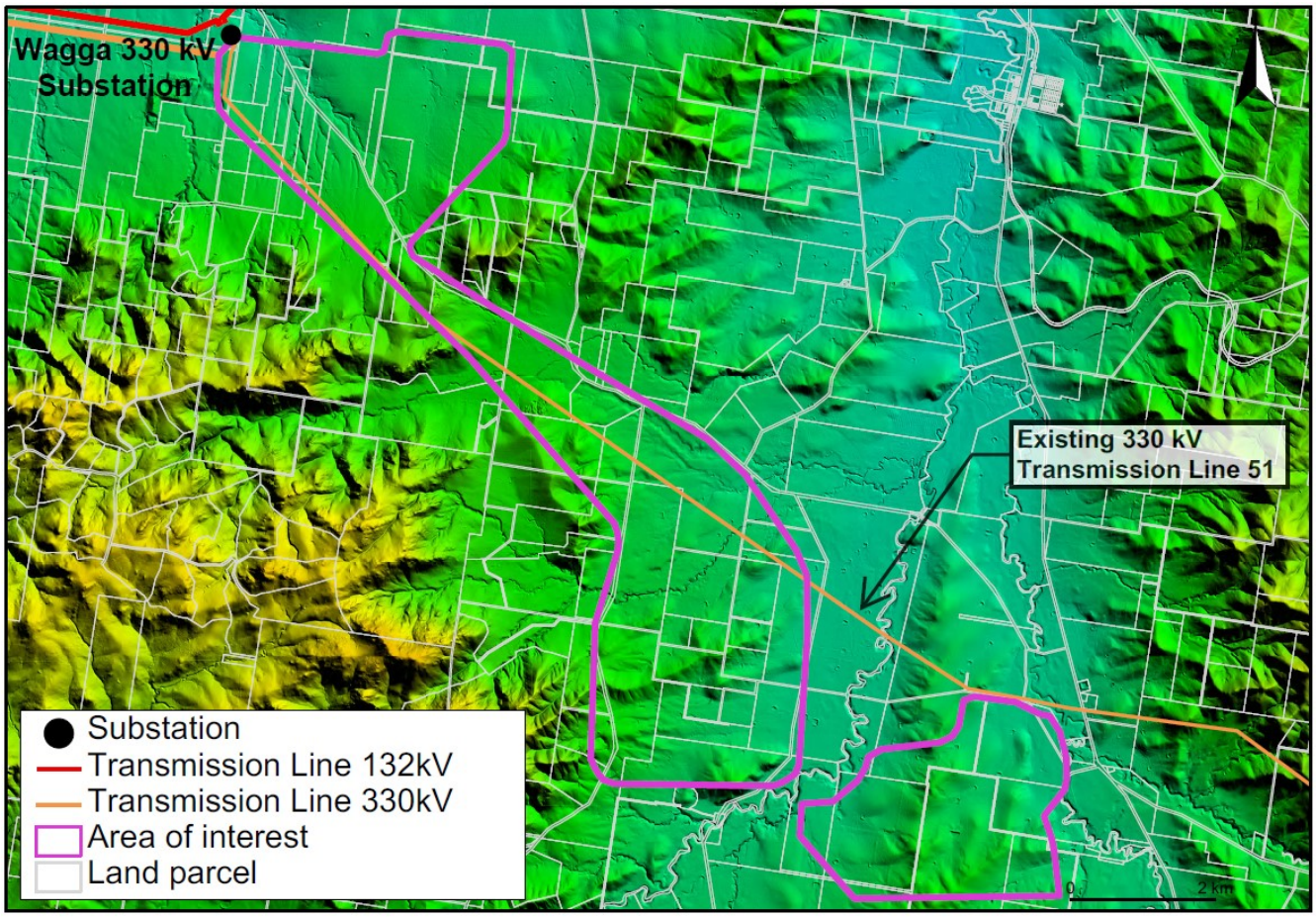


Figure 5-2 Potential substation site options identified on a topography overlay

Potential site options were subject to further assessment to identify a short-list of suitable sites. The criteria in Table 5-2 were used to short-list the sites. These additional criteria were required to narrow down the list of potential sites that may otherwise have a similar ranking. Some of these criteria differ from those considered for the transmission line assessments as the nature of the substation disturbance is distinct from that of the transmission lines. There are also substation-specific design and construction considerations, such as flood risk and transport of heavy equipment such as transformers.

Table 5-2 Short-listing criteria for substation sites

Short-list criteria	Description
Property	Landholding size
	Number of landowners affected
	Land use severance
	Easements and encumbrances (e.g. leases, licences, options, etc.)
Community and stakeholder	Proximity to residences and other sensitive receivers (e.g. educational institutions, hospitals, etc.)

Short-list criteria	Description
	Potential visual impacts
Environment	EECs[10]
	Extent of vegetation cover
	Minor waterbodies/waterways
	Potential contamination (as per New South Wales Environment Protection Authority (NSW EPA) contaminated sites register)
	AHIMS listings
Design and construction	Site slope
	Distance from existing roads (length of new road required) and suitability of existing roads for construction vehicles and transformer transport (road upgrades required)
	Transmission line crossings
	Potential for flooding
Operational considerations	Connection to local electricity supply

A multi-criteria analysis (MCA) was applied to the long list of options to identify the following three shortlisted sites:

- An option which is closest to the existing Wagga 330kV substation but furthest away from Line 51 (around two kilometres) and would require a new access road. The closest residence is over 1.4 kilometre away and no EECs or heritage items have been identified.
- One option which has good direct access to a public road and is close to Line 51 (around 700 metres). The closest residence is around 700 metres away and no EECs or heritage items have been identified although some EECs are present in proximity along the road corridor.
- Another option which is furthest away from the existing Wagga 330 kV substation (approximately 15 kilometres) but close to Line 51 (around 500 metres). It would require a new access road and road upgrade. The site is relatively low-lying. The closest residence is around 800 metres away and no EECs or heritage items have been identified.

Landowners of the three options were engaged to identify concerns, requirements and an openness to sell part of their property. Following a flooding assessment, the last option listed above was ruled out as being susceptible to flooding and therefore the least feasible of the three options. Following further landowner discussions, the second option from the above list was also ruled out.

[10] EECs considered more relevant at the scale of the area of interest

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6. Ancillary Facilities

6.1. Background and Principles for Selection

A number of ancillary facilities including construction compounds and temporary worker accommodation facilities would be required to support construction.

The primary objective for locating these sites was to minimise environmental and community impacts, while addressing landowner requirements and being suitably located at key strategic locations to support construction activities.

6.2. Construction Compounds

6.2.1. Construction Compound Selection

In addition to laydown areas at the substation sites, temporary construction compounds were identified as being required, mainly between Yass and Bannaby and between Bago State Forest and the existing Line 990.

The construction compound selection process involved identifying a long-list of potential sites using a geo-spatial tool and checks by Transgrid's Property, Environment and Community & Stakeholder Engagement teams based on a set of multi-disciplinary criteria as shown in Table 6-1.

Table 6-1 Long-list criteria for construction compound sites

Long-list criteria	Description
Property	Minimum landholding size of 50 m by 100 m
	Minimise the number of landowners affected (ideally not more than one landowner)
	Avoid use of private property where possible
Community and stakeholder	Maintain appropriate distance from sensitive receivers to minimise potential amenity impacts (i.e. adequate separation from residential buildings)
Environment	Avoid Tier 1 constraints
	Minimise areas mapped as plant community types (especially endangered ecological communities) and threatened species habitat
	Minimise the need for vegetation clearing
	Maximise distance from waterbodies and waterways
	Target areas which have previously been disturbed, or would require disturbance as part of the construction of the project
	Avoid AHIMS listed sites and non-Aboriginal heritage items
Constructability	Site slope should be less than 5%
	Maximise proximity to existing roads especially roads currently suited to construction vehicle use
	Close proximity to the project footprint (within 2 km)

The next steps in the compound selection process involved:

- detailed desktop reviews of long-list of options including a review of feedback from landowners on the interactive map
- consulting with public authorities and other key stakeholders (such as local councils, Crown Land, Transport for NSW and Forestry Corporation of NSW) to identify other potential locations which may be suitable
- engaging with private landowners on potentially suitable options
- identifying a short-list of compound locations based on detailed desktop assessments and consultation outcomes.

6.2.2. Construction Compound Locations

Following the desktop assessment and consultation with landowners a short-list of 14 potential sites was progressed for the purpose of the EIS. The list will be refined by the appointed contractor(s) during the detailed design stage of the project.

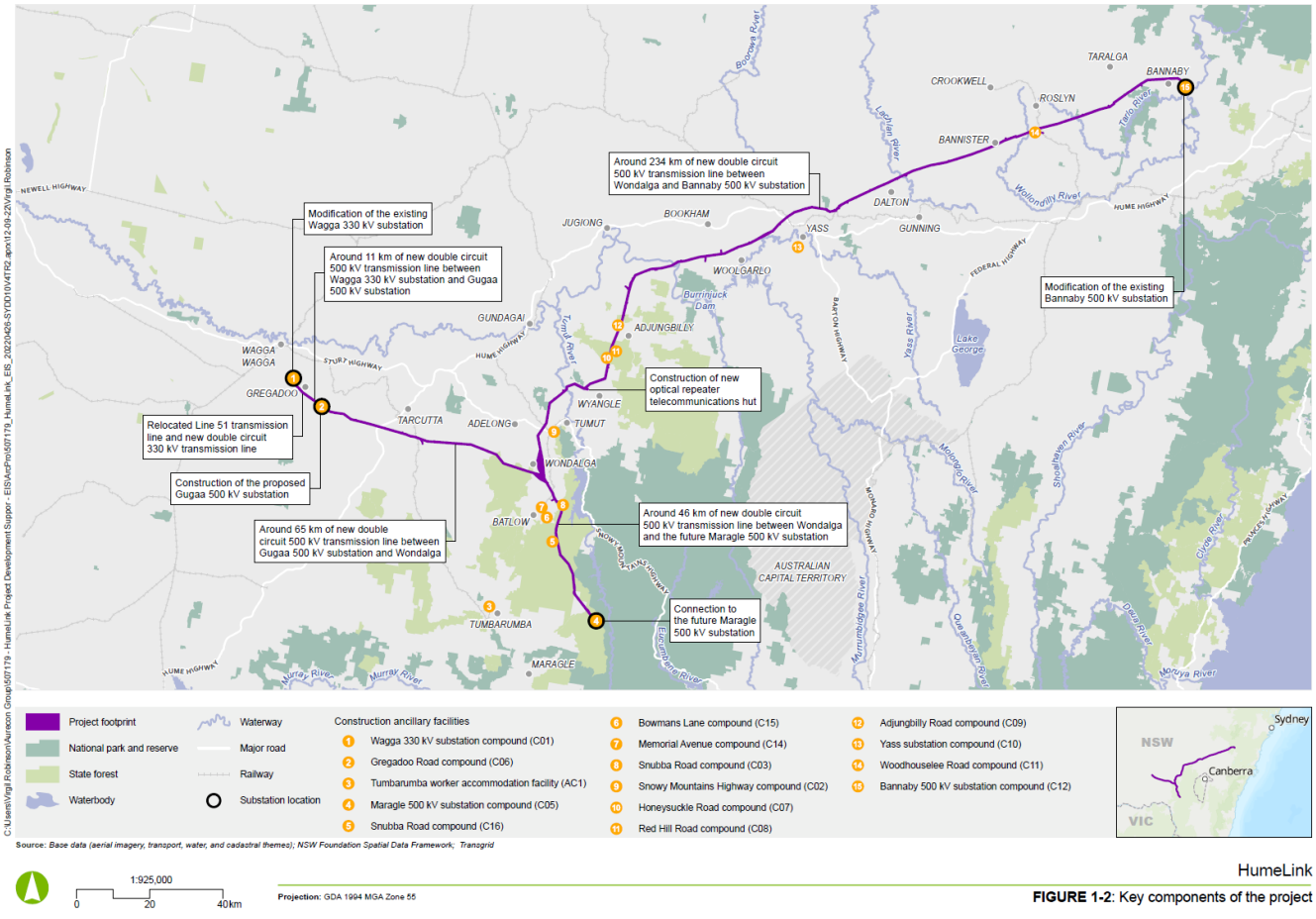


Figure 6-1 Project footprint including potential compound locations

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6.3. Worker Accommodation Facilities

6.3.1. Worker Accommodation Facility Selection

A preliminary review of available worker accommodation in the vicinity of the HumeLink project footprint identified a potential accommodation shortage, especially around Maragle and Tumut. Transgrid identified Tumbarumba and Batlow as suitable towns for the establishment of temporary accommodation for workers during early project planning and development, as well as through consultation with councils.

The accommodation facility would need to include the following:

- accommodation for 200 workers
- common meal room
- common room for leisure/entertainment
- parking for an estimated 10 heavy vehicles (to allow for parking of shuttle buses and other heavy vehicles) and 100 light vehicles.

The next steps in the accommodation facility selection process involved:

- consulting with Snowy Valleys Council and Yass Valley Council to identify potential suitable sites
- reviewing sites nominated by the local councils against the site selection criteria listed in Table 6-1
- preliminary environmental investigations (including biodiversity and heritage) to identify potential constraints.

6.3.2. Temporary Accommodation Facility Locations

Snowy Valleys Council proposed two potential sites:

- a greenfield site in Tumbarumba
- Batlow Caravan Park expansion.

In July 2022, Snowy Valleys Council indicated that the Batlow Caravan Park was no longer available. The EIS therefore progressed the proposed greenfield site in Tumbarumba. If any other potential temporary accommodation facility locations are identified through further engagement with councils or following engagement of the construction contractor, they will be subject to the same assessment process.

6.4. Access Tracks

A multi-criteria analysis (MCA) has been used to identify and generate access track options. Criteria used were similar to those used for the transmission line to avoid adverse impacts where possible and minimise residual impacts.

Where possible, access tracks to transmission structures would be sited:

- using existing roads and farm tracks
- on ridge and spur alignments
- on northern and western facing slopes as they are likely to be drier than southern and eastern slopes
- to avoid natural drainage lines and low wetland areas where possible
- to avoid impacts to heritage and plant community types
- to minimise vegetation clearing
- to balance cut and fill earthworks.

Road safety would be considered at curves and intersections to maximise sight distances. Curves would be widened to ensure sweep paths for larger vehicles. Track longitudinal grades would be kept within recommended guidelines. Generally, the maximum grade should be up to 8 per cent but there may be short sections with grades up to 18 per cent. Road cross fall grade would be 4 per cent and road width approximately 4 metres.

Waterway crossings would be designed to minimise impacts on key fish habitat and riparian vegetation. The size of pipe and culvert construction or use rock causeways would be minimised to the extent possible.

7. Next Steps

7.1. Environmental Assessment Exhibition

Transgrid has utilised the indicative 200 metre refined corridor and indicative location of construction compounds and accommodation facilities to develop the project footprint for assessment in the EIS and to commence easement negotiations with landowners.

The ultimate goal is to identify a transmission line easement, generally 70 metres wide, within the project footprint. The identification of the easement is subject to ongoing design development and landowner engagement. The easement will be confirmed by the appointed design and construct contractors during the detailed design stage of the project, planned to commence in 2023.

Opportunities for micro-siting of transmission line structures and access tracks will be ongoing, through discussions with easement affected landowners.

Transgrid and its contractors will use landowner and community feedback and the results of EIS specialist studies to continue to minimise impacts to landowners, communities, and the environment through the detailed design process.

7.2. Detailed Design and Easement Finalisation

Once the relevant State and Commonwealth planning approvals have been obtained, a final easement of generally 70 metres wide and up to 130 metres at transposition locations will be established taking into account considerations such as:

- additional landowner feedback
- detailed design work and input from the construction contractor(s)
- property acquisition negotiations
- public submissions on the project from the community, interest/action groups and government agencies (EPA, Heritage NSW, etc)
- environmental planning approval conditions.

Throughout the detailed design and easement finalisation process, Transgrid will continue to aim to minimise impacts to landowners, the community and the environment.

Appendix A Datasets and Sources

A.1 Tier 1 constraints datasets and sources

Table A.1 Tier 1 constraints – No-go zones

Constraint	Dataset	Source
Environmental, social and land use		
Areas of national environmental significance – Commonwealth and World Heritage areas, declared wilderness areas	Commonwealth Heritage List National Heritage List World Heritage List Declared Wilderness Areas	Department of Environment & Energy (Australian Government) Department of Planning & Environment (DPE)
Defence land	Defence Land (Land Use)	DPE
Township, homesteads, residential areas and sensitive community locations (churches/ schools etc)	Built Up Areas - derived from Zoning & Land Use Building Footprint Dwellings	DPE Geoscape Spatial Services NSW
Proximity to airports and licensed airstrips	Airports	Spatial Services NSW
Large open-cut mining sites	Mining (Land Use) Mining Licences	Resources & Geoscience NSW
Areas subject to Native Title and land granted under NSW Aboriginal Land Rights Act – high archaeological significance	Native Title Register	National Native Title Tribunal

A.2 Tier 2 constraints datasets and sources

Table A.2 Tier 2 constraints – Avoid if possible or minimise impacts

Constraint	Dataset	Source
Environmental, social and land use		
Ecological conservation areas including National Parks, National Park Estate and reserves	NPWS Estate NPWS Other Land	Spatial Services NSW NPWS
State Non-Aboriginal heritage items or conservation areas	State Heritage Register	Department of Premier and Cabinet
Known or registered Aboriginal heritage sites and places (managed by DPE e.g. AHIMS sites)	AHIMS	DPE
Commonwealth land	Commonwealth Land (Land Use)	DPE

Constraint	Dataset	Source
Large scale agricultural/irrigated land and horticultural uses	Important Agricultural Land Biophysical Strategic Agricultural Land Intensive Horticulture (Land Use)	DPE
Plant community types and threatened ecological communities	State Vegetation Type Map:	DPE
Engineering/design		
Active mining area	Mining (Land Use)	Resources & Geoscience NSW
< 80 m width available to accommodate an easement	Based on other constraints	Based on other relevant data sets
Areas with undulating terrain, valleys / rivers requiring large spans (30% slope over 500 metres)	Vulnerable Land: Steep, Highly Erodible Land	DPE
Crossings with existing transmission lines (130 kV and above)	Distributor Lines Transgrid Transmission Lines	Spatial Services NSW Transgrid
Adequate set back from wind farm turbine	Derived from available location data for renewable energy projects	Various - publicly available information and confidential data sources
Network operational risks including high bushfire risk and lightning risk (i.e. separate 500 kV circuits by 5 km in high bushfire risk areas)	Bushfire Prone Land	Rural Fire Service
Major infrastructure crossings (waterways / railway)	Rivers Railways	Spatial Services NSW

A.3 Local considerations

Table A.3 Local considerations – avoid if possible or minimise impacts

Constraint
Property, social and land use
Residences
Structures (such as sheds)
Land use and operations (including airstrips and aerial spraying)
Property boundaries
Future development
Landcare areas
Feedback from interactive maps

Appendix B Undergrounding Considerations

B.1 Underground being significantly more expensive than overhead

The cost of underground cable installation is highly dependent on the terrain and soil characteristics along the route. A complete in-depth study and characterisation of the subsurface and electrical environment would be necessary to get an accurate cost estimate for undergrounding a specific section of transmission.

Transgrid is required to deliver regulated transmission assets at a prudent and efficient cost for NSW energy consumers. This generally results in overhead construction being the selected option, except in locations where an overhead option is not technically viable due to existing physical constraints, such as in highly urbanised areas.

B.2 Cable joints being required at regular intervals along the length of any underground sections

The high-capacity cables that would be required to deliver equivalent capacity to the overhead circuits considered for HumeLink, would be large and hence require joins at regular intervals. Cable joints are installed in joint vaults which are large concrete boxes, with a footprint likely greater than 60 square metres and approximately 1.5 metre deep, buried along the underground construction route. In addition to splicing (joining) cables during construction, these vaults are also used for permanent access, maintenance, and repair of the cables.

The number of vaults required for an underground transmission line is dictated by the maximum length of cable that can be transported on a cable drum, the cable's allowable pulling tension, elevation changes along the route, and the sidewall pressure as the cable goes around bends.

For 500kV cable, as would be required for HumeLink, it is expected that at least two cables per phase would be required and would need to be spliced (joined) approximately every 400-500 metres. Therefore, a minimum of two cable vaults would be required, adjacent to each other, every 400-500 metres along the entire length of any underground cable sections.

The footprint impact from underground cables must also include the area required for joint vaults.

B.3 Differences in reliability and fault restoration

Overhead and underground lines are exposed to different types of outage and reliability risks. Unlike underground cables, overhead lines are exposed to weather related outages, such as those caused by lightning strikes. However, the large number of cable joints required for underground high voltage cables increase the risk of failure. In the event of a cable fault, locating and repairing the fault can be challenging and time-consuming, and may take several weeks / months to repair. The duration of outages varies widely, depending on the circumstances of the failure, the availability of parts, and the skill level of the available repair personnel.

The typical outage of a 500kV cable fault is estimated from 3-6 months and may involve the excavation of hundreds of meters of the cable depending on the type of fault and the extent of the damage. During this time, the circuit capacity will be significantly reduced.

In contrast, a fault or failure of an overhead line can usually be located almost immediately and repaired within hours or, at most, a day or two. A worst-case scenario where a tower has failed, the majority of supply can be restored, even on temporary structures, within 3-5 days.

B.4 Limited supply of underground expertise

The expertise available that can install and repair underground cables gets rarer the higher the voltage. Given the rarity of 500kV cables in Australia, there are few personnel trained in their maintenance limiting availability and most of these are tied to a cable supplier further limiting availability.

The duration of outages varies widely, depending on the circumstances of the failure, and the availability of parts. However, they are almost always planned around the availability of suitably skilled repair personnel.

Additionally, the expertise required to manufacture underground cables is limited, which would delay the delivery of the Project compared to an overhead technology.

B.5 Shorter asset life expectancy of underground cables

Underground cables have higher life cycle costs than overhead transmission lines when combining construction repair and maintenance costs over the life of the line.

In addition, most cables are only supplied by the manufacturer with a maximum design life of 40 years. Overhead transmission lines, on the other hand, can have a design life of 80-100 years. This means that in order to match the life expectancy of an overhead line, a cable system will have to be replaced after 40 years, significantly increasing the ultimate cost of the solution. This is not factored into the capital cost comparison discussed above.

B.6 Construction differences between overhead and underground installations

Installation of an underground transmission cable generally involves the following sequence of events:

1. Clearing
2. Trenching/blasting
3. Laying of conduit
4. Joint vault installation
5. Backfilling
6. Cable installation
7. Site restoration

The required continuous trench for the construction of underground lines causes greater soil disturbance than overhead lines, limiting the ability to avoid directly impacting environmental and culturally sensitive areas. Overhead line construction disturbs the soil mostly at the site of each transmission tower and can be micro-sited to avoid sensitive areas.

B.7 Operational differences between overhead and underground installations

Post-construction, trees and large shrubs would not be allowed within the easement of underground cables due to potential problems with roots. Certain vegetation and agricultural crops with shallow root systems may be allowed to return to the easement. However, these may need to be removed if the ground is required to be excavated for cable repairs. In terms of overhead lines, native vegetation can be retained within the easement up to a limited height.

Underground cables have improved visual and noise amenity as they are not visible after construction and have less impact on nearby property values and aesthetics. Overhead lines may have the potential to impact on visual amenity in sensitive locations.

Overhead lines, during certain climatic conditions, experience corona breakdown. This corona breakdown, which has a cracking sound, occurs when there is a temporary breakdown of the insulation of the air around the conductor. The noise associated with this corona breakdown can only be heard in close proximity to the overhead line. This effect does not occur in underground cable installations.

Underground cables are not exposed to bushfire events and do not hinder aerial firefighting activities. Overhead lines may be required to be de-energised before safe operation can occur by firefighting crews.

While land use activities such as grazing are permitted for both underground and overhead cables, location of structures are restricted within easements. When it comes to underground cables specifically, there is no restriction on irrigation methods or height of machinery as there would be with overhead. Although not restricted in terms of height, there is a restriction on weight of machinery when it comes to entering an underground easement.

These operational differences highlight why undergrounding decisions are very route-specific – in some circumstances it may impede existing land-use.

B.8 Underground cables require narrower easements

Underground cables require a narrower easement width of approximately 40-50 metres compared to an overhead line easement of 70 metres for 500kV double circuit transmission lines.