Review of Environmental Factors
Hunter-Central Coast REZ Network Infrastructure
April 2025

Wired for good.™

Ausgrid

Document control

Document status	DRAFT for EXHIBITION
Document type	REF
Approval Authority	James Hart
Release Authority	James Hart
Release date	29/04/2025
Security classification	Unclassified
Proposed activity	Construct, operate and maintain Hunter - Central Coast REZ Network Infrastructure
Document code	REF - 339
Network investment governance	NIG – 11641
Work breakdown structure	WBS – NC-01006
Proponent name	Ausgrid Operator Partnership, trading as Ausgrid
Proponent address	42 Honeysuckle Dr, Newcastle NSW 2300
REF Prepared by	Richard Dunnicliff
Title	Environment Officer
Qualifications	BSc, MEBM

Version headline	Headline
Rev A	For Public Exhibition

Contents

Tables

Figures

Executive summary

The NSW energy system is undergoing a major transformation to transition its reliance on coal-fired power to renewable energy. By 2040, the remaining four of NSW's coal-fired generators will have been retired, while increasingly higher demand for electricity will be required. The construction of new and upgraded network infrastructure is required to ensure energy can be transferred from Renewable Energy Zones (REZs) to major load centres in NSW.

Ausgrid was selected by EnergyCo as the preferred network operator to deliver the critical network infrastructure works required to support the Hunter-Central Coast Renewable Energy Zone (HCC REZ). The HCC REZ stretches geographically from the Upper Hunter down to Doyalson and Budgewoi on the Central Coast, including Newcastle and north to Port Stephens. The project scope includes upgrades to the existing network infrastructure to deliver an additional 1GW of network transfer capacity. The network infrastructure proposed runs from Kurri Kurri to Muswellbrook. The proposed infrastructure generally comprises of:

- approximately 85km of powerlines between Kurri Kurri and Muswellbrook
- two new substations in the Muswellbrook area known as; Sandy Creek Subtransmission Switching Station (STSS) and Antiene Subtransmission Switching Station (STSS)
- major upgrades of Kurri Subtransmission Substation (STS) and Rothbury Zone Substation.

Ausgrid, as an Authorised Network Operator, is a prescribed Determining Authority for the purposes of Division 5.1 of the *EP&A Act* and is defined as a 'Public Authority' under Schedule 1 of the *Environmental Planning and Assessment Regulation 2021 (EP&A Reg).*

This prescription allows Ausgrid to be a Part 5 Determining Authority for Development for the purposes of an electricity transmission or distribution network. As a Determining Authority, Ausgrid can assess and self-determine activities that are not likely to significantly affect the environment and are conducted by, or on our behalf and for the purpose of electricity transmission or distribution.

This Review of Environmental Factors (REF) assesses the proposal to construct, operate and maintain REZ network infrastructure (RNI) required to achieve the 1GW network capacity. The proposal includes:

- new Sandy Creek 132kV (STSS)
- new Antiene 132kV (STSS)
- rebuilding of 66kV and 132kV powerlines between Kurri STS to the new Antiene STSS
- rebuilding of 132kV powerlines between new Sandy Creek STSS and Transgrid's Muswellbrook Bulk Supply Point (BSP)
- associated 132kV and 66kV network augmentations
- Kurri STS 132kV busbar extension
- Rothbury zone substation inductor installation
- Muswellbrook fibre marshalling kiosk.

Construction of the proposal would be expected to commence in late 2025 with commissioning expected in mid-2028, subject to assessment and approval.

Related projects that support these works subject to separate environmental impact assessments include:

- early works distribution 11kV/400V network relocations
- secondary systems upgrades
- Berowra to Somersby Optical Pilot Ground Wire (OPGW) and All-Dielectric Self-Supporting fibre cable (ADSS)
- Antiene STSS to Muswellbrook BSP Fibre Optic cable installation.

This REF forms a Part 5 assessment in accordance with section 171(2) of the *Environmental Planning and Assessment Regulation 2021* (NSW) and the NSW Code of Practice for Authorised Network Operators. It assesses the potential environmental impacts associated with the construction, operation and maintenance of the HCC REZ proposal.

Key issues associated with the proposal were identified as Aboriginal heritage, ecology, noise and vibration, EMF and visual impact. Several specialist assessments were undertaken to assist in assessing the environmental impacts. Mitigation measures have been identified to address the impacts and to minimise any residual issues.

The REF concludes that the proposal:

- is not likely to significantly affect the environment
- is not likely to significantly affect threatened species, ecological communities or their habitats
- will not be carried out on land that is, or is part of a declared area of outstanding biodiversity value
- is not likely to have a significant impact on matters of National Environmental significance (NES) or a significant impact on the environment (for actions outside Commonwealth land) or a significant impact on the environment on Commonwealth land (for actions on Commonwealth land).

1 Introduction

The purpose of this Review of Environmental Factors (REF) is to assess the potential environmental impacts of the proposal and determine appropriate mitigation measures to reduce those impacts. The findings of this REF would be considered when determining whether the proposal is likely to:

- significantly affect the environment
- significantly affect threatened species, ecological communities or their habitats
- be carried out on land that is, or is part of a declared area of outstanding biodiversity value, or
- have a significant impact on matters of NES, or a significant impact on the environment (for actions on Commonwealth land) or a significant impact on the environment on Commonwealth land (for actions outside Commonwealth land).

1.1 The proposal

Ausgrid is proposing to construct, operate and maintain the Hunter-Central Coast REZ network infrastructure (RNI) required to achieve the 1GW network transfer capacity.

The proposal includes:

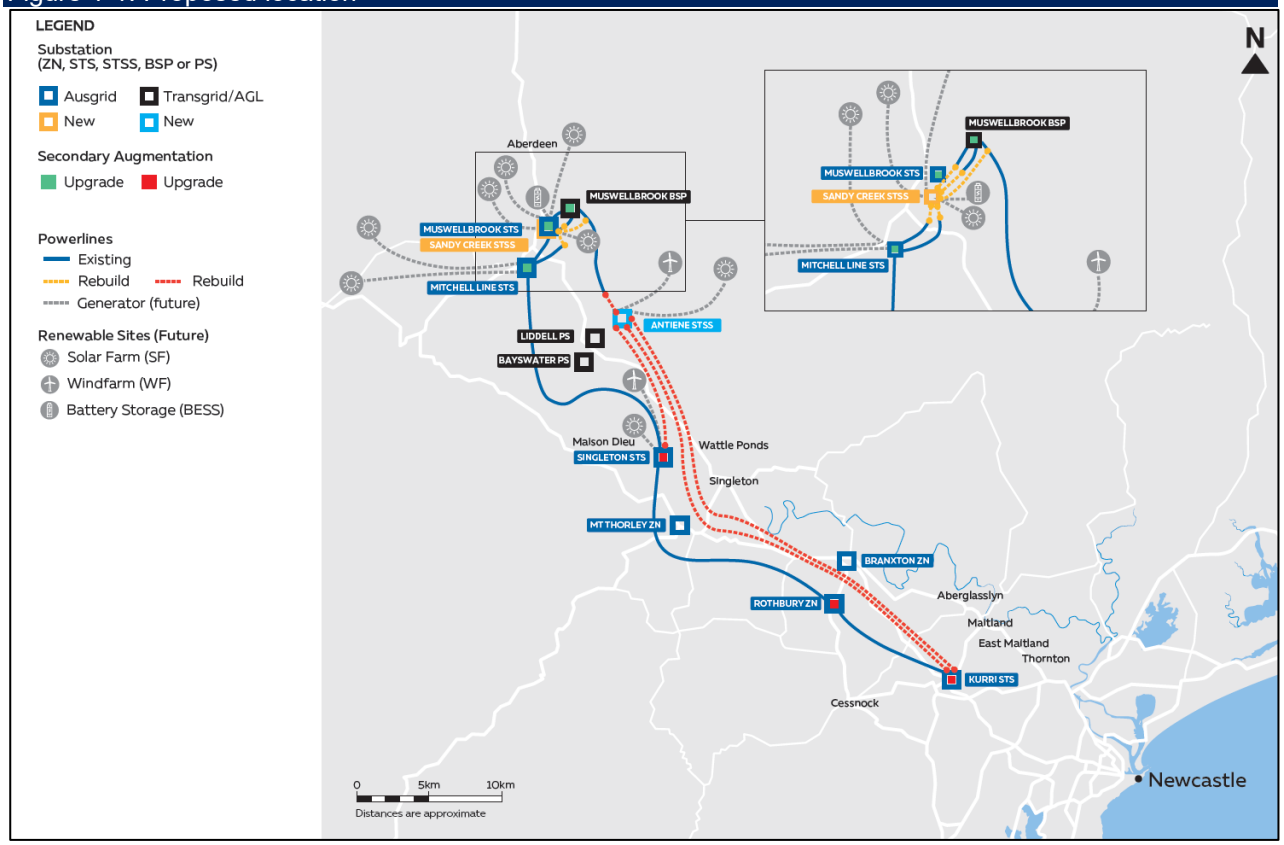
- new Sandy Creek 132kV Subtransmission Switching Station (STSS)
- new Antiene 132kV Subtransmission Switching Station (STSS)
- rebuilding of 66kV and 132kV powerlines between Kurri Subtransmission Substation (STS) to the new Antiene STSS
- rebuilding of 132kV powerlines between new Sandy Creek STSS and Transgrid's Muswellbrook Bulk Supply Point (BSP)
- associated 132kV and 66kV network augmentations
- Kurri Subtransmission Station (STS) 132kV busbar extension
- Rothbury Zone Substation (ZS) inductor installation
- Muswellbrook fibre marshalling kiosk.

All network augmentations, including both substation and powerline works, will be undertaken while a secure electricity supply is maintained to customers.

1.2 Proposed location

The proposed location is generally defined as the land within existing powerline corridors and those areas identified that connect those corridors between Kurri Kurri and Muswellbrook, 25m on either side of the route shown in Figure and 3 and associated access points and tracks to gain access from public roads to the corridor. The proposed powerlines start at Kurri STS and continue for a length of 81km northwest towards to the proposed Antiene STSS on the northern side of Lake Liddell, and another 4km section between Ausgrid's proposed Sandy Creek STSS (located on the southern side of Ausgrid's existing Muswellbrook STS) and Transgrid's Muswellbrook BSP.

Figure 1-1: Proposed location



1.3 Background and need

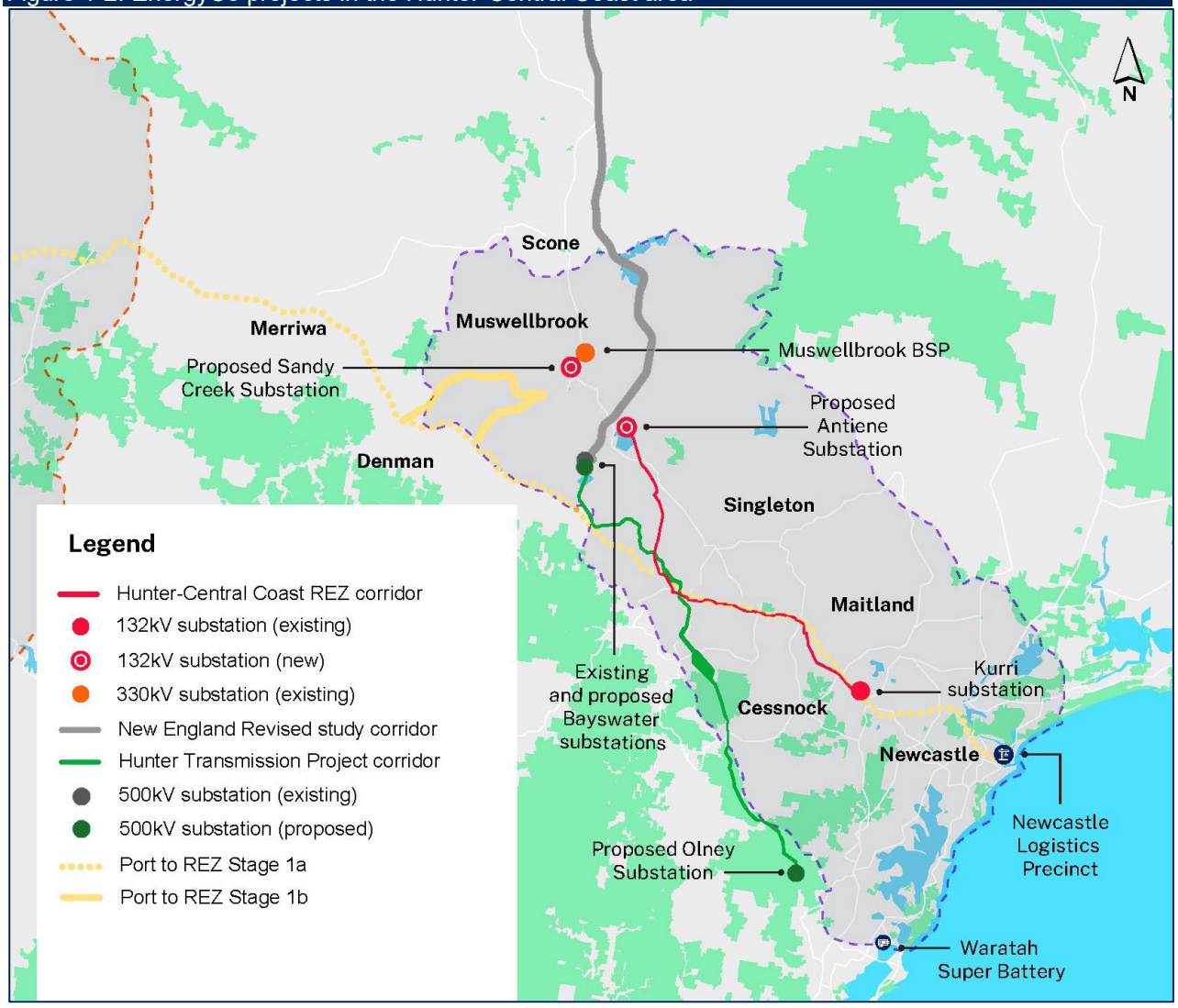
The NSW electricity system is undergoing a major transformation to transition its reliance on coal-fired power to renewable energy. By 2040, the remaining four of NSW's coal-fired generators will have been retired, with the demand for electricity continuing to increase. The construction of new and upgraded network infrastructure is required to ensure energy can be transferred from Renewable Energy Zones (REZs) to major load centres across NSW.

The Hunter-Central Coast REZ (HCC REZ) was formally declared on 9 December 2022 and comprises a specified geographical area which lies within the Ausgrid distribution network. The Energy Corporation of NSW (EnergyCo) as the infrastructure planner has nominated that planned, new and existing network infrastructure within the geographical area is specified as REZ infrastructure.

The HCC REZ is expected to accommodate renewable energy generation and storage projects and become a hub for low-emission industrial development in the region. EnergyCo conducted an initial engagement process with industry regarding the potential investment in renewable generation and storage projects in the HCC REZ. From this, an intended network transfer capacity of 1GW has been identified for the HCC REZ by mid-2028.

The HCC REZ is one project within EnergyCo's portfolio to invest in new renewable infrastructure in the region and is shown in red in Figure 2.

Figure 1-2: EnergyCo projects in the Hunter-Central Coast area



1.4 Related projects

Ausgrid projects typically have related projects and flow on activities due to the interconnected nature of the network. These related projects would be subject to separate environmental impact assessments due to factors such as differences in funding, construction timeframes and design.

The following projects associated with the proposal have or will be assessed separately under the relevant provisions of the *EP&A Act:*

- early works distribution 11kV/400V network relocations to facilitate main subtransmission work
- secondary systems upgrades: Upgrade of 132kV feeder protection relays at various substation in the Upper and Lower Hunter Networks to meet compliance requirements with the National Electricity Rules
- Berowra to Somersby Optical Pilot Ground Wire (OPGW) and All-Dialiectric Self-Supporting fibre (ADSS)
- replacement of approximately 30km of Overhead Earthwire (OHEW) with Optical Pilot Ground Wire (OPGW) and All-Dielectric Self-Supporting fibre (ADSS) on existing overhead lines between Berowra and Somersby
- Antiene STSS to Muswellbrook BSP underground fibre optic cable installation.

Known material cumulative impacts associated with these related projects are addressed in section 6.17.

1.5 Study area

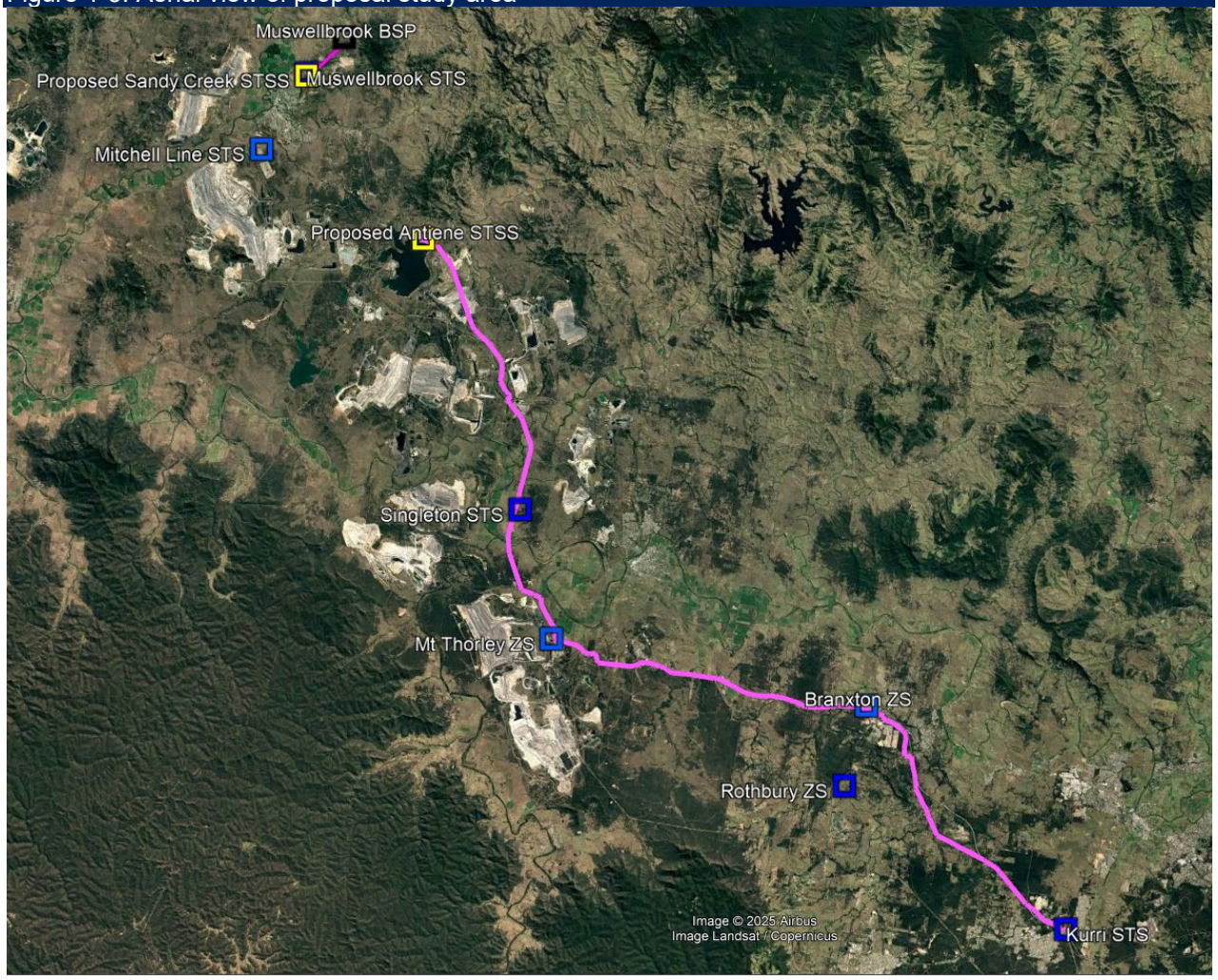
The study area is the environment that could be directly or indirectly affected by the proposal.

For the purpose of this REF, the study area is defined as the proposed powerline route and switching station sites including a buffer area (the size is dependent on the issue being assessed).

Some potential impacts do not have clear physical boundaries. These are assessed on a broader scale and include land use, climate change, air quality, hydrology, waste disposal, fauna (including migratory birds), visual aesthetics, social and economic impacts.

Figure 3 shows the study area for direct impacts assessed in this REF.

Figure 1-3: Aerial view of proposal study area



2 Description of the proposal

2.1 Powerlines

2.1.1 Summary of the proposed works

The powerline works comprise of the rebuilding of existing Ausgrid powerlines with increased capacity between Kurri STS and the proposed new Antiene STSS, and between the proposed new Sandy Creek STSS and the Transgrid Muswellbrook BSP.

Two new high capacity 132kV circuits would be built between Kurri STS and the proposed Antiene STSS, approximately 81km and an additional 132kV circuit built between Ausgrid's proposed Sandy Creek STSS (adjacent to Ausgrid's existing Muswellbrook STS) and Transgrid's Muswellbrook BSP, approximately 4km.

The works generally comprise:

- the recovery and disposal of conductors and power poles (of various materials such as timber, steel or concrete) and associated equipment/materials (anchors, stays, insulators, switches, earthwires and so on)
- erection of new steel monopoles, conductors and associated equipment.

The specific route section design includes:

- Kurri Kurri to Branxton (24km):
  - Replace existing 66kV powerlines with new steel monopole lines comprising of two 132kV circuits with twin conductor and install OPGW.
- Branxton to Gouldsville (27km)
  - Replace existing 66kV powerlines with new steel monopole line comprising of two 132kV circuits with twin conductor, rebuild 66kV circuit underneath and install OPGW. There is approximately 2km where a new easement is proposed to be acquired and public road reserve used to connect between two existing 66kV corridors.
- Gouldsville to Hebden (30km)
  - Replace existing 132kV powerlines with two new steel monopole lines comprising two 132kV circuits with twin conductor and one 132kV circuit with single conductor. Install OPGW on both monopole lines.
- Muswellbrook (4km)
  - Replace existing 132kV powerlines with new steel monopole lines comprising of two 132kV circuits with single conductor and install OPGW.
  - Relocate existing 66kV circuit to western side of Sandy Creek STSS.

The project would be staged to allow each corridor to be taken out-of-service for the duration of the rebuild.

Ausgrid would ensure that electrical supply is maintained to substations in the area, thereby ensuring customers maintain continuous electricity supply during the works. There would be short duration critical activities which would require customer outages for the safe demolition and construction of the powerlines and where those activities are near electricity infrastructure.

To enable the staged rebuild of the network, there would be several reconfigurations of the existing 132kV and 66kV lines in the vicinity of:

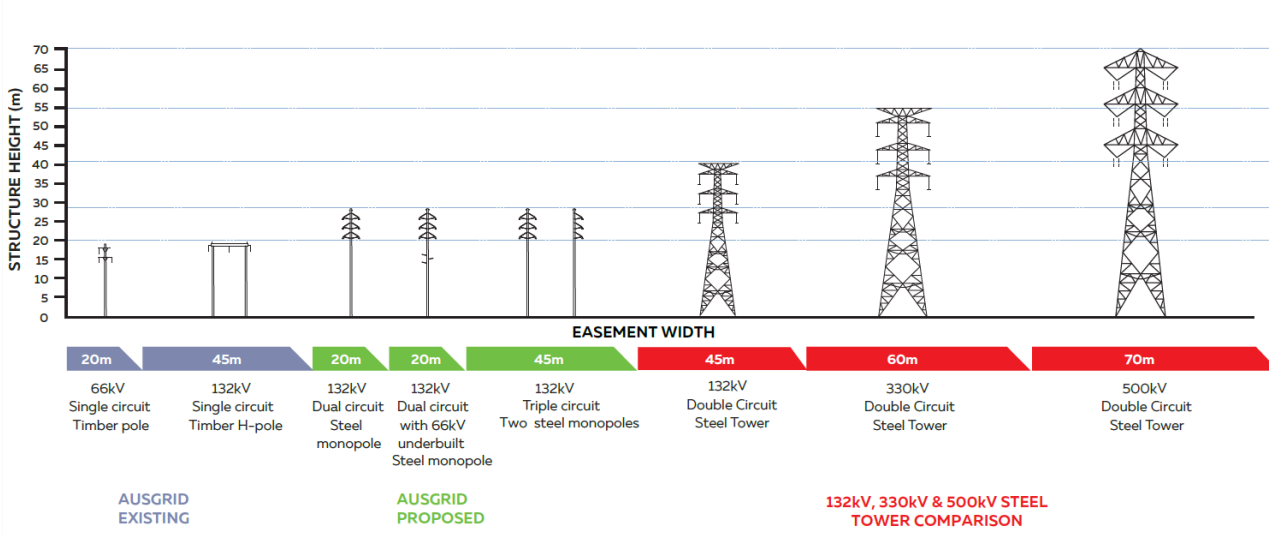
- Kurri STS
- Branxton ZS
- Mt Thorley ZS
- Singleton STS
- Proposed Antiene STSS
- Proposed Sandy Creek STSS
- Muswellbrook STS
- Transgrid Muswellbrook BSP

Ausgrid's project differs from other comparative projects in the region (namely the Central West Orana REZ, New England REZ and the Hunter Transmission Project (HTP)), which require the construction of steel lattice transmission towers and operate at the same or higher voltage levels.

Ausgrid's proposal is to replace existing powerlines with new steel monopoles, leading to an overall smaller footprint and faster construction time. The following image illustrates a comparison between:

- Ausgrid's existing structures (mainly timber poles)
- Ausgrid's proposed 132kV steel monopole arrangements
- comparative projects that would construct steel lattice transmission towers of voltages of 132kV, 330kV and 500kV.

Figure 2-1: Ausgrid's 132kV proposal versus other projects



2.1.2 Easements and electricity legislation

Easements, leases, licences and rights of way/carriageway over land are established to protect the future security and tenure of Ausgrid's assets including switching stations and distribution lines of all voltages, both overhead and underground.

The proposed powerlines would generally be constructed along Ausgrid's existing 66kV and 132kV powerline corridors, which includes over public land, private land, Commonwealth land and land owned by Ausgrid. New powerlines will be constructed using steel poles with direct embedded foundations, or where ground conditions are unfavourable, alternative foundations would be used.

The benefit of using existing powerline corridors ensures that areas of disturbance are minimised across the powerline route. This minimises, where practical, environmental impacts associated with vegetation clearing and construction access tracks, which would have otherwise been required for a new powerline route.

Where powerlines are installed within public land, as defined in the *Electricity Supply Act 1995* (ES Act). Section 45 of the ES Act enables Ausgrid to install electricity works within that land and no easement or other licence is required over the powerlines in these areas.

On other land, the existing powerlines may or may not reside under the protection of established electricity easements. In cases where:

- the existing powerlines reside outside an electrical easement
- the easement is either non-contiguous or insufficient width
- the easement terms do not provide Ausgrid appropriate rights

then existing powerlines, which were constructed between 1960 and 2015, reside under the protections of either:

- Section 53 of the *Electricity Supply Act 1995 (ES Act)*; or
- *Electricity Supply Act 1995* or *Electricity Network Assets (Authorised Transactions) Act 2015.*

That said, the alteration of the powerlines may require protections that exceed those afforded by established easements and/or legislation. In these cases, it is Ausgrid's intention to acquire sufficiently wide end-to-end continuous easements, over the proposed powerlines, with the appropriate rights.

2.1.3 Vegetation clearing

The vegetation within the powerline corridors proposed are already maintained in accordance with Ausgrid's tree trimming guidelines, standards and plans. Reusing this pre-cleared corridor minimises the amount of additional clearing required for the new higher capacity powerlines. Additional clearing would only occur in areas where additional clearance is required.

The clearances required between powerlines and poles and tree branches are governed by Ausgrid's network standard (NS179), the Industry Safety Steering Committee Guide for Management of Vegetation near Electricity Assets (ISSC3) and the Australian Standard Pruning of Amenity Trees (AS4373).

Table 2-1: Vegetation clearing requirements

Powerline corridors	Existing cleared vegetation corridor	New cleared vegetation corridor
Kurri Kurri to Branxton	10m – 15m	20m
Branxton to Gouldsville	10m – 15m	20m
Gouldsville to Hebden	45m	45m
Muswellbrook	45m	45m

Additional clearing would be required to allow the connection of circuits into substations, connection between circuits, on each side of infrastructure crossings, access tracks and construction pads.

Impact on flora and fauna is described in Section 6.10.

2.1.4 Access points

The construction site would be transient in nature and progressively move along the corridor through each of the six powerline corridors.

There would be multiple work-fronts at any one time, which would necessitate multiple access points to be active along corridor. Access points will generally be located on the side of a public road and access tracks established between the public road and the portion of the powerline corridor to be rebuilt.

Where required, access point approaches would be graded and reshaped to accommodate the turning circle of construction plant, gated entrances would typically be setback from the trafficable lane to allow long plant to move off the road with minimal impact to traffic flow. Road-side drainage would be considered in the forming of approaches to avoid damming.

Typically, access points would be fenced and sign-posted for ease of identification of construction crews.

There would be over 100 access points across the project, those would service both heavy and light vehicles. Final access points are subject to site surveys and landowner consultation, these will be confirmed during the contract phase.

2.1.5 Access tracks

The works would utilise where practical pre-existing access tracks historically utilised by Ausgrid's field crews to inspect, maintain and repair the existing powerlines. However, access tracks would either be remediated or installed where required to accommodate the safe access of plant, equipment and materials required to complete the works.

The repair and upgrade of existing access tracks would involve:

- grading and/or shaping of existing access tracks
- excavation up to 150mm followed by the laying and compaction of crushed rock or gravel, to improve the surface and drainage
- vegetation slashing and removal where required.

New access tracks would be between 4m to 5m in width, with wider areas only as required for vehicle passing bays. Access tracks would be excavated 150mm up to 600mm deep depending on the terrain. Terrain with firm ground would require less excavation, however, swampy and boggy areas will require deeper excavation up to 600mm deep. In both cases the excavations would be infilled with crushed rock or gravel and compacted.

Access tracks in sensitive areas would be well signposted and bunting or similar would be used to define the access track route.

Where private property is concerned, consultation would occur with property owners.

Access would be required for ongoing maintenance and operation of the powerline.

2.1.6 Water crossings

Upgrade of watercourse crossings may involve bank regrading, bed widening and additional clean rock fill to allow for access by heavy construction plant and for continued flow of water.

New water crossings would typically involve some excavation of the banks and grading works to smooth out the approach on each side of the crossing. This would be infilled with clean rock fill.

Water crossings would typically be temporary in nature and be removed following the works.

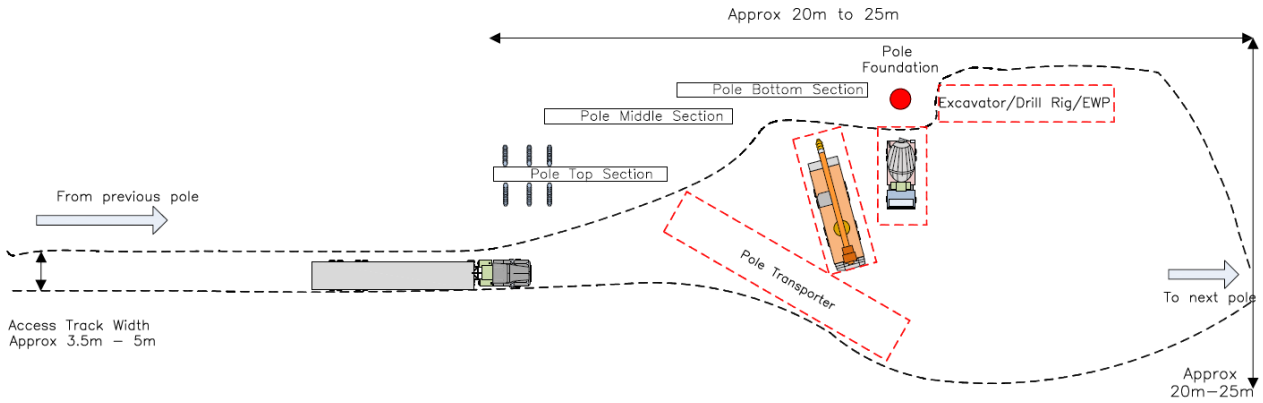
Up to 12 waterways mapped as key fish habitats may require works to facilitate safe construction access. Where reasonable and feasible alternative access would be used. Where unavoidable, the crossings will be constructed in accordance with NSW Fisheries requirements outlined in Section 6.10.1. Where necessary, further consultation will be undertaken with Fisheries regarding specific treatments for Class 1 and 2 waterways.

2.1.7 Worksites, construction benches and pads

To complete the demolition and construction of activities safely, designated work sites would be established at each existing and new structure.

The worksite would be up to 25m x 25m within the worksite there would be the construction of benches and pads. This will enable the stable and safe operation of large plant such as Elevated Work Platforms (EWPs) and cranes. Typical pads around pole structures would be 20m x 20m, however, may be larger depending on activities or location.

Figure 2-2: Typical pole construction pad



Poles would be assembled and dressed adjacent to new pole locations and construction pads.

Brake and winch sites would be 20m x 40m up to 50m x 70m, however, due to lighter plant and equipment, would require less ground disturbance than those around pole structures.

Excavation of depths of up to 600mm with infill of clean crushed rock, gravel or road base may be required for some tracks, pads and brake and winch sites dependant on ground conditions at the time of

construction. In Aboriginal sensitive areas, where possible, geofabric will be laid on the ground surface with rock/road base placed on top to minimise any subsurface impacts.

Where the dimensions of the worksite, benches or pads are required to extend beyond the easement, consultation with the landowner would be undertaken.

2.1.8 Hurdles at undercrossing locations

Hurdles would be established where the proposed lines cross over existing 11kV or low voltage distribution lines. Works would require the installation of timber pole structures to support a non-conductive netting system. This would prevent conductors contacting lower voltage mains during stringing operations, if there is a loss of tension during the stringing process. The area required would be up to 30m x 30m, with potential benching required on sloped areas, no other ground disturbance would be required as poles are placed within precast concrete supports. Any proposed benching within Aboriginal sensitive areas may require additional assessment.

2.1.9 Construction storage yards

The rebuild of each corridor would comprise of strategically located bulk construction yards, which would be sized to accommodate the bulk storage of pole sections, conductor drums, containers, hardware and accessories. This site would also include temporary air-conditioned offices and amenity facilities, parking for light and heavy vehicles, and waste facilities. These main construction storage yards would service the rebuilding of multiple powerline corridors acting as a central logistic hub for the deployment of materials and works. General locations would be Lochinvar, Singleton, Hebden and Muswellbrook.

All storage yards would be enclosed in temporary construction fencing. Storage yards would be powered by either small petrol generators or low voltage network supply.

Separate assessment (including consultation) of the proposed construction yards would be undertaken when these site locations are confirmed.

2.1.10 Construction laydowns

On or near each powerline corridor being rebuilt, there would be multiple smaller laydowns to accommodate the construction activities. These smaller laydowns would be transient and follow the construction activities as they progress across the corridor. These would typically be located within the easement boundaries or on public land.

All laydowns, if powered, will use petrol generators and would be enclosed in temporary construction fencing.

2.1.11 Waste

As existing powerlines are dismantled and recovered, waste materials will be stockpiled for collection and disposal at appropriately licenced facilities.

2.1.12 Installation of temporary environmental controls

Temporary environmental controls would be installed during the construction phase to mitigate potential environmental issues identified in section 6. Temporary controls for the proposal to mitigate such issues as noise and sediment would be installed where appropriate. These controls would be removed once construction is complete.

Concrete washouts would be required at most construction sites. Concrete washout will be undertaken in accordance with the TfNSW concrete washout guidelines[1]. Where works are in a sensitive Aboriginal area the concrete washout must be of a type that does not involve ground disturbance.

2.1.13 Powerline construction methodology

The precise construction methodology would be determined at the post-contract/construction stage of the proposal. The works would be undertaken by a combination of Ausgrid and contractors for various components. The mitigation measures detailed in this REF must be included in the Ausgrid/contractor construction environmental management plans (CEMP).

Key tasks associated with the construction of the powerline are outlined in Table 2-2 and illustrated in Figure 2-3: Powerline construction activities. Existing powerline corridors would be rebuilt across six distinct sections. Each corridor would be de-energised end-to-end to allow the efficient demolition and construction of new powerlines.

Table 2-2: Powerline construction methodology

Construction stage	Key tasks
Mobilise	• Mobilise site including bulk storage yards and laydowns.
Access tracks and clearing works	• Preparation of a site assessment to determine and tape/barricade off sensitive areas. • Negotiation with landowners for laydown areas in strategic locations along the route. • Clearing and trimming vegetation along easement/corridor in accordance with the required width. • Constructing suitably sized access tracks, benches and pads for cranes and EWPs, where required. • Constructing temporary water crossings where required.
De-energise corridor	• De-energise and disconnect circuit within corridor to be worked on in accordance with project staging.
Removal, recovery and recycle	• Recover and recycle existing conductors along corridor. • Fell existing poles below ground level and backfill to natural surface contours. • Dispose and/or recycle poles, cross-arms, insulators and other hardware.
Excavation	• Bore pole foundations, with boring machine selected based on local ground conditions. The diameter could be up 2m diameter and up to 10m deep. However, most poles would require a 1.2m-1.5m diameter hole and be approximately 5m deep. • Where there are poor ground conditions, excavation of mass concrete foundation would be completed. • Hole to be covered and demarcated until pole is ready for assembly and erection.
Pole transportation, assembly and erection	• Heavy all-terrain vehicles to be used to transport poles to site. • Crane to lift poles from trucks to laydown area. • Pole will be assembled lifted into position. • Holes backfilled around pole butt with concrete.
Ground stays, anchors and guys	• Some poles may require additional support by ground stay, anchors and guys. • Ground anchors would require boring of a 1m diameter hole up to 5m deep. The anchor would be set in the hole at an angle of 45 degrees and backfilled with mass concrete. • Guy wires and stays would generally be set down 1/3 from the top of the pole and tensioned at an angle of 45degrees to pole and natural ground.

Construction stage	Key tasks
Insulating, stringing, sagging and tensioning	• Insulators installed on pole arms. • Rollers to be erected. • Draw wire to be run via helicopters, drones or other conventional stringing methodologies. • Conductors/OPGW/earthwire pulled via draw wire using stringing tensioners, winches and bull wheels. • Appropriately sag/tension conductors. • Clip in and terminate conductors, as required. • Terminate and splice OPGW, as required. • Install conductor spacers and vibration dampers, by trolley, remotely or by conventional EWPs.
Inspection, testing and commissioning	• Completion of inspections and testing of the line. • Completion of final testing and commissioning.
Waste disposal and restoration	• Waste to be disposed of at a licenced facility. • Any vegetation clearing to be chipped and spread on site (with the exception of weeds). • Clean spoil to be spread on site. • Demobilisation of temporary site facilities. • Disturbed areas that are required for future operation and maintenance of the powerline, such as access tracks, benches and pads, would be left in a stable condition for long-term use.

2.1.14 Resources and equipment

Typical construction equipment and materials are listed below. The construction contractor would determine the type and quantities of equipment/plant based on the adopted work methodology, construction staging and its own resources. The work methodology would be captured in the CEMP.

The following equipment may be used on site but is not limited to:

Table 2-3: Typical construction equipment

Construction stage	Typical equipment	
Transmission line construction	• site compounds and sheds • ablutions • skips • construction fencing • light 4x4 vehicles • 4x4 quad axle full widening low loader • positrac/forester • excavators • bulldozer • bobcat/skid steer • grader • tipper • roller compactor • piling rig • pepper drill • EWP various sizes • concrete trucks • concrete pump	• traffic control equipment and vehicles • helicopter • drone • winches • tensioners • robotic spacer • generators • cranes various sizes • forklift • manitou • power tools (hydraulic, pneumatic, electric and battery) • portable combustion powered tools (e.g. chainsaw, compactor, demolition saw) • grinder • oxy welder • large rock breaking equipment

The following materials may be required for the proposal but is not limited to:

Table 2-4: Typical construction materials

Construction stage	Typical materials	
Powerline construction	• temporary office and amenities • steel, concrete and timber poles • steel and aluminium conductor • OPGW • copper down leads and electrodes • insulators and stand-offs • line fittings, and hardware • concrete • asphalt • steel stays and anchors	• materials and equipment for biosecurity controls • typical rural fencing and gates • imported soil for engineered fill and topsoil • seed, grasses and saplings • sand, aggregates, gravels, crushed rock and other landscape supplies • fuel, oils, lubricants and conductive pastes • erosion and sediment controls

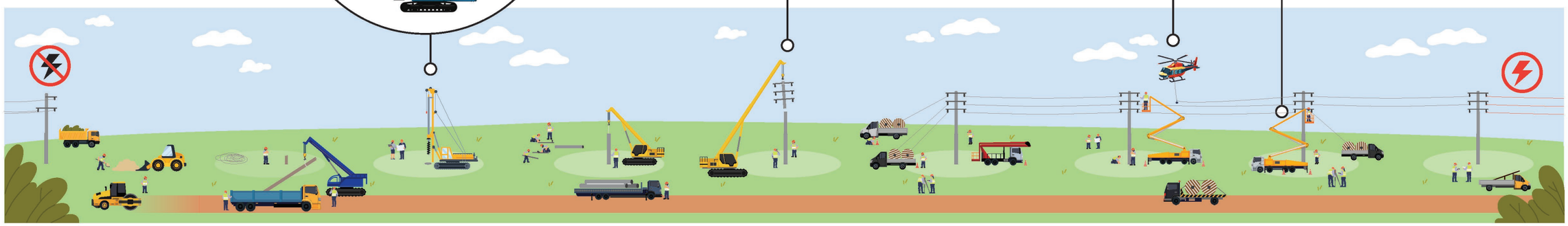
Figure 2-3: Powerline construction activities

MONOPOLES require less realestate than lattice towers, generally between 25m-40m in height. Constructed on site between 3-4 pieces, installed in the bored hole, followed by the middle sections, and finally the top section. The top section includes the cross arms, which will support the insulators and conductors.

HELICOPTERS are used to string draw wires between poles, so new conductors can be hauled over the pole line, and clipped into place.

MOBILE ELEVATED WORK PLATFORMS are trucks with man basket designed to lift or lower people and equipment by a telescopic and articulated arm. They allow workers to access the cross arms and wires at the top of the monopole.

PILING MACHINES are specialised equipment designed to bore holes into the ground quickly and accurately. They come in various sizes and styles to accommodate different types of soil and project requirements.



Stage 1
- Access track building/ remediation and vegetation clearing

Stage 2
- Deenergise powerlines
- Demolish exiting tranmission line
- Remove conductors
- Cut and fell exisitng pole line

Stage 3
- Construct equipment pads to work around pole location
- Peg location of monopole
- Bore pole hole

Stage 4
- Deliver pole sections to peg
- Stand first pole section in hole

Stage 5
- Assemble cross arms on top section
- Lift and stack middle section and top section
- Install rollers on cross arms

Stage 6
- Setup stringing sites.
- Install draw wire onto the monopoles' rollers using helicopter.
- String new conductors along powerline using pulling and tensioning equipment.
- Install insulators on monopoles
- Clip-in conductors

Stage 7
- Inspect, test and energise line
- Leave site clean and tidy

2.2 Substations

2.2.1 Antiene Subtransmission Switching Station (Antiene STSS)

The proposed Antiene STSS will be constructed to have a design life of 50 years. The Antiene STSS would be located Lot 9 DP 2050890 Hebden Road with the busbar orientated parallel with Hebden Road. The STSS would consist of a new 132kV outdoor switchyard, control and protection building, fencing, lighting, signage, amenities building, utilities, stormwater management, driveways and access routes and landscaping.

Bulk earthworks include a 'cut and fill' excavation and placement of spoil to create a 290m x 110m level pad. The total volume of spoil to be excavated would be approximately 18,000m^3. The total volume of spoil to be placed onsite would be approximately 18,000m^3. This would result in minimal spoil needing to be removed from site.

Concrete plinths and foundations would be constructed for all structures to be installed.

Site electronic security incorporating building swipe card access, perimeter thermal and imaging cameras, will be connected via a dedicated security perimeter pit and duct system.

NB: The STSS has provisions for future expansion. An additional area of 100m by 100m will be levelled to the east of the substation area during bulk earthworks. This area is included in the bulk earthworks figure provided above.

132kV outdoor switchyard

The outdoor switchyard would have an approximate footprint of 80m by 180m and comprise of an outdoor busbar, isolation and earth switches, circuit breakers, voltage transformers, overhead powerline support structures, lightning protection mast and other STSS equipment.

The earthing system is an essential part of providing a safe working environment within the STSS as well as correct protection. The earthing system would be integrated in the STSS design and would extend 1m from the building and STSS fencing within Ausgrid's property subject to confirmation in the detailed design. The earth rods may be drilled to a depth of approximately 15m, subject to confirmation in the detailed design.

The outdoor switchyard equipment will require control and protection cabling that will be installed in a pit and duct system though out the STSS and extending to Ausgrid assets within the property.

The 132kV outdoor switch yard surface will be ballasted to provide earthing safety to workers inside the STSS.

Control and protection building

The control and protection building would have an approximate footprint of 32m by 6m. The building will be of transportable design and delivered to site as an oversize load.

The control and protection building will house associated control and protection equipment, batteries and associated chargers, air conditioning and communications equipment.

Fencing, lighting and signage

During construction, the site will be temporally fenced to prevent unauthorised access. Signage will be attached to the external face of the fence in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs.

The final fencing for the operational and maintenance phase would comprise of two layers. The first being a boundary rural style fence, and the second being a high security three-metre-high weldmesh fence. Signage would be installed on the external face of the weldmesh fence, comprising site identification, danger and warning signs.

Security lighting and CCTV is also required at the STSS, and would be installed on either During construction, signage will be displayed in accordance with Occupational, Health and Safety Regulations for

construction sites. This will include danger signs and protective equipment signs, with new signs placed on the STSS fence.

A combination of lightning masts or dedicated lighting poles would provide switchyard lighting and CCTV capability.

Amenities building and utilities

Electricity infrastructure is available near the site and will be extended to service the STSS. A new 11kV/415v kiosk substation will be installed.

Water infrastructure is not available at the site and standalone systems will be installed to provide potable and firefighting water supplies.

A hydrant ring main pipe system has been provided encircling the entire switching station with sufficient hydrants to provide ample coverage for all items of equipment. The tanks and fire pump system have been designed for a nominal 20L/s flow rate allowing for two hydrants operating at once with the tanks having a 288,000L capacity.

Wastewater infrastructure is not available at the time and standalone pump-out systems will be installed. The amenities will contain a site toilet that will be connected to a pump-out septic system.

There is no requirement for natural gas.

The permanent amenities building would have an approximate footprint of 6m by 6m. The building will be of transportable design and delivered to site as an oversize load.

Construction amenities will be in accordance with best practice procedures and be constructed to avoid environmentally sensitive areas during the construction of the substations.

Stormwater management

Drainage pits will be distributed across the switchyard. A drainage system concept has been developed that caters for overland surface flows plus perimeter diversions. The yard cable trench system will also be connected to the site drainage.

Access and parking

A new access would be created from Hebden Road. There would be provision for a heavy ridge truck to park in the driveway on the outside of the boundary fence gate to enable the truck to safely be parked while unlocking gates. There will also be provision to park more than two passenger vehicles and one heavy rigid truck within the property

The Driveways would have an approximate footprint of 2000m^2. A paved driveway will be installed from Hebden Road to the STSS and buildings.

Reasonable area would be provided for maintenance and testing vehicles to access the STSS for testing and maintenance purposes.

Delivery and removal of control room to and from the site would be via the main access roadways. The control room is a large unit in excess of 27m long, 4.5m wide and 30 tonnes, and is required to be delivered by large specially configured trucks. Delivery to the site of the control room will likely require road closures. Any road closures would require the appropriate approvals. Delivery of a control room would only occur during the construction of the switching station and at the end of the equipment life span (estimated 50 years).

For maintenance and firefighting access unpaved access routes will be constructed around the perimeter of the 132kV outdoor STSS high security fence.

Landscaping

No specific landscape plan has been prepared. Landscape planting to screen the STSS will be planned in consultation with the Lake Liddell Recreation Area and the local Landcare Group.

Land ownership

The proposed new Antiene STSS site will be acquired from Crown Lands and/or via the relevant Aboriginal Land Council.

Figure 2-4: Site location Antiene STSS

2.2.2 Sandy Creek 132kV Subtransmission Switching Station (Sandy Creek STSS)

The Sandy Creek STSS will be constructed to have a design life of 50 years. The STSS would be located on Ausgrid's property south of the Ausgrid existing Muswellbrook STS with the busbar orientated east west. The STSS would consist of a new 132kV outdoor switchyard, control and protection building, fencing, lighting, signage, amenities building, utilities, stormwater management, driveways and access routes and landscaping.

Bulk earthworks include cutting and filling excavation and placement of spoil to create a 170 by 90m level pad. The total volume of spoil to be excavated would be approximately 17,000m3. The total volume of spoil to be placed onsite would be approximately 17,000m3. This would result in minimal spoil needing to be removed from site.

Concrete plinths and foundations would be constructed for Sandy Creek STSS.

Site electronic security incorporating building swipe card access, perimeter thermal and imaging cameras, connected via a dedicated security perimeter pit and duct system

132kV outdoor switchyard

The outdoor switchyard would have an approximate footprint of 160m by 80m and comprise of and outdoor busbar, isolation and earth switches, circuit breakers, voltage transformers, overhead powerline support structures, lightning protection mast and other STSS equipment.

The earthing system is an essential part of providing a safe working environment within the STSS as well as correct protection. The earthing system would be integrated in the STSS design and would extend 1m from the building and STSS fencing within Ausgrid's property subject to confirmation in the detailed design. The earth rods may be drilled to a depth of approximately 15m, subject to confirmation in the detailed design.

The outdoor switchyard equipment will require Control and protection cabling that will be installed in a pit and duct system though out the STSS and extending up to meet up with other Ausgrid assets within the property.

The 132kV outdoor switch yard surface will be ballasted to provide earthing safety to workers inside the STSS.

Control and protection building

The control and protection building would have an approximate footprint of 32m by 6m. The building will be of transportable design and delivered to site as an oversize load.

The control and protection building will house associated control and protection equipment, batteries and associated chargers, air conditioning and communications equipment.

Fencing, lighting and signage

A two-stage fencing system will be installed. The system includes the existing boundary rural style fence, and then a high security three-metre-high weldmesh fence, Security lighting will be required for the STSS.

Switchyard lighting and CCTV utilising a combination of lightning masts and dedicated lighting poles

New signs will be placed on the STSS fence

During construction, signage will be displayed in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs.

Amenities building and utilities

Electricity infrastructure is available at the existing Muswellbrook STS near the site and will be extended to service the STSS.

Water infrastructure is available at the existing Muswellbrook STS near the site and will be extended to service the STSS. A hydrant ring main pipe system has been provided encircling the entire switching station with sufficient hydrants to provide ample coverage for all items of equipment. The tanks and fire pump system have been designed for a nominal 10L/s flow rate allowing for two hydrants operating at once with the tanks having a 144,000L a reduced tank capacity might be considered subject to incoming water tank in-fill rate.

Wastewater infrastructure is not available at the time and standalone pump out systems will be installed. The amenities will contain a site toilet that will be connected to a pump out septic system.

There is no requirement for natural gas.

The permanent amenities building would have an approximate footprint of 6m by 6m. The building will be of transportable design and delivered to site as an oversize load.

Construction amenities will be in accordance with best practice procedures and be constructed to avoid environmentally sensitive areas during the construction of the substations.

Stormwater management

Drainage pits will be distributed across the switchyard. A drainage system concept has been developed that caters for overland surface flows plus perimeter diversions. The yard cable trench system will also be connected to the site drainage.

Access and parking

The existing Driveway from Sandy Creek Road to Muswellbrook STS Is a single lane and currently does not allow for 2 trucks to pass, two 100m by 3m unpaved passing points will be installed to allow trucks to pass safely, details will be developed during detailed design.

There is currently provision for a heavy ridge truck to park in the driveway on the outside of the boundary fence gate to enable the truck to safely be parked while unlocking gates. There will also be provision to park more than 2 passenger vehicles and 1 Heavy Rigid truck within the property.

A paved access Road will be installed from Muswellbrook STS to Sandy Creek STSS and buildings an unpaved construction access road would be installed around the Muswellbrook Bess construction site to allow unimpeded access to Sandy Creek STSS. The new driveways would have an approximate footprint of 5500m2.

Reasonable area would be provided for maintenance and testing vehicles to access the STSS for testing and maintenance purposes.

Delivery and removal of control room to and from the site would be via the main access roadways. The control room is a large unit more than 27m long, 4.5m wide and 30 tonnes and is required to be delivered by large specially configured trucks. Delivery to the sites for control room will likely require road closures. Any road closures would require the appropriate approvals. Delivery of a control room would only occur during the construction of the switching station and removal at the end of the equipment life span (estimated 50 years).

Landscaping

No specific landscape plan has been prepared.

Land ownership

The new Sandy Creek STSS site would be on land already owned by Ausgrid.

Figure 2-5: Site location Sandy Creek STSS

2.2.3 Muswellbrook Subtransmission Substation (Muswellbrook STSS)

Muswellbrook STS is currently supplied by two overhead powerlines. Once Sandy Creek STSS is constructed, the overhead powerlines will be redirected to Sandy Creek STSS in a staged fashion. Two new underground 132kV powerlines will be installed from Sandy Creek STSS to Muswellbrook STS. Each route will be determined during detailed design process and include a trefoil conduit bank for 132kV single core cables, plus additional conduits for earth continuity conductors and communications.

The existing Muswellbrook STS would be decommissioned, the footprint of the Muswellbrook STS would not be reduced during decommissioning

2.2.4 Kurri Subtransmission Substation (Kurri STS)

Augmentation of the Kurri STS is required to facilitate the transfer capacity connection into the southern part of the network and through Transgrid's Newcastle BSP. The augmentation would be located immediately to the west of Ausgrid's existing Kurri STS. The augmentation would consist of a extending the existing 132kV outdoor switchyard, control and protection upgrades, fencing, lighting, signage, stormwater management, driveways and access routes and landscaping.

Bulk earthworks include a net importing and placement of spoil to create an additional 60m by 40m level pad.

Concrete plinths and foundations would be constructed for the augmentation

Site electronic security upgrades incorporating building swipe card access, perimeter thermal and imaging cameras, connected via a dedicated security perimeter pit and duct system.

132kV outdoor switchyard

The extension to the outdoor switchyard would have an approximate footprint of 60m by 40m and comprise of and outdoor Busbar, Isolation and earth switches, circuit breakers, voltage transformers, overhead powerline support structures, lightning protection mast and other substation equipment.

The earthing system is an essential part of provides a safe working environment within the substation as well as correct protection. The earthing system would be upgraded in the substation design and would extend 1m from the buildings and substation fencing within Ausgrid's property subject to confirmation in the detailed design. The earth rods may be drilled to a depth of approximately 15m, subject to confirmation in the detailed design.

The outdoor switchyard equipment will require control and protection cabling that will be installed in a pit and duct system though out the substation and extending to meet up with other Ausgrid assets within the property.

The 132kV outdoor switch yard surface will be ballasted to provide earthing safety to workers inside the Substation.

Control and protection building

The control and protection would be housed in the existing buildings.

Fencing, lighting and signage

During construction, the site will be temporally fenced to prevent unauthorised access. Signage will be attached to the external face of the fence in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs.

The final fencing for the operational and maintenance phase would comprise of two layers. The first being a boundary rural style fence, and the second being a high security three-metre-high weldmesh fence. Signage would be installed on the external face of the weldmesh fence, comprising site identification, danger and warning signs.

Security lighting and CCTV is also required at the STSS, and would be installed on either lightning masts or dedicated lighting poles.

A combination of lightning masts and dedicated lighting poles would provide switchyard lighting.

During construction, signage will be displayed in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs, with new signs to be placed on the substation fence.

Amenities building and utilities

Electricity infrastructure, water infrastructure and wastewater infrastructure would utilise the existing services at Kurri STS.

There is no requirement for natural gas. The permanent amenities would utilise the existing services at Kurri STS. Construction amenities will be in accordance with best practice procedures and be constructed to avoid environmentally sensitive areas during the construction of the substations.

Stormwater management

Drainage pits will be distributed across the switchyard. A drainage system concept has been developed that caters for overland surface flows plus perimeter diversions. The yard cable trench system will also be connected to the site drainage.

Access and parking

The existing driveway from Main Road to the substation will be maintained for project.

There is currently provision for a heavy ridge truck to safely park in the driveway on the outside of the boundary fence gate while unlocking gates. There will also be provision to park more than two passenger vehicles and one heavy rigid trucks within the property.

Reasonable area would be provided for maintenance and testing vehicles to access the substation for testing and maintenance purposes.

Landscaping

No specific landscape plan has been prepared.

Land ownership

Kurri STS site is on land already owned by Ausgrid.

Figure 2-6: Kurri STS augmentation

2.2.5 Rothbury Zone Substation (Rothbury ZS)

Augmentation of the Rothbury ZS is required to improve load sharing under contingent conditions. The augmentation would be located at Ausgrid's existing Rothbury Zone Substation. The augmentation would

consist of the installation of an inline 132kV series inductor and switchgear, control and protection upgrades, fencing, lighting, signage, stormwater management, driveways and access routes and landscaping.

Bulk earthworks include cutting and filling and placement of spoil to create an additional 40m by 30m with minimal spoil needing to be removed from site.

Concrete plinths and foundations would be constructed for the augmentation.

Site electronic security upgrades incorporating building swipe card access, perimeter thermal and imaging cameras, would be connected via a dedicated security perimeter pit and duct system.

132kV outdoor switchyard

The extension to the outdoor switchyard would have an approximate footprint of 30m by 40m and comprise of an outdoor inductor, isolation and earth switches, circuit breakers, voltage transformers, overhead powerline support structures, lightning protection mast and other substation equipment.

The earthing system is an essential part of provides a safe working environment within the substation as well as correct protection. The earthing system would be upgraded in the substation design and would extend 1m from the buildings and substation fencing within Ausgrid's property subject to confirmation in the detailed design. The earth rods may be drilled to a depth of approximately 15m, subject to confirmation in the detailed design.

The outdoor switchyard equipment will require control and protection cabling that will be installed in a pit and duct system though out the substation and extending to meet up with other Ausgrid assets within the property.

Control and protection building

The control and protection would be housed in the existing buildings.

Fencing, lighting and signage

The existing two-stage fencing system would be maintained. The system includes the existing boundary rural style fence, and then a high security three-metre-high weldmesh fence, security lighting will be required for the substation. The augmentation would modify the existing high security fence.

Switchyard lighting utilising a combination of lightning masts and dedicated lighting poles would be installed.

During construction, signage will be displayed in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs. New signs will be placed on the substation fence.

Amenities building and utilities

Electricity infrastructure, water infrastructure and wastewater infrastructure would utilise the existing services at Rothbury ZS.

There is no requirement for natural gas.

The permanent amenities would utilise the existing services at Rothbury ZS.

Construction amenities will be in accordance with best practice procedures and be constructed to avoid environmentally sensitive areas during the augmentation of the substation.

Stormwater management

Drainage pits will be distributed across the switchyard. A drainage system would be developed that caters for existing water flows. New culverts would be installed to divert existing waterflows around the substations. The yard cable trench system will also be connected to the site drainage.

Access and parking

The existing driveways from Wine Country Drive would be maintained for project. The driveway access from Old North Road will be maintained with modifications to the access roads within the site. The new driveways would have an approximate footprint of 300m2.

There is currently provision for a heavy ridge truck to park in the driveway on the outside of the boundary fence gate to enable the truck to safely be parked while unlocking gates. There will also be provision to park more than two passenger vehicles and one heavy rigid truck within the property.

Reasonable area would be provided for maintenance and testing vehicles to access the substation for testing and maintenance purposes.

Landscaping

No specific landscape plan has been prepared.

The 132kV outdoor switch yard surface will be ballasted to provide earthing safety to workers inside the substation.

Land ownership

Rothbury ZS site is on land already owned by Ausgrid.

2.2.6 Transgrid's Muswellbrook Bulk Supply Point (BSP)

There is a requirement to install a fibre marshalling kiosk at Transgrid's Muswellbrook Bulk Supply Point. The fibre marshalling kiosk would be located on Transgrid's property near Muswellbrook Bulk Supply Point.

Earthworks include filling and placement of spoil to create a 10m by 10m. The total volume of spoil to be placed onsite would be approximately >100m3.

Concrete plinths retaining walls and foundations would be constructed for the augmentation.

Fibre marshalling kiosk

The fibre marshalling kiosk would be a transportable type building 6m by 6m, and house commutation equipment, and air conditioning.

The kiosk would require control and protection cabling that will be installed in a pit and duct system that would extending to meet up with other Ausgrid and Transgrid assets within the property.

Fencing, lighting and signage

A 3m high chain-link fence would be constructed around the kiosk.

During construction, signage will be displayed in accordance with Occupational, Health and Safety Regulations for construction sites. This will include danger signs and protective equipment signs, with new signs to be placed on the fence.

Amenities building and utilities

Electricity infrastructure would utilise the existing services at the substation.

There is no requirement for permanent water or wastewater.

There is no requirement for natural gas.

There is no requirement for permanent amenities.

Construction amenities will be in accordance with best practice procedures and be constructed to avoid environmentally sensitive areas during the construction of the substations.

Stormwater management

There will be no change to the existing stormwater management.

Access and parking

There will be no change to the existing access and parking.

Landscaping

The area around the kiosk will be reinstated in line with the surrounding area.

Land ownership

The proposed site is located on land owned by Transgrid. Agreements and approvals to locate the infrastructure on this land will be sought from Transgrid.

2.2.7 Remote end control and protection upgrade sites

There is a requirement to upgrade control and protection systems at Ausgrid substations throughout the lower and upper Hunter regions. This work would be within Ausgrid's existing substations. The work does not require any modifications to buildings, fencing, access and parking, utilities and landscaping.

2.2.8 Vegetation clearing

All vegetation within the switching stations and substations footprints would need to be cleared to enable unimpeded access to the site for the bulk excavation equipment. The Sandy Creek STSS would require clearing of up to six hectares of vegetation including the overhead connections. The Antiene STSS site would require clearing approximately 200m2 of vegetation. Kurri STS and Rothbury ZS are within cleared land. Detailed designs will aim to reduce the required clearing to the minimum possible to complete the works.

Impact on flora and fauna is described in section 6.10.

2.2.9 Access points

During construction access to the proposed Substation sites would be from:

- Antiene STSS – via a new access off Hebden Road located to the east of the site. Protection measures such as cattle grates or sections of blue metal would be placed at the entrance to reduce the potential for tracking mud onto the roadways.
- Sandy Creek STSS – via existing access
- Kurri STS – via existing access
- Rothbury zone substation - via existing access
- all other substations - via existing access.

2.2.10 Dilapidation surveys

A dilapidation survey would be undertaken as part of the CEMP to assess any damage that might occur as a result of the proposed works.

2.2.11 Site compounds

The site compound would be and area within the site that is vacant and available for use by the civil contractor during construction. Construction materials, portable buildings containing meal rooms, offices and amenities would most likely be positioned in this location however, other suitable areas may be utilised.

2.2.12 Installation of temporary environmental controls

Temporary environmental controls would be installed during the construction phase to mitigate potential environmental issues identified in section 6. Temporary controls for the proposal to mitigate such issues as noise and sediment would be installed where appropriate. These controls would be removed once construction is complete.

2.2.13 Switching Station and substation construction methodology

Key tasks associated with the construction of the switching stations and substations are outlined in Table 2-5.

Table 2-5 Switching Station and substation construction methodology

Construction stage	Key tasks
Survey work	• identify and mark worksite site extent • preparation of dilapidation study
Site establishment	• establishing construction compounds • establishing temporary construction facilities • constructing an access road and parking areas • installing pre-construction mitigation measures, such erosion, sediment and water quality controls, fencing sensitive areas
Earthworks	• clearing vegetation within the switching station footprint • relocating utilities, services and signage • completion of all earthworks and compaction
Erecting substation buildings and equipment yard	• installation of pits and ducts, hydrant and drainage and other in ground services • construction of piles and foundations • construction of control and protection building • construction of amenities building • construction of outdoor switchyard • construction of fencing, signage and other ancillary equipment
Testing and commissioning	• completion of all testing and commissioning
Demobilisation and restoration	• restoring the site (including general site cleanup and removing site compounds, temporary construction facilities and temporary environmental controls) rehabilitating topsoil and seeding

2.2.14 Resources and equipment

Typical construction equipment and materials are listed below. The construction contractor would determine the type and quantities of equipment/plant based on the adopted work methodology, construction staging and its own resources. The work methodology would be captured in the Construction Environment Management Plan (CEMP) to be prepared for the proposal.

The following equipment may be used on site but is not limited to:

Table 2-6: Construction resources and equipment required

Construction stage	Typical equipment	
Proposed Substations Sandy Creek STSS and Antiene STSS	• site and compound sheds • temporary construction facilities • pollution prevention equipment. • water tankers and pump trucks • skip bins • construction fencing • power generator • traffic control vehicles • mulcher/chipper/vegetation management tools • bulldozers • large rock breaking equipment • large and small excavators • roller compactor • grader • street sweeper vehicles • drill and piling rigs (continuous flight or impact) and augers • cranes various sizes	• elevated work platforms • trucks all sizes including oversize and over mass deliveries. • concrete pumps • portable combustion powered tools (e.g. chainsaw, compactor, demolition saw) • portable electric and battery tools (saws, drills, jack hammers, welders) • hand tools • concrete form work • cable winch • scaffolding • oil handling equipment • SF6 gas handling equipment • gas cutting and heating tools • associated minor construction equipment
Substation upgrades Kurri, Rothbury, Muswellbrook BSP	• site and compound sheds • temporary construction facilities • pollution prevention equipment • water tankers • skip bins • construction fencing • traffic control vehicles • rock breaking equipment • large and small excavators • drill and piling rigs (continuous flight or impact) and augers • cranes various sizes • elevated work platforms • trucks all sizes	• concrete pumps • portable combustion powered tools (e.g. chainsaw, compactor, demolition saw) • portable electric and battery tools (saws, drills, jack hammers, welders) • hand tools • concrete form work • cable winch • scaffolding • SF6 gas handling equipment • gas cutting and heating tools • associated minor construction equipment.

The following table describes some of the materials which may be required for the proposal.

Table 2-7: Typical construction materials

Construction stage	Typical materials	
New substations and substation upgrades	• temporary infrastructure for office and amenities • concrete piles and, footings and pre-cast panel walls • asphalt • various metals for reinforcement and structural steel, balustrades, fencing, signage, Colorbond cladding roof sheeting, fire suppression system, ventilation panels, • doors and windows including hardware • downpipes, guttering and plumbing and drainage supplies • paint • lighting and fittings • wall and floor tiling • vinyl flooring • plasterboard • conduits	• imported soil for engineered fill and topsoil • thermally stabilised backfills • seed, grasses and saplings • sand, aggregates (e.g. blue metal and gravel), crushed rock and other landscape supplies • energy sources such as fuel and oils • SF6 Gas • Sediment and erosion controls and other pollution prevention materials • electrical cables • communication cables • electrical equipment including but not limited, circuit breakers, busbars, voltage transformers and isolators • distribution kiosk • control and protection equipment • communications equipment

2.3 Construction activities

There would be approximately 280 FTE employed during the construction phase. Ongoing maintenance requirements during operation would be undertaken by Ausgrid field personnel and contractors.

2.3.1 Timing and working hours

Subject to assessment and approval, work is expected to commence in mid to late 2025 and would take approximately three years to complete.

Works that would generate audible noise at any sensitive receiver would be undertaken between 7am and 6pm Monday to Friday, and 8am and 1pm on Saturday. Audible works outside these hours may be undertaken where the following requirements are met:

- the works are emergency works, unplanned or unavoidable and the affected residents have been notified as far as reasonably practicable; or
- the works fall into one of the following categories and the affected residents are provided with a notification letter at least five days prior to the works:
    - the delivery of oversized plant or structures that cannot be undertaken during standard hours
    - maintenance and repair of essential public infrastructure that is unable to occur during standard hours
    - public infrastructure works that shorten the length of the construction phase and are supported by the affected community (this would require community consultation)
    - it is a requirement of a regulatory authority (for example, where working along, over or in proximity to regional or state classified roads, where Transport for NSW restrict works during times of low traffic volume, such as, nights or weekends)
    - where there is a demonstrated and justified need to operate outside the recommended standard operating hours and this is supported by Ausgrid's Project Manager, Community Relations Section and Environmental Services.

2.3.2 Extended working hours for remote powerline works

Where powerline works are located away from sensitive receivers, some works would be undertaken outside normal working hours to shorten the length of the project.

The extended work hours will be Saturdays, Sundays and Public Holidays 7am to 6pm. Specific controls around out of hours works are outlined in section 7.4.

2.3.3 Sensitive receivers

Sensitive land uses with the potential to be affected by noise from construction, include:

- residences
- classrooms
- hospitals
- places of worship
- passive recreation areas, such as outdoor grounds used for teaching
- active recreation areas such as parks and sports grounds.

Other land uses that may at times be sensitive to noise from construction, include:

- commercial premises, such as film and television studios, research facilities, entertainment spaces, temporary accommodation, (such as caravan parks and camping grounds), childcare centres, restaurants, office premises and retail spaces, wineries and cafes
- industrial premises.

2.3.4 Operation and maintenance requirements

Once the proposal is constructed, periodic maintenance would be required consisting of regular attendance on site by small work groups utilising light vehicles and small to medium plant. The site would not accommodate staff or contractors on a permanent basis, however access would be undertaken at any time for irregular short duration works, such as to identify defects and hazards such as damaged components, vandalism, degraded access tracks and reduced safety clearances.

No regular collection of waste is required. All waste generated during the operational phase on site would be minimal and managed on an ‘as required’ basis.

The operational system is monitored and controlled remotely. The switching station buildings have been designed to be low maintenance. Block work and high-quality metal/pre-cast concrete panels on the façade have been selected to reduce the maintenance requirements over the life of the switching station.

Access to the overhead powerlines would only be required when inspection, repair or maintenance is required. Repair events would happen on an infrequent basis and would generally require access for trucks and EWPs.

Likely maintenance and operation activities associated with the switching stations/powerlines include but are not limited to:

- vegetation trimming to maintain electrical safety clearances and asset protection zone
- access track maintenance
- fire detection and suppression system inspection and maintenance
- general building, fence and roadway maintenance
- stormwater inspection and maintenance
- regular maintenance of electrical equipment
- fence maintenance and repair
- unplanned fault and breakdown repairs
- insulator and conductor repair
- pole replacement where pole integrity is reduced
- staff attendance for routine inspection, operation and maintenance activities.

3 Stakeholder and community consultation

This section outlines the outcomes of our stakeholder and community engagement activities to date in support of the Review of Environmental Factors (REF) process.

Ausgrid is committed to an engagement process that is proactive, transparent and represents a genuine desire to work with our stakeholders. Ausgrid recognises that a two-way feedback process is the key to understanding the needs and views of stakeholders and communities who are directly and indirectly affected by its operations. Throughout the development of the proposal, Ausgrid has and will continue to engage with affected and interested parties so that project planning is informed by input from stakeholders and communities in line with both regulatory requirements and Ausgrid internal policies and standards.

A Community and Stakeholder Engagement Plan (CSEP) was developed to guide this engagement throughout the project. Our engagement strategy is based on Ausgrid's Engagement Principles, aligned with the guidelines in Ausgrid's Community Engagement Handbook, NS174C Environmental Handbook for Construction and Maintenance, June 2023, the Engagement Framework 2024–2029 Regulatory Proposal, and the International Association for Public Participation (IAP2) standards. These principles are tailored to meet the unique needs and expectations of each community and stakeholder group, ensuring all interactions are conducted with the utmost respect and transparency.

This approach is underpinned by two key components:

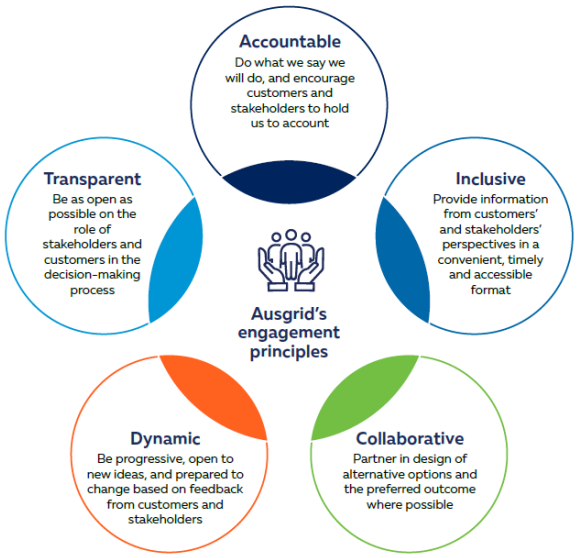


Figure 3-1: Ausgrid's HCC REZ project communication principles

1. Broad public engagement: involving an online webinar, an online survey, and community information sessions for local input.

2. Targeted stakeholder briefings: focusing on informing Project design, community priorities, and other matters.

3.1 Engagement objectives

Ausgrid's engagement objectives are highlighted in the table below:

Table 3-1: Engagement objectives

Objective	Description
Builds trust and confidence	• Allow open dialogue which challenges Ausgrid's approach and practices. • Stakeholders and community have trust in the process and rationale behind decisions, even if all positions are not agreed to. • Stakeholders and community have confidence that Ausgrid has genuinely listened and that decisions are in the long-term interests of the local community. • Stakeholders and community have support for the broader REZ and the benefits it brings.

Objective	Description
Reaches diverse audiences	• Engagement utilises approaches that enable diverse communities and stakeholders to contribute. • Improved understanding of diverse community preferences and how to address them with design planning
Understand local aspirations and preferences	• Engagement identifies community preferences and views on current and future energy services and enables communities to shape our strategy and REZ proposal. • Community views and preferences to impact the SLP and CSEP. • The engagement is designed to capture breadth and depth of views.
Better practice engagement	• Address specific local concerns and make information easily accessible. • Listen to and implement feedback from stakeholders, including the community. • Increase community and stakeholder understanding of renewable energy resources and benefits. • Engage proactively with the community to solve problems and provide valuable opportunities for stakeholders to collaborate on solutions. • Build and maintain strong working relationships with governments. • Build and maintain strong collaboration with First Nations communities.

3.2 Consultation undertaken prior to and during the preparation of the REF

A wide-ranging engagement program was developed prior to and during preparation of the REF to consider the range of stakeholders who may be potentially impacted by or interested in the HCC REZ and the proposal. This included providing opportunities for general stakeholder participation as well as more targeted consultation with government agencies and Aboriginal group representatives.

3.3 Opportunities for engagement

Ausgrid has undertaken a range of activities to ensure community members are aware of the proposed activities and have an opportunity to provide feedback on the project. Table 32 outlines the activities undertaken and the stakeholder group involved.

Table 3-2: Consultation mechanisms

Consultation mechanism	Engaged stakeholder/s	Summary
Drop-in sessions	Landowners/ community	Two community information sessions have been held to provide information regarding HCC REZ in: • Muswellbrook on 1 February 2025 • Singleton on 31 January 2025 Six landowner information sessions have been held; • Muswellbrook on 5 December 2024 and 1 February 2025 • Branxton on 6 December 2024 and 30 January 2025 • Singleton on 7 December 2024 and 31 January 2025

Consultation mechanism	Engaged stakeholder/s	Summary
Pop-up sessions	Community	One pop up session was held in Singleton on 27 February 2025 providing an opportunity for direct interaction and discussion with the Project team, allowing stakeholders to voice concerns in a face-to-face setting.
Webinars	Community	Two webinars were held on 6 February 2025 providing information on the REZ from EnergyCo and Ausgrid. The webinars had 43 attendees.
Emails – Project inbox	Landowners Community Local Government	A dedicated email address (hccrez@ausgrid.com.au) has been created to receive and response to enquiries from the community and interested stakeholders. Over 26 emails have been made engaging stakeholders on the proposals via the Project inbox.
Phone calls and direct emails	Landowners Local Aboriginal Land Council representatives	Over 278 telephone calls and direct emails have been made engaging landowners on the proposal. In addition, a dedicated toll-free telephone number has been created to receive and respond to enquiries from the community and interested stakeholders.
Ausgrid website and Your Say page	All	2316 visits have been made to the HCC REZ Your Say page, with 1130 unique visitors.
Individual meetings/site visits	Landowners	~25 personalised sessions to date with specific landowners to introduce the HCC REZ and address particular concerns.
Survey	Community	An online survey was set up on yoursay.ausgrid.com.au/HCC-REZ to gather community feedback and gauge sentiment towards the HCC REZ network infrastructure upgrades.
Stakeholder briefings	Councils Industry bodies	10 briefings and presentations have been conducted with relevant local councils and key industry stakeholders. The briefings have included presentations and discussions on the need for the HCC REZ, any upcoming planning issues that all parties should be aware of, how stakeholders would like to be engaged, and any other topics of interest.
Media and advertisements	Community	A radio campaign on local stations Power FM and 2NM was used to promote the project and the information sessions in January. Print advertisements were placed for community information sessions held in Muswellbrook and Singleton in January 2025.
Social media	Community	Ausgrid's Facebook page has shared various updates in relation to the proposal. This includes advertising community drop-in sessions and online resources and participation options. The focus of the posts has been to increase general awareness of the proposal and highlight opportunities for stakeholders to participate.

3.4 Statutory consultation

Under the *Electricity Supply Act 1995* (ES Act) Ausgrid is required to undertake 40 days notification to the local council for proposed works (other than routine repairs or maintenance works) so that Council has an opportunity to comment on the proposal. Submissions received under the ES Act from the relevant local council and Ausgrid's response are summarised in Table 10.

Under the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport & Infrastructure SEPP), Ausgrid is the determining authority for electricity developments under Part 5 of the EP&A Act. While the work undertaken does not require council consent, the Transport & Infrastructure SEPP requires Ausgrid to undertake 21 days notification to Council where works may impact upon Council infrastructure, the community or local heritage items. In some instances, other public authorities need to be notified.

Table 3-3: Statutory consultations

Stakeholder	Notification requirement	Summary of engagement	Response
Cessnock City Council	ES Act SEPP T&I	• Notification 12 November 2024 – 40-day Council Notification • Email response received acknowledging receipt. No issues raised	Noted
Singleton Council	ES Act SEPP T&I	• Notification 5 November 2024 40-day Council Notification. Response received on 13 December 2024	Response sent to Council on 6 March 2025
		• Request for coordinated approach between REZ infrastructure and private energy providers	Ausgrid provides design information and guidelines to generator proponents connecting to its network. Ausgrid has a role in certifying designs for compliance to its network standards and once new connection assets are built and commissioned, takes over ownership and maintenance of those assets. It is in Ausgrid's interests to coordinate between the new HCC REZ Network Infrastructure (HCC RNI) and these private proponents. Private proponents must undertake their own planning approvals and environmental assessment processes.
		• Request further details regarding amendments to existing easements, interfacing, distribution relocation, and comms upgrade works	Ausgrid is committed to ongoing consultation

Stakeholder	Notification requirement	Summary of engagement	Response
		• Work hours – Request further details on the predicted impacts to the community and the road network	Further details are provided in section 2.3.1 and 2.3.2 of this REF.
		• Formal application under S138 of the Roads Act will be required for works over regionally classified roads	Ausgrid will submit applications
		• Request copy of environmental assessment for review once completed	Ausgrid REF will be placed on public exhibition
		• Request embedded presence from Ausgrid in Singleton CBD	Ausgrid has an embedded presence within the Singleton LGA with our depot located at 40-44 Magpie St, McDougall's Hill. We will consider other opportunities to locate within the CBD with project offices and/or project information hub alongside other EnergyCo projects such as HTP
		• Request Accommodation and Employment Strategy be developed in close consultation with Council	Ausgrid can confirm accommodation will be the responsibility of individual contractors
		• Additional response 20 December 2024 - All S138 applications submitted by Ausgrid will require a briefing to Council	Ausgrid has arranged a Council briefing
Muswellbrook Shire Council	ES Act SEPP T&I	• Notification 5 November 2024 40-day Council Notification • Response received on 29 January 2025	Response sent to Council on 6 March 2025
		• Requested traffic safety audit of Hebden Road and New England Highway Intersection	Ausgrid has engaged Aurecon to complete requested study
		• Requested Traffic Assessment for Hebden Road	Ausgrid has engaged Aurecon to complete requested study
		• Comment re temporary workers accommodation	No temporary workers camp required
		• Request replacement of trees removed from proposed Antiene STSS site	Ausgrid will work with Council and the Lake Liddell Recreation Area to identify mitigation, including replanting appropriate species

Stakeholder	Notification requirement	Summary of engagement	Response
		• Request visual impact assessment	A Landscape Character and Visual Impact Assessment Report has been completed for the project refer to section 6.14 and Appendix L
Adjoining land occupiers	SEPP T&I	• Notifications delivered between 17-25 February 2025	No responses were received
Subsidence Advisory NSW	MSC Act	• Notification sent	Approval received for Sandy Creek STSS. Reter to Appendix D
Transport for NSW	Roads Act	• Request for consent sent 10 March 2025. Briefing held 14 April 2025	No response received.
Maritime NSW		• Notification sent 14 March 2025	Application to be submitted once detailed design is completed
Biodiversity Conservation Trust	BC Act	• Discussions held with BCT officer. Advice provided that BCT can provide approval once detailed design complete	Noted
NSW DPI	Fisheries Management Act	• Notification sent 14 March 2025	Response received 7 April 2025
		• Please note and refer to section 3.2.2 section 3.3, and chapter 4 of the Policy and Guidelines for Fish Habitat[2]	Addressed in section 6.10
		• Permanent and temporary waterway crossings should be designed and constructed in accordance with Chapters 4.1 and 4.2 of the P&Gs and national guidelines entitled 'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings'[3]	As above
		• Erosion and sediment mitigation devices are to be erected in a manner consistent with current Best Management Practice (i.e. Managing Urban Stormwater: Soils and Construction 4th Edition Landcom, 2004[4]) to prevent entry of sediment into the waterway prior to any earthworks being undertaken	As above
		• There is to be no complete blockage of fish passage during the works	As above

Stakeholder	Notification requirement	Summary of engagement	Response
		• Any material removed from the waterway that is to be temporarily deposited or stockpiled on land is to be located well away from the waterway and to be contained by appropriate erosion and sediment control devices	As above
		• On completion of the works all disturbed soil is to be levelled, smoothed and sown with a mixture of sterile/native grass seeds to encourage rapid revegetation and planted out with native endemic riparian vegetation	As above
		• Machinery is not to enter or work from the waterway unless in accordance with the proposed works	As above
		• Only clean rock (no fines) is to be used during these works	As above
		• Prior to use at the site and/or entry into the waterway, machinery is to be appropriately cleaned degreased and serviced. Spill kits are to be available on site at all times during the works	As above
		• Works are to be undertaken during low flows in the waterway	As above
		• Any rock scour protection at the culvert inlet and outlet must abut the aprons at the same level and the stream bed at the same level to ensure that there is no drop in elevation at the joins. This is to maintain fish passage and minimise impact on the morphology of the creek	As above

Stakeholder	Notification requirement	Summary of engagement	Response
		• Removal of any large woody debris from NSW rivers and streams is listed as a key threatening process under Part 7A of the FM Act. A snag is considered to be any piece of woody debris that is both greater than 3m in length and 300 mm in diameter, or any rock larger than 500 mm in two dimensions, that is located within a waterway (either fresh, estuarine or marine) and is, or would be, wholly or partly submerged as a bank-full flow level of highest astronomical tide level. As a general principle for timber snags, lopping should be considered as the first priority for the management of snags. Where lopping will not solve the immediate problem, re-alignment should be considered as the next possibility, followed by relocation. Removal of a snag is the least desirable option and should only be adopted as a last resort. Proposals for snag removal should be accompanied by a 7-part test and/or Species Impact Statement where proposed in areas that are TYPE 1 aquatic habitats (see Table 1 and section 2.6.9 *Policy and Guidelines for Fish Habitat Conservation and Management* (2013))	As above

Stakeholder	Notification requirement	Summary of engagement	Response
		• Any dewatering should not involve pumping the water directly downstream without adequate treatment to remove suspended solids. • Dewatering must not result in a visible turbid plume or additional [2004], Managing Urban Stormwater: Soils and Construction [4th Edition]). In addition, mitigation controls such as a sediment fence between the sump water release outlet and the waterway are to be employed to ensure that downstream water quality is not adversely affected. • Dewatering at the worksite is to be undertaken with a screen around the pump inlet possessing mesh no greater than 6 mm. Netting and removal of fish should be undertaken at late stages of dewatering regardless of any positive identification of fish. Any fish captured via netting should be released unharmed into adjacent waters downstream of the worksite. • c. a visual inspection of the waterway is to be conducted at all times during dewatering operations to ensure that no visible plumes are generated within the waterway from dewatering operations.	As above
		• DPIRD Fisheries (1800 043 536) and the Environment Protection Authority (EPA) (131 555) are to be notified immediately if any fish kills occur in the vicinity of the works. In this situation, all works other than emergency response procedures are to cease until the issue is rectified and approval is given by DPIRD Fisheries and/or the EPA for the works to proceed.	As above

Refer to Appendix C 0 for a copy of the notice and subsequent correspondence with key stakeholders.

3.5 Community consultation

Ausgrid undertook community consultation around the design for the overall project proposal from January 2025.

Community consultation and community engagement was carried out to understand community views and values so that feedback could be considered in further development of the concept design. Community consultation aimed to seek comments, feedback, ideas, and suggestions on the proposed early concept design features, identify and contact any potentially affected residents and stakeholders, and to build a comprehensive database of any interested and concerned community members.

Ausgrid seeks to balance community feedback with other project considerations in finalising the route/site and construction program.

3.6 Aboriginal community consultation

Input from the Aboriginal community is an essential part of assessing the significance of Aboriginal objects or places that may be impacted by a proposal. The *NSW Aboriginal cultural heritage requirements for proponents 2010*[5] specify that the proponent:

- identify Aboriginal people who may have an interest in a proposal and hold knowledge relevant to determining the cultural significance of Aboriginal objects and/or places
- provide written notification to identified Aboriginal groups/individuals and Heritage NSW and place notice in the local paper to undertake a cultural and archaeological assessment
- provide a draft report to registered stakeholders and the Local Aboriginal Land Council (LALC) for comment
- submit a final report to Heritage NSW for determination, where a permit is required.

Ausgrid will also prepare First Nations engagement strategy and Aboriginal and Torres Strait Islander Participation Plan in accordance with Clause 60 of the National Parks and Wildlife Regulation 2019. This process has formed part of the Aboriginal Cultural Heritage Assessment Report (ACHAR) undertaken to assess the Aboriginal cultural significance of the study area and any Aboriginal objects within it.

In summary the following activities occurred:

- public and direct notices were placed in order to identify Registered Aboriginal Parties (RAP) for the project as required by the Regulation
- several direct notices were sent to agencies including the La Perouse LALC, National Native Title Tribunal, Local Land Services and Heritage NSW.

As a result of notices issued, 24 Registered Aboriginal Parties were identified:

- A1 Indigenous Services
- Amanada Hickey Cultural Services
- Aleira French Trading
- AGA Services
- Cacatua
- Corroboree Aboriginal Corporation
- DFTV Enterprises
- Didge Ngunawal Clan
- Gomeroy Consultants
- Gunjeewong
- Hunter Valley Aboriginal Corporation
- Kevin Duncan
- Konnango Aboriginal Cultural Heritage Services
- Long Gully Cultural Services
- Gomeroi People (Native Title Claim Group)
- Thomas Dahlstrom
- Ungooroo Aboriginal Corporation
- Wallangan
- Upper Hunter Wonnarua Council
- Wanaruah Nation Aboriginal Corporation
- Wanaruah Local Aboriginal Land Council
- Widescope
- Yarrawalk
- Yinarr Cultural Services

Consultation with the RAPs has been conducted in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DEECCW, April 2010) (the ACHCRs). Each RAP was invited to comment on the scope and assessment methodology, and subsequent copy of the draft ACHAR. The RAP responses, where received, were incorporated into the ACHAR recommendations.

Recognising the significance and unique perspectives of First Nations communities, Ausgrid is dedicated to fostering respectful and collaborative relationships with these communities throughout the HCC REZ network infrastructure project. Ausgrid has demonstrated purposeful co-creation within our organisation,

building on existing relationships with Local Aboriginal Land Councils and establishing new relationships with other community groups. This engagement has been led through the Aboriginal First Nations Officer.

We have initially consulted with First Nations communities to ensure their voices are heard and their concerns are addressed. For those who have expressed interest in the project, we will continue to liaise with them, ensuring ongoing dialogue and collaboration. This approach reflects our commitment to respecting First Nations perspectives and integrating their valuable insights into the project's development.

Initial meetings with representatives of various Aboriginal groups focused on sharing project information and supporting Aboriginal cultural heritage assessments. This included participation in cultural heritage surveys and site supervision during preliminary activities.

3.7 Landholder consultation

The project team engaged directly with potentially impacted landholders during the consultation process to help inform the alignment of the proposed transmission powerlines and understand potential impacts of the proposal including associated access tracks. Landholders expressed a range of sentiment towards the proposal and potential impact on their properties.

Table 3-4: Landowner consultation summary

Stakeholder	Summary of engagement
Residential landowners	• Email and letter notifications, scheduled face-to-face sessions (at community locations), follow up phone/video calls and in-person site visits. Ongoing engagement and consultation to be provided, including the development of a tailored Property Management Plan (PMP). • General sentiment has been mostly neutral, with most landowners already having existing easements/electrical infrastructure on their properties. Landowners where the proposed infrastructure will be installed closest to their properties generally sought more detailed information to understand the impacts.
Private landowners	• Email and letter notifications, follow up phone/video calls and in-person site visits. Ongoing engagement and consultation to be provided, along with a PMP. • Sentiment has generally been neutral by private landowners and businesses. Some concerns from developers around potential impact to their development yield.
ARTC	• Initial email notification followed by a video call to discuss proposal and potentially impacted properties. • Significant easements and railway crossings already in place. Key response was to ensure their processes were adopted for the interface management.
Crown Lands	• Initial phone discussion and email communication. • All property matters to be dealt with under the compulsory acquisition pathway. Any matters with Aboriginal Land Claims are to be resolved prior to further interaction with Crown Lands.
TfNSW	• Initial email notification followed by a video call to discuss proposal and potentially impacted properties. • List of properties provided to TfNSW, to be distributed to the appropriate internal contacts to manage access and/or acquisition.
Defence	• Initial email notification followed by video calls to discuss proposal and potentially impacted properties. • Agreed that the appointment of an interface manager was necessary to ensure a single point of contact with Defence, noting the interactions already occurring with Hunter Transmission Project (HTP).

Stakeholder	Summary of engagement
Mine owners/operators	• Initial email notifications followed by video calls to discuss proposal and potentially impacted properties. • Significant easements and electrical infrastructure already in place across the mine site. Key response was to ensure their processes were adopted for the interface management as well as arranging site access or acquisition. On-site management teams to be consulted with if requiring access, while property officer within ownership entity to resolve easement related matters.

3.8 Summary of community and stakeholder issues raised

A summary of the issues raised during community consultation is contained in Table 12.

Table 3-5: Summary of issues raised

Concern	Details	Response
Site access and safety	Ensuring landowner preferences and sensitivities are addressed, such as livestock management, access to powerline easements/corridors, safety of landowners and Ausgrid workers during planning, construction and operation.	Site access will be addressed through Ausgrid following Land and Property protocol for notification of works, as part of the terms and conditions of the property easements/corridors. Ausgrid is committed to working alongside affected landowners and where possible and reasonable will seek to minimise any potential impact to landowners.
Environmental and vegetation impacts	Community and landowners are passionate about protecting the environment, preserving vegetation and natural habitats of wildlife. If trees need to be removed or pruned to make way, several landowners had views on the type of pruning and replacement trees/screening vegetation they would want.	Will be addressed as part of the project design, in consultation with affected landowners. Where trees are required to be removed, Ausgrid will liaise with individual landowners around possible replanting.
Potential health impacts	Concerns have been raised about electric and magnetic fields (EMF) radiation emitted from the powerlines, and the perceived impact of this EMF on the residents of houses within proximity to the lines.	In section 6.3, Ausgrid addresses EMF requirements in detail. This includes the results of significant independent testing which estimates the potential EMF to be well under international requirements.
Potential impact on property value	Landowners expressed concern their property values may be adversely impacted by the powerline easement on their properties.	Easements were existing when the properties were purchased, and land value would have been adjusted accordingly at the time. Ausgrid will continue to work with landowners to resolve any issues about perceived impact to property value.
Confusion between HCC REZ network infrastructure upgrades and the Hunter Transmission Project (HTP)	Landowners and community members expressed negative sentiment towards the HTP – believing this is Ausgrid's project.	Develop communication assets to share with the community and stakeholders, that clearly differentiate the two projects. Identify stakeholders potentially impacted by both Ausgrid's HCC REZ work, and Transgrid's HTP project.

Concern	Details	Response
Aboriginal heritage	The project represents a positive opportunity to work with Indigenous groups to identify, protect and promote Aboriginal Heritage and assist with upskilling younger people through: • a willingness to continue participating and advocating for Country throughout project development (such as site walkthroughs) and construction activities (including excavation) • encouraging Ausgrid to invest in skills development and training opportunities for Aboriginal people • a desire for Ausgrid to promote Aboriginal cultural heritage finds and facilitate visits to cultural sites on private land to foster shared values and enhance heritage preservation • recommending the implementation of culturally appropriate ceremonies of recognition aligned with key project milestones and activities.	Ausgrid is committed to positive term outcomes and relationships for the aboriginal community. We aim to achieve these outcomes through: • Early engagement with local Aboriginal Community as our project is completed, including the First Nations Outcomes team & First Nations Working group. • implementation of first nations targets within our Industry and Aboriginal Participation Plan. • Following the FN Guidelines set by EnergyCo
Consultation	Landowners and stakeholders voiced the need for early and continuous engagement on the project, and coordination between the coordination of various projects.	Ausgrid has developed a thorough REF exhibition consultation action plan that includes several channels to provide feedback.
Employment and suppliers	There was an expression of interest to work on the project, or supply product for the project.	Ausgrid has encouraged local suppliers and businesses to register their interest in helping deliver the HCC REZ. A meet and greet session is planned for May to facilitate introductions between Ausgrid and our proposed contractors, and local and First Nations suppliers.

3.9 Consultation during REF Exhibition

The REF will be exhibited for a minimum six-week period commencing 29 April until 9 June 2025. During this period, written submissions will be accepted for consideration. The REF will be exhibited online at yoursay.ausgrid.com.au/HCCREZ.

Ausgrid will ensure stakeholders and the community are provided with opportunities to view the REF and engage with the Project team. The details of engagement activities will be advised at the commencement of public exhibition through advertising (print and digital), a newsletter delivered to properties, emails to registered parties and information provided on the Ausgrid website.

As a minimum, consultation activities would meet relevant statutory requirements in place at the time.

Community members and stakeholders are invited to submit their feedback on the proposal to Ausgrid by:

- Emailing: HCCREZ@ausgrid.com.au

- Writing to:

  Ausgrid
  HCC REZ Team
  GPO Box 4009
  SYDNEY NSW 2001

During the exhibition period, community members and stakeholders can also direct any enquiries to Ausgrid:

- Enquiries phone line: 1800 955 635 (9am to 4pm, Monday to Friday)

3.10 Response to Submissions Report

Following the REF exhibition, a Response to Submissions Report will be prepared by Ausgrid.

This report will:

- summarise the issues raised in the submissions
- provide responses to each issue raised in the received submissions
- describe any proposed changes to the proposal and assesses the environmental impact of these changes, and
- identify any proposed new or revised environmental mitigation and management measures.

Ausgrid will write to individuals and organisations that have made submissions advising them that their submission will be addressed in the Response to Submissions Report. The Response to Submissions Report will be published on the Ausgrid website.

3.11 Post determination engagement activities

Subject to determination of the proposal, Ausgrid would continue to engage with community and stakeholders in the lead up to, and during the construction of the proposal.

Methods used for engaging and providing proposal information to the community and stakeholders before and during the delivery of the proposal are outlined below. These activities would be carried out by the construction contractor in consultation with Ausgrid.

Table 3-6: Post determination engagement activities

Activity	Purpose
Community liaison team	A dedicated community liaison team will be available during construction. This team will work closely with construction personnel and the community to ensure the community is informed about upcoming works and potential impacts, and to address any construction related issues as quickly as possible
Community emails	To allow communication with the project team and inform the community of progress key milestones or activities including traffic changes
Community information line	Access to the project team via a 1800 number
Letterbox notifications	Notification letters to inform identified sensitive receivers (local residents and businesses) affected by changes to road network and traffic conditions Specific notification requirements for any noisy works outside standard construction hours consistent with NS174C
Project website	Documents uploaded to the website would include public materials related to works

Activity	Purpose
Signposting	Information or directional signage at the location of road tie ins and construction works
Doorknocking	Used to discuss potential impacts of the proposal on highly impacted stakeholders, especially residents and businesses directly impacted by construction activities
Meetings with individuals/groups	Discuss Project activities, including work in progress, upcoming activities and any issues associated. Meetings will also be used to discuss potential impacts and proposed mitigation measures

4 Investigation of alternatives for the proposal

4.1 Assessing alternative options

As part of developing this proposal, consideration was given to alternative sites, designs, construction and management options.

4.2 Do nothing

The first option considered to address the objectives of this proposal is to refrain from undertaking any further development of the network in the area (do nothing).

Benefits of this option would include reduced capital expenditure and no construction or operation impacts as described in this REF.

The consequences of doing nothing would be that new renewable projects would be unable to connect to the Ausgrid network in an efficient and cost-effective manner. And without the proposed upgrades the potential benefits to the network would not be realised.

The 'do nothing' option is not a viable option.

4.3 EnergyCo Tender

Coal-fired power stations currently provide most of NSW's electricity supply as well as the firming capacity that keeps the grid stable during peak periods such as summer heat waves.

Most of these power stations are reaching the end of their life and are due to shut in the next 10 years.

At the same time, our electricity demand is increasing as our population grows and we electrify our vehicles, homes, businesses and industry. This means NSW needs new electricity supply urgently.

The NSW Government has developed the Electricity Infrastructure Roadmap to transition NSW to a cleaner future and ensure this new supply comes from renewable energy.

The Roadmap involves:

- generating electricity (wind and solar) in 5 new Renewable Energy Zones (REZs) across NSW
- improving the reliability of the grid with new storage capacity such as batteries and pumped hydro, and
- building new transmission powerlines such as the HTP to deliver clean energy to consumers.

EnergyCo is responsible for coordinating the delivery of the Roadmap, minimising impacts on people and the environment, and maximising the benefits for regional communities including income and employment opportunities.

EnergyCo have completed a competitive tender the outcome of the tender process was that Ausgrid's solution was selected. An alternative option was proposed by Transgrid, however this solution this was not preferred by EnergyCo.

In December 2024, Ausgrid signed an agreement with EnergyCo to be the preferred network operator to provide an additional 1GW of renewable energy transfer capacity by 2028. Ausgrid would be responsible for the planning, design, construction, financing, operating and maintaining the network infrastructure of the HCC REZ project.

4.4 Overhead powerlines

4.4.1 Build new powerlines in greenfield areas

Construction of new powerlines in a new easement (new greenfield route) from Kurri Kurri to Muswellbrook was not preferred as it would involve significantly more land/easement acquisition, vegetation removal, land disturbance and cost in comparison to the preferred option.

4.4.2 Preferred network option - overbuild powerlines in existing corridors

Construct the new powerlines within existing powerline corridor from Kurri Kurri to Muswellbrook. This option was preferred as it involves significantly less land/easement acquisition, vegetation removal, land disturbance and cost. This option could also be delivered in significantly less time.

4.5 Antiene STSS

4.5.1 Options

Nine potential sites were identified as potentially suitable for the new Antiene STSS site. The sites were in the Liddell and Muscle Creek areas. Criteria used to evaluate the potential sites included:

- substation design (layout, earthing and structural)
- mains design (location of existing services, proposed powerline routes)
- environmental site considerations (flood, heritage, archaeological, noise flora and fauna
- construction (contours, access oversized deliveries), and
- commercial/ease of acquisition (method of acquisition and current ownership (public, corporate, private).

4.5.2 Chosen site / option

Site 7 – Lot/DP 9/250890 was evaluated as significantly more favourable than other identified options. This site is owned by NSW Crown Land and is located on the northern shore of Lake Liddell in Hebden.

Following initial investigations, the site has no significant environmental or geotechnical constraints, a favourable acquisition pathway, and can accommodate the required substation footprint and transmission line interfaces.

The proposed site/route was selected as the preferred option due to a number of benefits, including:

- the proposed infrastructure is predominantly located within existing powerline easements/corridors
- easy access for construction and maintenance
- least commercial and schedule risk to the proposal, and
- determined to be the lowest cost option.

4.6 Sandy Creek STSS

The Sandy Creek STSS site was chosen because it is located on Ausgrid land immediately adjacent to the existing Muswellbrook STS site. No alternative sites were considered.

4.7 Kurri STS

The Kurri STS works involve an extension of the existing substation busbar. No alternative locations were considered.

4.8 Rothbury Zone Substation

The Rothbury Zone Substation works involve an extension of the existing substation. No alternative locations were considered.

5 Environmental legislation

5.1 *Environmental Planning and Assessment Act 1979 (EP&A Act)*

The EP&A Act is the primary legislation regulating land use planning in NSW. It provides the framework for the development of state and local planning instruments which, through their hierarchy, determine the statutory process for environmental impact assessment. This proposal satisfies the definition of an activity under Part 5 of the EP&A Act since it:

- may be carried out without development consent
- is not exempt development
- would be carried out by a determining authority or requires the approval of a determining authority.

Under Part 5 of the EP&A Act, activities require a determining authority to take into account all matters affecting or likely to affect the environment by the proposed activity.

The NSW Government has included Authorised Network Operators (ANOs) as prescribed determining authorities for the purposes of section 5.6 of the Environment Planning and Assessment Act 1979 (EP&A Act) as per the definition of “public authority” under Schedule 1(4) of the Regulation. That prescription allows an ANO to be a Part 5 Determining Authority for Development for the purposes of an electricity transmission or distribution network. As a determining authority, an ANO can assess and self-determine Activities that are not likely to significantly affect the environment and are conducted by or on behalf of the ANO for the purpose of electricity transmission or distribution.

Environmental planning instruments (EPIs) are legal documents that regulate land use and development, including the type of assessment process required. EPI is the generic term used to describe state environmental planning policies (SEPP) and local environmental plans (LEP).

The following EPIs that apply to the proposal area were considered:

- SEPP – (Transport and Infrastructure) 2021
- SEPP (Biodiversity and Conservation) 2021
- Cessnock LEP 2011
- Singleton LEP 2013
- Muswellbrook LEP 2009

5.2 *State Environmental Planning Policy (Transport and Infrastructure) 2021*

Subject to certain exemptions, the T&I SEPP allows development for the purpose of an electricity transmission or distribution network to be carried out by or on behalf of an electricity supply authority or public authority without development consent on any land.

Exclusions to the application of the T&I SEPP include some developments under the State Environmental Planning Policy (Resilience and Hazards) 2021 referring to land that is identified as “coastal wetlands” or “littoral rainforest”. There are no coastal wetlands or littoral rainforests located near the Proposed Activity Area.

Therefore, this proposal falls within the scope of the T&I SEPP as an activity permissible without development consent. Consultation requirements under the T&I SEPP are addressed in section 2.

5.3 *State* Environmental Planning Policy (Planning Systems) 2021

The State Environmental Planning Policy (Planning Systems) 2021 (Planning SEPP) declares certain development to be State Significant Development (SSD) and State Significant Infrastructure (SSI), including Critical SSI. Applications for SSD and SSI must be accompanied by an Environmental Impact Statement (EIS).

The proposal is not a type of development listed in the schedules of the Planning SEPP as being SSD or SSI. The proposal is not likely to significantly affect the environment (refer to section 6) and therefore does not require an EIS.

On this basis, the Planning SEPP is not applicable to the proposal and the proposal can be assessed under Part 5 of the EP&A Act through the operation of the T&I SEPP.

5.4 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected species, populations and communities and heritage items. The approval of the Commonwealth Minister for the Environment is required for the following controlled actions:

- an action that may have a significant impact on matters of national environmental significance (MNES)
- actions that are likely to have a significant impact on the environment of Commonwealth land
- actions taken on a Commonwealth land that are likely to have a significant impact on the environment anywhere.

The EPBC Act lists nine MNES which must be addressed when assessing the impacts of a proposal. An assessment of how the proposal may impact on matters of NES is provided in section 7.

The assessment of the proposal's impact on matters of NES and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Accordingly, the proposal has not been referred to Commonwealth Department of Environment (see Section 6.10 and Appendix I).

5.5 Electricity Supply Act 1995 (ES Act)

The ES Act sets out the licensing regime on Ausgrid and provides a framework for the development and maintenance of electricity infrastructure. The ES Act allows Ausgrid to trim and remove trees, carry out works on public roads and acquire land.

The ES Act also requires that works (other than routine repairs or maintenance works) must not be undertaken without a minimum of 40 days consultation with relevant local councils. Any submission must be considered by Ausgrid. Consultation requirements under the ES Act are addressed in section 4.

5.6 Protection of the Environment Operations Act 1997 (POEO Act)

The POEO Act provides a framework for the licensing of certain activities and is administered by the Environment Protection Authority (EPA).

Schedule 1 of the POEO Act lists activities that require an Environment Protection Licence to operate. The need for a licence would be evaluated and sought prior to the commencement of construction, once a detailed construction method has been finalised. Refer to table 14 for licences that may be required for the proposal. Regardless of whether a licence is required, the following restrictions during construction and operation of the proposal apply:

- works must not pollute the environment
- waste must be classified, handled, transported and disposed appropriately
- environmental incidents involving actual or potential harm to human health or the environment must be reported to EPA.

5.7 Biodiversity Conservation Act 2016 (BC Act)

Section 5.5 of the EP&A Act requires that assessment of an activity must take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity. The Biodiversity and Conservation Act 2016 (BC Act) establishes mechanisms for the management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and consideration an assessment of threatened species impacts in development assessment process amongst other controls.

If an activity potentially affects any flora or fauna species, population or ecological community listed by the BC Act, a test of significance is required. The test of significance, Section 7.3 of the BC Act, determines

whether the Proposed Activity is likely to have a significant impact. It is applied as part of the Biodiversity Offsets Scheme entry requirements and for Part 5 activities under the EP&A Act. If the activity is likely to have a significant impact or will be carried out in a declared area of outstanding biodiversity value, a proponent must either apply the Biodiversity Offsets Scheme (Division 4) or prepare a species impact statement (SIS) (Division 5).

A Seven Part Test of Significance Assessment (refer to Appendix I) was completed for the works and concluded that there would be no significant impact to threatened flora or fauna species, populations or ecological communities listed by the BC Act. This assessment is summarised in section 6.10.

A small section of the route is located within the Hillcrest Offset Area which is regulated by the NSW Biodiversity Conservation Trust. The works required in this area involves the removal of four to five existing poles and associated lines and the construction of one new pole to connect the Antiene STSS into the existing powerline 95U. Approval will be required from BCT once detailed design is complete.

5.8 Other legislative requirements

Additional pieces of environmental legislation that apply to Ausgrid's network area were considered in the preparation of this REF, including:

- *Aboriginal Land Rights Act 1983 (NSW)*
- *Biosecurity Act 2015 (NSW)*
- *Coal Mine Subsidence Compensation Act 2017 No 37*
- *Coastal Management Act 2016 (NSW)*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 2016 (NSW)*
- *Fisheries Management Act 1994 (NSW)*
- *Heritage Act 1977 (NSW)*
- *National Greenhouse and Energy Reporting Act 2007 (NSW)*
- *National Parks and Wildlife Act 1974 (NSW)*
- *Native Title Act 1993 (Commonwealth)*
- *Roads Act 1993 (NSW)*
- *Rural Fires Act 1997 (NSW)*
- *Water Act 1912 (NSW)*
- *Water Management Act 2000 (NSW)*

5.9 Planning approvals process

Ausgrid as an Authorised Network Operator is a prescribed Determining Authority for the purposes of Division 5.1 of the EP&A Act and is defined as a "Public Authority" under Schedule 1 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulations).

This prescription allows Ausgrid to be a Part 5 Determining Authority for Development for the purposes of an electricity transmission or distribution network. As a Determining Authority, Ausgrid can assess and self-determine Activities that are not likely to significantly affect the environment and are conducted by, or on our behalf, for the purpose of electricity transmission or distribution.

In addition, by virtue of Ausgrid's status as Public Authority under the Transport & Infrastructure SEPP, certain activities would be subject to Part 2.3, Division 5 of the Transport & Infrastructure SEPP, amongst other things, which permits Ausgrid to undertake certain Development for the purpose of electricity transmission or distribution on any land without consent.

Ausgrid's access to the "without consent" provisions of the Transport & Infrastructure SEPP and its role as a Determining Authority is accompanied by the duty to consider an activity's impact on the environment. Development under Division 5.1 is referred to as an Activity under the EP&A Act. While Division 5.1 Activities do not require development consent under Part 4 of the Act, consideration of an Activity's environmental impact is required by section 5.5 of the EP&A Act. This is accompanied by section 5.7,

which requires an Environmental Impact Statement (EIS) to be prepared if an Activity is likely to significantly affect the environment.

This REF forms an assessment for the purposes of 5.5 of the EP&A Act and section 171(2) of the Environmental Planning and Assessment Regulation 2021 (NSW) and is undertaken in accordance with the *NSW Code of Practice for Authorised Network Operators*[6] (Planning Code).

Specific licences, permits, approvals and notifications required for the construction, maintenance and operation of the proposal are outlined in Table 14.

Table 5-1: Other key legislative requirements

Legislation	Authority	Requirement	Comment	Responsibility
Aboriginal Land Rights Act 1983	Office of the Registrar	**Approval:** under s. 42, by the Local Aboriginal Land Council (LALC) to consent to property tenure on the land which is subject to the Aboriginal land claim.	Ausgrid is currently in negotiations with both the Local Aboriginal Land Council with an unresolved claim on the site, as well as Crown Lands, regarding potential acquisition of the site.	Ausgrid
Biodiversity Conservation Act 2016	NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW)	**Approval:** under s.7.8 a Species Impact Statement or Biodiversity Development Assessment Report is required for activities likely to significantly affect threatened species or ecological communities, or their habitats. **BCT Approval:** For works in Glencore – Ravensworth - (09_0176) Hillcrest Offset Area.	Ecology Assessment determined no significant impact. See Section 6.10 and Appendix I. Addressed in Section 6.10	Ausgrid / Contractor
Biosecurity Act 2015	NSW Department of Primary Industries (DPI)	**General:** Control of priority weeds on land it occupies to which a weed control order applies, to the extent necessary to prevent the weeds from spreading to adjoining land.	Weed management is addressed in section 6.100.	Ausgrid / Contractor
Coal Mine Subsidence Compensation Act 2017 No 37	Subsidence Advisory NSW	**Approval**: under s.22, to alter or erect improvements, or to subdivide land, within a mine subsidence district	Approval for Sandy Creek STSS was given on 24 March 2025 (see Appendix D). Approvals for the powerline route will be sought in stages as the detailed design is completed.	Ausgrid
Contaminated Land Management Act 1997	NSW Environment Protection Authority (EPA)	**Notification:** under s. 60, by a person whose activities have contaminated land or a landowner whose land has been contaminated is required to notify EPA when they become aware of the contamination.	Ausgrid to address the requirements of s60 of the CLM Act if unexpected contamination is uncovered during construction works.	Ausgrid / Contractor
Crown Land Management Act 2016	Crown Lands	**Approval:** under s. 2.18, by the Minister to grant a 'relevant interest' (i.e. lease, licence, permit, easement or right of way) over a Crown Reserve for new works.	Ausgrid will complete a compulsory acquisition process for the proposed Antiene STSS site.	Ausgrid

Legislation	Authority	Requirement	Comment	Responsibility
Electricity Supply Act 1995	Local Council	**Notification:** under s.45, of 40 days' notice for the proposed electricity works.	Consultation has been undertaken with Cessnock City Council, Singleton Shire Council and Muswellbrook Shire Council (see section 3.4 and Appendix C)3.5.	Ausgrid
Environment Protection and Biodiversity Conservation Act 1999	Commonwealth Department of Climate Change, Energy, the Environment and Water (Commonwealth DCCEEW)	**Approval:** under Part 3, for an action that may have a significant impact on matters of national environmental significance (NES) requires Minister consent. **Approval:** under s. 27A, by the Minister for an action on Commonwealth that has, will have or is likely to have a significant impact on the environment. **Approval:** under s. 47, by the Minister for an action outside Commonwealth land that has, will or is likely to have a significant impact on the environment on Commonwealth land.	Ecology Assessment determined no significant impact (see section 6.10 and Appendix I).	Ausgrid
Environmental Planning and Assessment Regulation 2021	Ausgrid	**Consideration:** under cl. 171, of the factors to take into account concerning the impact on an activity on the environment.	This REF has considered factors under cl. 171 in section 7.1.	Ausgrid
Fisheries Management Act 1994 (FM Act)	DPI	**Consideration:** under s. 220ZZ, by carrying out a test of significance to determine whether the proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats.	Notification sent on 14/3/25. Response received on 7/4/25 (see Section 3.4 and 6.10).	Ausgrid
		Notification: under s. 199, of 28 days' notice to carry out dredging and reclamation work in water land (land permanently or intermittently submerged by water).	NA. May be required for access track works subject to future assessment.	Ausgrid/Contractor
		Permit: under s. 205, to harm any mangroves, seagrass or any other protected marine vegetation.	NA	NA
		Permit: under s. 219, to block the passage of fish.	NA. May be required for access track works subject to future assessment.	Ausgrid/Contractor

Legislation	Authority	Requirement	Comment	Responsibility
Heritage Act 1977	NSW DCCEEW	**Approval:** under s. 60, to impact items listed on the State Heritage Register	NA. No SHR items to be affected.	NA
		Permit: under s. 140, for activities with potential to excavate or disturb a relic.	NA. No relics to be affected.	NA
Local Government Act		**Approval:** under section 68 to install and operate an on-site sewage management system.	Obtain prior to construction of system at Antiene STSS.	Ausgrid/
National Greenhouse and Energy Reporting Act 2007	Clean Energy Regulator (Commonwealth)	**Reporting:** under s. 19 a registered corporation is required to report information on energy production, energy consumption and the amount of greenhouse gas (GHG) emissions for the facilities under their operational control on an annual basis by 31 October following the financial year for which they are reporting.	Reporting will be undertaken by 31 October each year.	Ausgrid/Contractor
National Parks and Wildlife Act 1974	NPWS	**Approval**: under s. 90, to harm or desecrate Aboriginal objects and Aboriginal places.	AHIP to be obtained prior to commencement of works.	Ausgrid
Native Title Act 1993 (Commonwealth)	Commonwealth DCCEEW	**Notification:** under s. 24KA, notify native title holders notice of proposed works (future act) and take into consideration comments received.	There is an active Native Title Claims on the proposed Antiene site.	Ausgrid
Protection of the Environment Operations Act 1999	EPA	**General:** under s. 120, no 'dirty water' discharge into a stormwater drain.	Water management is addressed in section 0.	Ausgrid/Contractor
		Licence: under s. 47, for scheduled development work.	A licence is not required for electricity transmission works.	NA
Roads Act 1993	TfNSW	**Approval:** under s. 138, for road work on a Classified Road.	Ausgrid sent a letter requesting approval under S138 of the Roads Act on 10/3/25	Ausgrid

Legislation	Authority	Requirement	Comment	Responsibility
Rural Fires Act 1997	NSW Rural Fire Service	**Consideration**: under s. 63, public authorities must take all practicable steps to prevent the occurrence and minimise the spread of bush fires on or from land vested in or under its control or management.	Bush fire is addressed in section 6.110.	Ausgrid/Contractor
State Environmental Planning Policy (Transport and Infrastructure) 2021	Local Council	s2.10-2.14 Notification (21 days) - substantial impact on council related infrastructure and local heritage or works in flood liable land that will change flood patterns other than to a minor extent.	Notice was given concurrently with the ES Act notification.	Ausgrid
	OEH	s2.15 Notification (21 days) - works adjacent to land reserved under the *National Parks and Wildlife Act 1974* or development on land in Zone C1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone.	NA	Ausgrid
	TfNSW	s2.15 Notification (21 days) - development comprising a fixed or floating structure in or over navigable waters	Notification sent on 14 March 2025. (see Appendix C).	Ausgrid
	Local Council and adjoining land occupiers	S2.45 Notification (21 days) for works involving new or existing switching stations.	Notification sent on 14-17 February 2025 (see Appendix C).	Ausgrid
	SANSW	s2.15 Notification (21 days) for development on land in a mine subsidence district	Notification provided on 4 March 2025 (see Appendix C).	Ausgrid
Water Act 1912	Environment and Heritage	**Permit**: under s. 113, to extract groundwater via any type of bore, well or excavation.	The need for a permit would be evaluated as part of preparation of the CEMP.	Ausgrid/Contractor
Water Management Act 2000	Environment and Heritage	**Approval:** under s. 91, to carry out a controlled activity in, on or under waterfront land (within 40m of a river, lake, estuary or mean high water mark).	Clause 39A of the Water Management (General) Regulation 2004 provides an exemption from controlled activity approval.	Ausgrid/Contractor

6 Environmental assessment

This section describes the existing environment of the study area and assesses the potential impacts of the proposal during construction and operation. This section also outlines the specific mitigation measures necessary to manage and control environmental impacts which consist of:

- controls detailed in Ausgrid's NS174C Environmental Handbook for Construction and Maintenance, June 2023[7]
- specific mitigation measures described in this REF (to be implemented during the construction and operation phases of the proposal)

Where there is an inconsistency, the proposal specific mitigation measures in this REF would prevail.

6.1 Land use

6.1.1 Existing environment

The proposal is located within the Cessnock, Singleton and Muswellbrook LGAs. The land adjacent to the proposed route comprises residential, rural, mining, defence, parks and recreation, commercial, and conservation.

The proposed powerlines would generally be constructed along Ausgrid's existing 66kV and 132kV powerline corridors, which includes over public land, private land, Commonwealth land and land owned by Ausgrid.

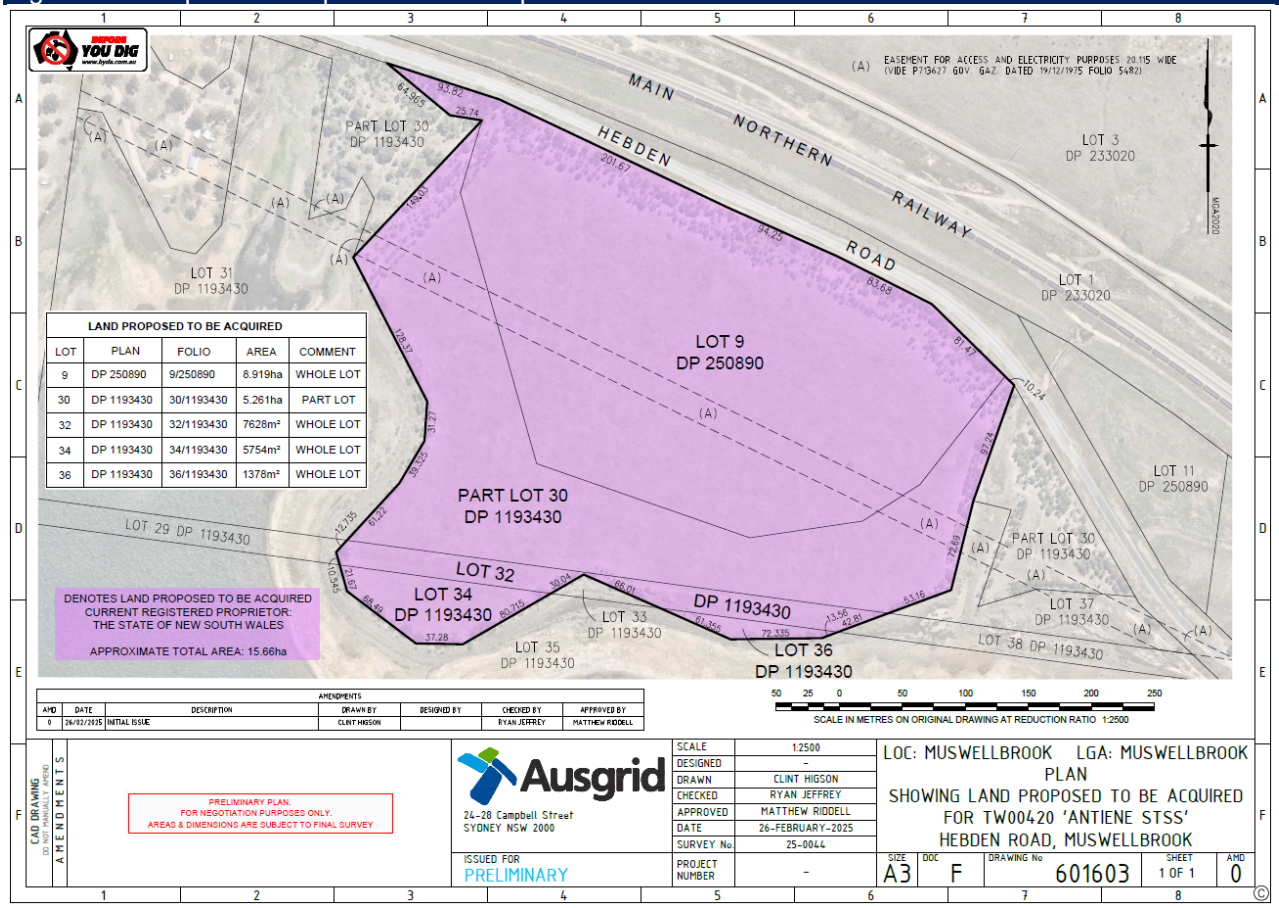
The proposed powerlines are permissible without consent for the entire route.

The two main areas of the proposal where there is currently no existing electrical infrastructure is a new route section at Mt Thorley and the Antiene site.

The new route section located at Mt Thorley is located within land zoned RU1 however the land currently forms part of a defence shooting range. The remainder of the powerline route is in existing powerline easements or corridors located between Kurri and Muswellbrook with widening required in some areas.

The Antiene site is currently zoned as RE1 public recreation. The site is subject to an Aboriginal Land claim and the claimant is Wanaruah Local Aboriginal Land Council. Council has not opposed the proposed development, and the site is surrounded by land zoned SP2 Infrastructure. Sandy Creek and the existing substations are located on Ausgrid Owned Land with existing electrical infrastructure.

Figure 6-1: Proposed land parcels to be acquired for the Antiene STSS site



6.1.2 Impact assessment

The proposal minimises the construction of new powerlines on land that doesn't already host this type of infrastructure, in those cases, new easements would be acquired.

The proposed powerlines would generally be constructed along Ausgrid's existing 66kV and 132kV powerline corridors. In some cases, the route would be realigned (to minimise the unnecessary clearing of vegetation) or widened to accommodate the upgraded powerlines. Equally, there are many cases, where the existing easement would not need altering.

The proposal is consistent with the current surrounding land use. The proposal is also consistent with the objectives of the applicable environmental planning instruments and is permissible without consent. There was no objection by Council in relation to the use of the Antiene site as an STSS.

There is an existing Aboriginal Land claim on the Antiene STSS Site. The claimant is Wanaruah Local Aboriginal Land Council. Before the Compulsory Acquisition Process can commence, Crown Lands requires confirmation that the land claim has been withdrawn, a practise which is commonplace. This will involve a negotiation and subsequent agreement between Ausgrid and Wanaruah Local Aboriginal Land Council, which will be facilitated by NSW Aboriginal Land Council.

Short term impacts on the surrounding land use during the construction phase of the proposal would include increased traffic intensity (section 6.150), noise (section 6.46.4) and visual (section 6.140) impacts.

Once constructed, the proposal would not restrict access to bushland, recreational space, agricultural land, commercial or industrial development, residential development or the water supply catchment. The proposal would have the benefit of facilitating both existing and future surrounding land uses in the region by providing a reliable and sustainable supply from the electricity network.

The proposal would not have a significant impact on existing land uses. The access roads and powerlines would not form a physical barrier as people, animals and machinery would continue to be able to move along and across the proposed route. Padlocked gates would be installed where the route traverses private property boundaries and Ausgrid would hold keys to these locks. However, Ausgrid padlocks could be installed in series with landowners padlocks to enable shared access to the land where required.

6.1.3 Environmental mitigation measures

Mitigation measures for all phases of the proposal are summarised below.

Table 6-1: Land use mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Consult with affected stakeholders about the proposal. Refer to section 3.	✓	✓	
Provide information via a free call 1800 number, email address and Ausgrid's website for people wanting more information	✓	✓	

6.2 Climate change

6.2.1 Existing environment

Climate change describes both changed average climatic conditions, such as increased temperature and lower average rainfall, as well as changes in the patterns of extreme events, including increased frequency and intensity of storms.

Greenhouse gas (GHG) emissions are defined by the GHG Protocol and international standards as scope 1 (direct emissions), scope 2 (indirect emissions from the consumption of purchased energy) and scope 3 (other indirect emissions).

The proposal is not located in low-lying areas near coastal locations.

6.2.2 Impact assessment

A risk assessment of predicted climate change impacts on power infrastructure and the assets and services that they provide, considered the following climate change scenarios:

- higher average temperatures
- more frequent occurrence of extreme temperatures (days over 35°C)
- lower average rainfall
- more intense extreme rainfall events
- increased lightning strikes
- higher evapo-transpiration
- higher sea level and storm surge events
- more frequent extreme fire danger days.

Climate change adaptation

The risk assessment showed that the key risks to power infrastructure would include extreme events, accelerated degradation of materials and structures, and resource demand pressures. In relation to the proposal, it is expected that the likely impact of extreme weather events would be low. This is because the switchroom buildings would be enclosed which would protect the switching station equipment from extreme events. Other protective elements would include lightning rods, protection, and earth grids.

Similarly, impacts related to the accelerated degradation of materials and structures would be low, as any exposed equipment and structures would be covered by specified epoxy paint and/or be of galvanised steel to reduce or eliminate accelerated degradation.

Current climate predictions anticipate that extreme heatwaves would increase in frequency and intensity, potentially generating an increase in electricity demand for air conditioning at the same time as the efficiency of the transmission is reduced by up to 30% due to high temperatures. This increased demand has the potential to place pressure on the resource supplied and increase capacity constraints and maintenance requirements of the feeder(s) / powerline(s) / switching stations. However, the new feeder(s)/powerline(s)/switching station would increase the reliability of the electricity supply within the region. Therefore, the new supply infrastructure would have a greater ability to withstand the increased pressure on the supply network.

Greenhouse gas emissions

Scope 1 emissions are direct GHG emissions produced from sources within the boundary of the proposal and as a result of the proposal's activities. Emissions arising from the construction of the proposal include those from vehicles and machinery used for materials delivery and handling, excavation, rehabilitation works, waste transport and general construction activities. The major contributor would be the consumption of fuel by transport vehicles.

The control buildings would house gas insulated switchgear (GIS) technology which utilises sulphur hexafluoride (SF6), a known GHG. SF6 was selected due to its excellent insulation properties and more compact design that requires fewer raw materials. The quantitative contribution of SF6 to global warming is below 0.1% with respect to the other manmade GHGs.

There is the potential for unintentional discharge of SF6 during maintenance of the GIS. The total amount of SF6 within the switching station would be approximately 540 kilograms (kg), however the largest compartment would contain approximately 74 kg. If losses were to occur it is likely that they would occur from one compartment only and not all 540 kg would be lost.

During operation, all electrical equipment would be monitored and maintained to reduce the likelihood of any leaks and to maximise the operating efficiency of the switching station. This would include the installation of gas density meters on each compartment to detect a drop in pressure. These meters will send an alarm if the pressure drops below a preset level which would allow action to be taken to rectify the leak. This (and handling of SF6 in accordance with appropriate guidelines) would ensure that losses of SF6 to the atmosphere are minimised, which would reduce its potential impact on atmospheric GHG concentrations.

Ausgrid's assets are subject to regular maintenance and monitoring to ensure all equipment is operating effectively. Minimal staff would be required to attend the asset thus limiting associated vehicle use and scope 1 emissions.

Under the *National Greenhouse and Energy Reporting Act 2007*, Ausgrid is required to report information on energy production, energy consumption and the amount of greenhouse gas emissions for the facilities under their operational control on an annual basis by 31 October following the financial year for which they are reporting.

Scope 2 emissions are GHG emissions generated from the production of electricity, heat or steam that a proposal consumes, but which is physically produced by another facility. These emissions would arise primarily from the consumption of electricity through network losses when the proposal is in operation. Electrical losses are an inevitable consequence of the transmission of electricity through the transmission and distribution network, and the energy consumed in these losses must be generated by power stations. This energy is sourced from the Australian electricity market, which is primarily supplied from coal-fired power stations that emit GHGs.

A key driver for this proposal is to facilitate NSW's transition to clean energy and, as such, the proposal is facilitating a positive impact on the environment.

Scope 3 indirect emissions for the proposal include energy consumed by all the processes associated with the production of materials and components. This includes mining and manufacturing of materials and equipment, as well as the transport of materials. These emissions are complex to quantify, however where practicable, this proposal has selected materials and design techniques with lower embodied energy, carbon and water.

Sea level rise

Under clause 171(2)(p) of the EP&A Regulation, Ausgrid is required to consider any impact on coastal processes and hazards, including those under projected climate change conditions. The NSW Government acknowledges that increased sea levels will have significant medium to long-term social, economic and environmental impacts for development located in the coastal zone. However, the proposal is not within the coastal zone.

6.2.3 Environmental mitigation measures

Climate change mitigation and adaptation measures for the proposal are summarised below Table 6-2.

Table 6-2: Climate change mitigation measures

Mitigation measures	Design	Construction	Operation
Comply with section 7 of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
Report information on energy production, energy consumption and the amount of greenhouse gas emissions to the Clean Energy Regulator for the facilities on an annual basis by 31 October the following year.			✓
The climatic conditions to which the plant, equipment and the major switching station shall be exposed are detailed in: • AS/NZS 1170 Structural design actions • AS 2067 Switching stations and high voltage installations exceeding 1kV A.C. • Bureau of Meteorology Climate maps for the “Annual Rainfall”, “Minimum Temperatures” and “Maximum Temperatures” in New South Wales • Engineers Australia “Australian Rainfall and Runoff – A Guide to Flood Estimation”[8] • NS185 Major Switching stations Building Design Standard • NS186 Major Switching stations Civil Works Design Standard	✓		
Materials sourced from local suppliers where cost effective and no impact on engineering properties.	✓	✓	
Recycled materials considered and used where cost effective and no impact on engineering properties.	✓	✓	
All plant and equipment would be turned off when not in use.		✓	✓

6.3 Electric and magnetic fields

6.3.1 Existing environment

Electric and magnetic fields (EMF) are part of the natural environment and are present in the atmosphere and static magnetic fields are created by the Earth’s core. EMF is also produced wherever electricity or electrical equipment is in use. Powerlines, electrical wiring, household appliances and electrical equipment all produce EMF. Power-frequency EMF (also known as extremely low frequency or ELF EMF) have a frequency of 50 hertz (Hz).

Electric fields are related to the voltage (volts) and magnetic fields are related to the current (amps).

Both electric and magnetic fields are strongest close to their source, and their strength diminishes rapidly as we move away from the source. While electric fields are shielded by most objects, including trees, buildings and human skin, this is not the case for magnetic fields.

As part of the Health Portfolio, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency charged with the responsibility for protecting the health and safety of people, and the environment, from EMF. In terms of exposure within the home, ARPANSA advise that:

> *"Magnetic fields within homes can vary at different locations and also over time. The actual strength of the field at a given location depends upon the number and kinds of sources and their distance from the location of measurement. Typical values measured in areas away from electrical appliances are of the order of 0.1 - 2 mG [milligauss]."*

Typical magnetic field measurements and ranges associated with various appliances and powerlines are shown in Table 6-3.

Table 6-3: Magnetic field measurements and ranges associated with various appliances and feeders

Magnetic field source	Range of measurement (in mG)
Electric stove	2 - 30
Computer screen	2 - 20
Television screen	0.2 - 2
Electric blanket	5 - 30
Hairdryer	10 - 70
Refrigerator	2 - 5
Electric toaster	2 - 10
Electric kettle	2 - 10
Electric fan	0.2 - 2
Street distribution lines (directly underneath)	2 - 20
HV Overhead Lines (directly underneath)	10 - 200

Source: ARPANSA, Measuring magnetic fields.

6.3.2 Impact assessment

The question of EMF and health has been the subject of a significant amount of research since the 1970s. This large body of scientific research includes both epidemiological (population) and laboratory (at both a cellular and an organism level) studies.

Research into EMF and health is a complex area involving many disciplines, from biology, physics and chemistry to medicine, biophysics and epidemiology.

EMF at levels well above the recognised international exposure guidelines can cause both synaptic effects perceived as magneto-phosphenes in the sensitive retinal tissue (magnetic fields) and micro-shocks (electric fields). The exposure guidelines are in place to protect against these biological effects.

No single study considered in isolation will provide a meaningful answer to the question of whether EMF can cause or contribute to adverse health effects. To make an informed conclusion from all of the research, it is necessary to consider the science in its totality. Over the years, governments and regulatory agencies around the world have commissioned many independent scientific review panels to provide such overall assessments.

As part of the Health and Aging Portfolio, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency charged with the responsibility for protecting the health and safety of people, and the environment, from EMF.

ARPANSA advises that:

> *"The scientific evidence does not establish that exposure to the electric and magnetic fields found around the home, the office or near powerlines causes health effects."*

These findings are consistent with the views of other credible public health authorities. For example, the World Health Organization (WHO) advises that:

> *"Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields."*

EMF health guidelines

The two internationally recognised exposure guidelines are established by the International Commission on Non-Ionising Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE). The current guidelines are:

- ICNIRP, 2010, Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)[9]
- IEEE, 2019, C95.1, Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz[10].

ARPANSA's advice[11] is that "the ICNIRP ELF guidelines are consistent with ARPANSA's understanding of the scientific basis for the protection of people from exposure to ELF EMF."

The following table summarises the magnetic field exposure Reference Levels for IEEE and ICNIRP.

Table 6-4: Magnetic field Reference Levels at 50Hz for IEEE and ICNIRP

	IEEE 2002	ICNIRP 2010
GENERAL PUBLIC		
Exposure general	Not specified	200 μT*
Exposure to head and torso	904 μT	Not specified
Exposure to arms and legs	75,800 μT	Not specified
OCCUPATIONAL		
Exposure general	Not specified	1,000 uT*
Exposure to head and torso	2,710 μT	Not specified
Exposure to arms and legs	75,800 μT	Not specified

Prudent avoidance

Since the late 1980s, many reviews of the scientific literature have been published by authoritative bodies. There have also been a number of inquiries such as those by Sir Harry Gibbs in NSW[12] and Professor Hedley Peach in Victoria[13]. These reviews and inquiries have consistently found that:

- adverse health effects have not been established
- the possibility cannot be ruled out
- if there is a risk, it is more likely to be associated with the magnetic field than the electric field.

Both Sir Harry Gibbs and Professor Peach recommended a policy of prudent avoidance, which Sir Harry Gibbs described in the following terms:

> "…. [doing] whatever can be done without undue inconvenience and at modest expense to avert the possible risk …"

Prudent avoidance does not mean there is an established risk that needs to be avoided. It means that if there is uncertainty, then there are certain types of avoidance (no cost/very low-cost measures) that could be prudent. These recommendations have been adopted by the Energy Networks Association and other electricity transmission and distribution businesses.

Energy Network Association position

The Energy Networks Association (ENA) is the peak national body for Australia's energy networks. ENA represents gas and electricity distribution, and electricity transmission businesses in Australia on a range of national energy policy issues.

ENA is committed to taking a leadership role on relevant environmental issues including power frequency EMF. ENA and its members are committed to the health and safety of the community, including their own employees.

The ENA's position is that adverse health effects from EMF have not been established based on findings of science reviews conducted by credible authorities. ENA recognises that that some members of the public nonetheless continue to have concerns about EMF and is committed to addressing these by the implementation of appropriate policies and practices.

ENA is committed to a responsible resolution of the issue where government, the community and the electricity supply industry have reached public policy consensus consistent with the science.

Policy statement:

- ENA recommends to its members that they design and operate their electricity generation, transmission and distribution systems in compliance with recognised international EMF exposure guidelines and to continue following an approach consistent with the concept of prudent avoidance.
- ENA will closely monitor engineering and scientific research, including reviews by scientific panels, policy and exposure guideline developments, and overseas policy development, especially with regard to the precautionary approach.
- ENA will communicate with all stakeholders including assisting its members in conducting community and employee education programs, distributing information material including newsletters, brochures, booklets and the like, liaising with the media and responding to enquiries from members of the public.
- ENA will cooperate with any bodies established by governments in Australia to investigate and report about power frequency electric and magnetic fields.

Magnetic field calculations

A specialist EMF assessment was undertaken for the proposal (Refer to Appendix E). There are various permutations of geometries and combinations of circuits along the proposed route. This EMF assessment has focused on the most common permutations - 132kV double circuit; 132kV double circuit with parallel 132kV single circuit; and 132kV double circuit with a 66 kV circuit underbuilt. Five representative sections along the route were modelled (see figures x-y below showing the location and construction at each section.

Figure 6-2: Project overview

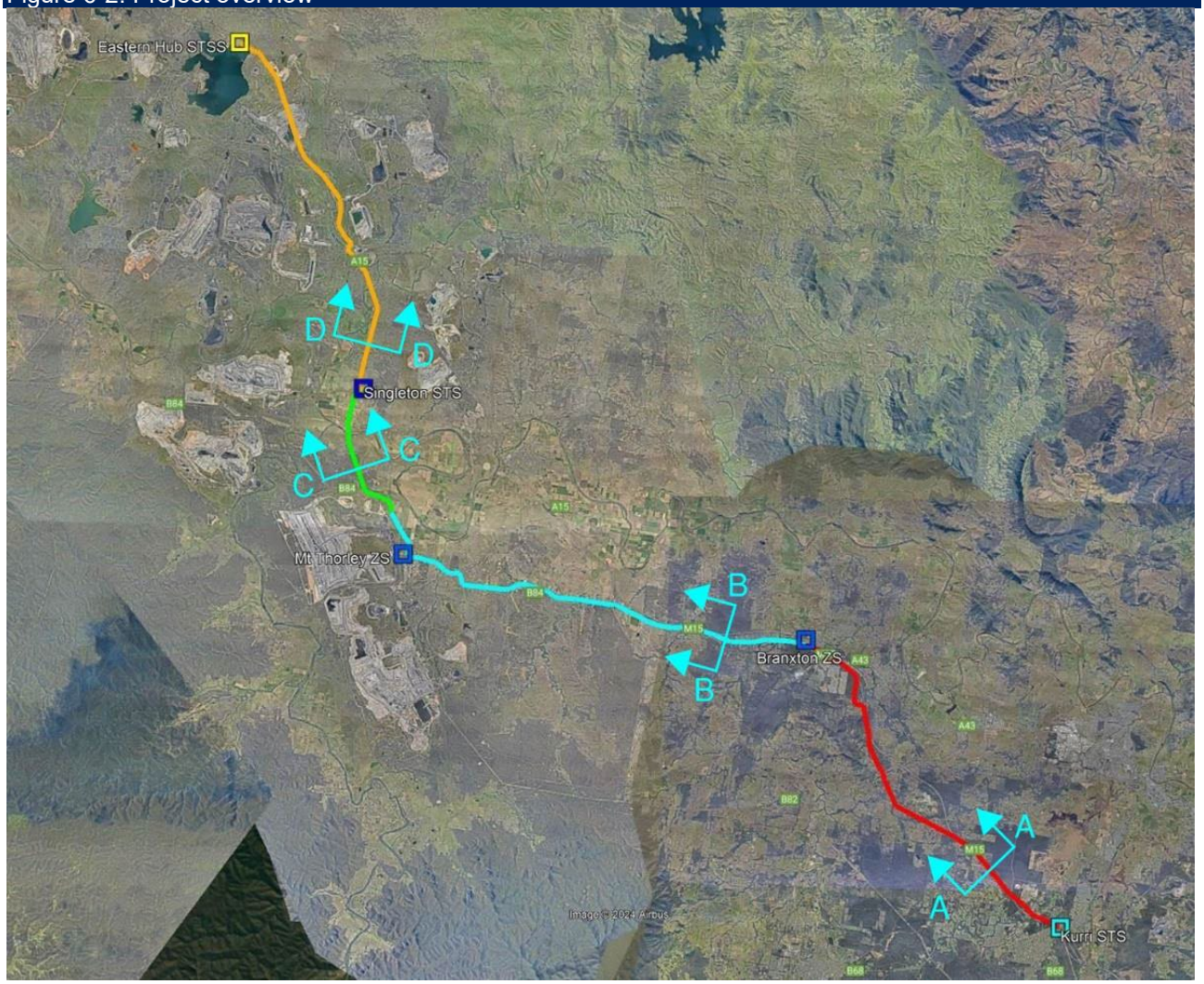


Figure 6-3: Kurri STS to Branxton Tee powerlines (Section A-A)

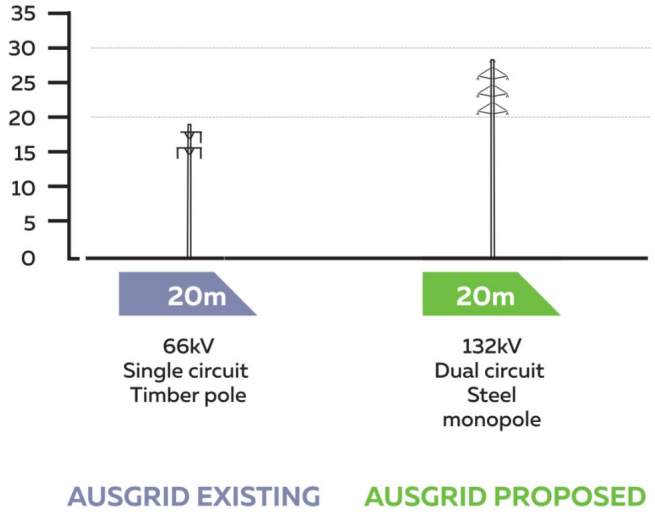


Figure 6-4: Branxton TEE to Mt Thorley ZS powerlines (Section B-B)

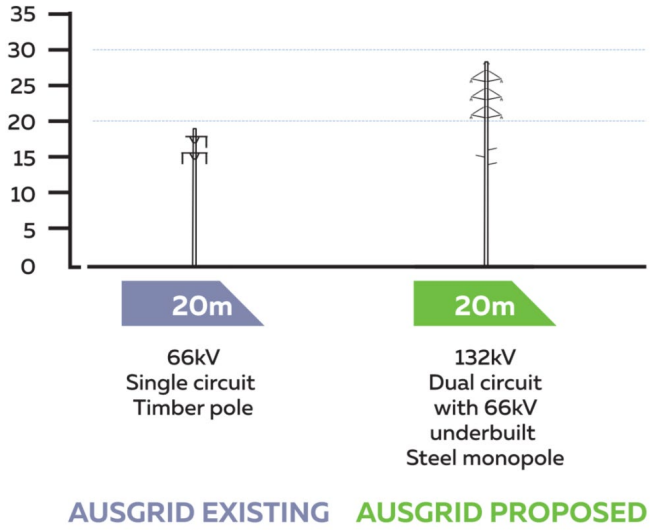
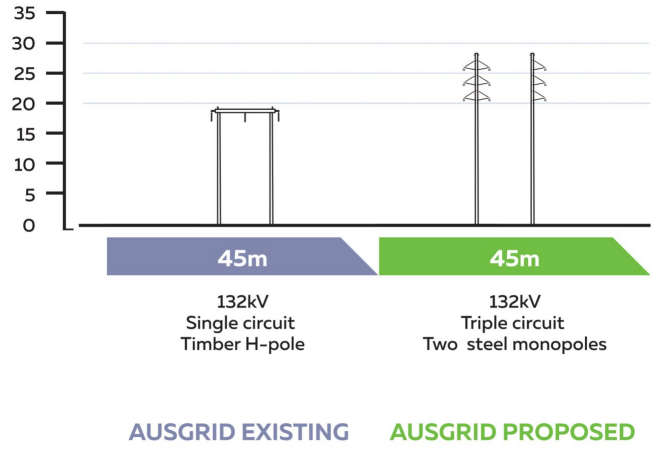


Figure 6-5: Mt Thorley ZS to Singleton STS (Section C-C); Singleton STS to Antiene Sub Transmission Substation (STSS) SS (Section D-D); Sandy Creek STSS to Muswellbrook BSP (Section E-E)



Magnetic fields

The contribution of the proposed transmission powerlines to the magnetic field environment is predicted to be well within the ICNIRP Guideline Reference Level of 2,000 mG. Relevant magnetic field values are summarised in Table 6-5.

Table 6-5: Summary of magnetic field results

Tx. Line Section	Scenario	Directly under the transmission lines				At the easement edge			
		For average load		For peak load		For average load		For peak load	
		(mG)	% of ICNIRP Guideline Ref. Level	(mG)	% of ICNIRP Guideline Ref. Level	(mG)	% of ICNIRP Guideline Ref. Level	(mG)	% of ICNIRP Guideline Ref. Level
Section A - A	Existing	< 1	< 0.05%	12	0.6%	< 1	< 0.05%	4	0.2%
	Proposed	33	1.7%	124	6.2%	10	0.5%	37	1.9%

Tx. Line Section	Scenario	Directly under the transmission lines				At the easement edge			
Section B - B	Existing	< 1	< 0.05%	12	0.6%	< 1	< 0.05%	4	0.2%
	Proposed	8	0.4%	34	1.7%	5	0.3%	18	0.9%
Section C - C	Existing	< 1	< 0.05%	83	4.2%	< 1	< 0.05%	9	0.5%
	Proposed	26	1.3%	152	7.6%	5	0.3%	24	1.2%
Section D - D	Existing	69	3.5%	159	8.0%	8	0.4%	19	1%
	Proposed	32	1.6%	96	4.8%	7	0.4%	18	0.9%
Section E - E	Existing	61	3.0%	130	6.5%	7	0.4%	15	0.8%
	Proposed	21	1.1%	146	7.3%	1.2	0.1%	22	1.1%

As shown above, the predicted maximum magnetic fields for the proposed transmission lines are less than 7.6% of the ICNIRP Guideline Reference Level directly under the transmission lines and less than 1.9% at the easement edges.

Electric fields

From the results it is evident that the contribution of the existing and proposed 66kV and 132kV transmission lines to the electric field environment is predicted to be well within the ICNIRP Guideline Reference Level of 5 kV/m. Relevant electric field values are shown below.

Table 6-6: Summary of electric field results

Tx. Line Section	Scenario	Directly under the powerline		At the easement edge	
		(kV/m)	% of ICNIRP Guideline Ref. Level	(kV/m)	% of ICNIRP Guideline Ref. Level
Section A - A	Existing	0.6	7%	0.3	3%
	Proposed	1.7	18%	0.5	5%
Section B - B	Existing	0.6	7%	0.3	3%
	Proposed	0.3	4%	0.2	3%
Section C - C	Existing	1.9	21%	0.2	3%
	Proposed	1.7	19%	0.1	1%
Section D - D	Existing	2.0	22%	0.2	3%
	Proposed	1.7	19%	0.1	1%
Section E - E	Existing	2.0	22%	0.2	3%
	Proposed	1.7	18%	0.1	1%

As shown above, the calculated maximum electric field values are less than 30% of the ICNIRP Guideline Reference Level directly under the powerlines and less than 5% at the easement edges.

EMF mitigation measures for the proposal are summarised in the following Table 6-7.

Table 6-7: EMF mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Implement optimal phasing of the dual circuit overhead sections to minimise the magnetic field profile.	✓	✓	
Refer all EMF related enquiries to Ausgrid's Environmental Services on (02) 9394 6659	✓		✓

6.4 Noise and vibration

6.4.1 Existing environment

Day Design Consulting Acoustical Engineers were engaged by Ausgrid to undertake an Environmental Noise Impact Assessment for the HCC REZ network infrastructure project. The assessment comprised Construction and Operational Impact Assessments for Sandy Creek STSS, Antiene STSS and Kurri STS along with a construction Noise and Vibration Management Plan for the proposed powerlines. Due to the distance to the nearest sensitive receptors and the lack of noise generating equipment being installed at Rothbury Zone Substation upgrade no assessment was deemed necessary.

Existing ambient noise levels were measured at the four STS/STSS sites. Project noise trigger levels were developed for operation and noise management levels were developed for construction using the measured ambient noise levels. Future operational noise levels were then predicted using iNoise V2024.1 industrial noise prediction modelling software. Inputs for operations included the proposed equipment to be installed and operated at each site. Inputs for construction included the types of plant and machinery likely to be used to complete construction works at each site. The result of the modelling is presented below.

6.4.2 Impact assessment

Antiene STSS

Background noise monitoring locations are shown in Figure 6-8. Operational noise predictions are outlined in Table 6-8: Antiene STSS operation – predicted Leq 15 minute noise levels at the receivers. Construction noise predictions are outlined in Table 6-9: Antiene STSS construction – calculated Leq 15 minute noise levels (without noise controls) – R1 to R5.

Figure 6-6 Antiene location plan

Table 6-8: Antiene STSS operation – predicted L_{eq} 15 minute noise levels at the receivers

Description	Predicted L_{eq} noise level (dBA) at receptor locations				
	R1	R2	R3	R4	R5
Day – 7am – 6pm					
Predicted noise level	7	12	17	15	14
Acceptable noise limit	40	40	40	58	40
Complies	Yes	Yes	Yes	Yes	Yes
Evening – 6pm – 10pm					
Predicted noise level	7	12	17	15	14
Acceptable noise limit	38	38	38	53	38
Complies	Yes	Yes	Yes	Yes	Yes
Night – 10pm – 7am					
Predicted noise level	12	17	22	20	19
Acceptable noise limit	37	37	37	48	37
Complies	Yes	Yes	Yes	Yes	Yes

Table 6-9: Antiene STSS construction – calculated L_{eq} 15 minute noise levels (without noise controls) – R1 to R5

Description	Calculated noise levels (dBA)				
	R1	R2	R3	R4	R5
Stage 1 works					

Description	Calculated noise levels (dBA)				
Typical works	44-45	48-52	48-57	46-54	45-53
Noise management level	45	45	45	60	45
Exceedance	Nil	Yes (+7db)	Yes (+12db)	Nil	Yes (+8db)
Stage 2 works					
Typical works	46-47	49-54	50-59	47-56	46-55
Noise management level	45	45	45	60	45
Exceedance	Yes (+2db)	Yes (+9db)	Yes (+14db)	Nil	Yes (+10db)

Sandy Creek STSS

Background noise monitoring locations are shown in Figure 6-7: Sandy Creek Location Plan. Operational noise predictions are outlined in Table 6-10: Sandy Creek STSS operation – Predicted L_{eq} 15 minute noise levels at the Construction noise predictions are outlined in Table 25.

Figure 6-7:Sandy Creek Location Plan

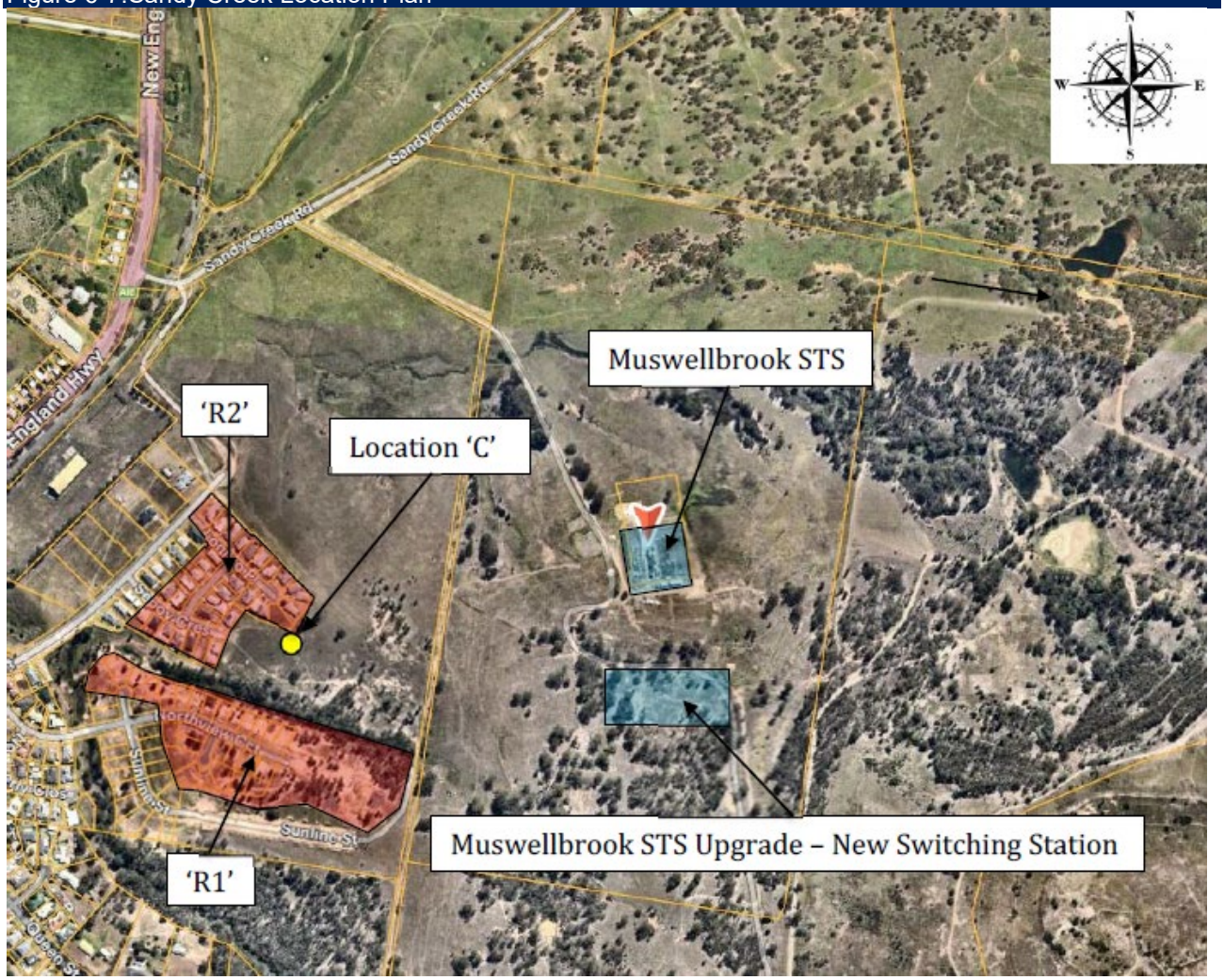


Table 6-10: Sandy Creek STSS operation – Predicted L_{eq} 15 minute noise levels at the receivers		
Description	Predicted L_{eq} noise level (dBA) at receptor locations	
	R1	R2
Day – 7am – 6pm		
Predicted noise level	6	7
Acceptable noise limit	46	46
Complies	Yes	Yes
Evening – 6pm – 10pm		
Predicted noise level	6	7
Acceptable noise limit	43	43
Complies	Yes	Yes
Night – 10pm – 7am		
Predicted noise level	11	12
Acceptable noise limit	38	38
Complies	Yes	Yes

Table 6-11: Sandy Creek STSS construction – calculated L_{eq} 15 minute noise levels (without noise controls) – R1 to R5		
Description	Predicted L_{eq} noise level (dBA) at receptor locations	
	R1	R2
Stage 1 works		
Typical works	44-49	46-49
Noise management level	51	51
Exceedance	Nil	Nil
Stage 2 works		
Typical works	45-50	48-50
Noise management level	51	51
Exceedance	Nil	Nil

Kurri STS

Background noise monitoring locations are shown in Figure 6-8: Kurri location plan below. Operational noise predictions are outlined in Table 6-12:Kurri STS operation – predicted L_{eq} 15 minute noise levels at the receivers. Construction noise predictions are outlined in Table 6-13:Kurri STS construction – calculated L_{eq} 15 minute noise levels (without noise controls) – R1 to R5.

Figure 6-8: Kurri location plan

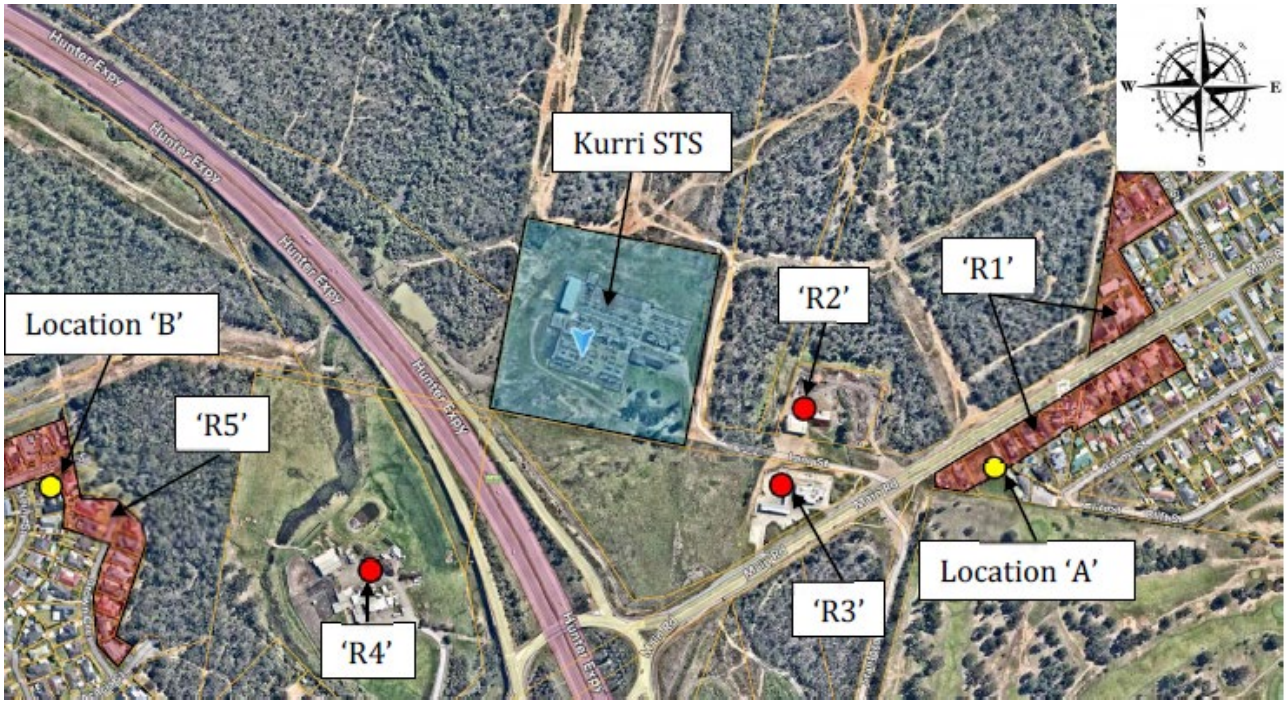


Table 6-12: Kurri STS operation – predicted L_{eq} 15 minute noise levels at the receivers

Description	Predicted L_{eq} noise level (dBA) at receptor locations				
	R1	R2	R3	R4	R5
Day – 7am – 6pm					
Predicted noise level	4	12	10	10	3
Acceptable noise limit	53	68	63	68	45
Complies	Yes	Yes	Yes	Yes	Yes
Evening – 6pm – 10pm					
Predicted noise level	4	12	10	10	3
Acceptable noise limit	45	68	63	68	45
Complies	Yes	Yes	Yes	Yes	Yes
Night – 10pm – 7am					
Predicted noise level	9	17	15	15	8
Acceptable noise limit	44	68	63	68	38
Complies	Yes	Yes	Yes	Yes	Yes

Table 6-13: Kurri STS construction – calculated L_{eq} 15 minute noise levels (without noise controls) – R1 to R5

Description	Calculated noise levels (dBA)				
	R1	R2	R3	R4	R5
Stage 1 works					
Typical works	52-52	59-61	59-59	59-59	51-51
Noise management level	63	75	70	75	50
Exceedance	Nil	Nil	Nil	Nil	Yes (+1db)
Stage 2 works					

Description	Calculated noise levels (dBA)				
Typical works	52-56	65-65	65-65	65-66	59-59
Noise management level	63	75	70	75	50
Exceedance	Nil	Nil	Nil	Nil	Yes (+9db)

Operational noise predictions indicate that all substation/switching station sites will be within Project Noise Trigger Levels. The predicted levels of noise from construction activities may at times be in excess of the noise management levels for the Antiene STSS and Kurri STS sites. To minimise the noise impact from all excavation and construction activities, Day Design recommends a number of engineering and management noise controls be implemented during the construction works at Antiene and Kurri. These measures are outlined in Section 7.4.3.

Rothbury Zone

Desktop assessment of likely construction noise for works at Rothbury Zone indicate that works are unlikely to exceed criteria as defined by ICNGs. Given the work scope and duration, the same mitigation measures will be applied to the Rothbury Zone works as the other substation sites.

Powerline construction

Works for the powerlines would include some out of hours works on Saturdays, Sundays and Public Holidays from 7am to 6pm. The scope of works undertaken out of hours would be carefully managed to minimise impacts to neighbouring properties. Only activities that are unlikely to cause impacts to sensitive receivers would be undertaken during these times and consultation will be undertaken.

Day Design has prepared a Construction Noise and Vibration Management Plan for the overhead powerline works between Kurri and Muswellbrook. The proposed management measures for the powerline works including specific requirements for works outside normal working hours are detailed in the environmental mitigation measures section below.

6.4.3 Environmental mitigation measures

Noise and vibration mitigation measures for the proposal are summarised below Table 6-14.

Table 6-14: Noise and vibration mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with sections 2.4 of NS174C Environmental Handbook for Construction and Maintenance, June 2023		✓	
Prepare a Construction Noise and Vibration Management Plan as part of the CEMP		✓	
All workers to be made aware of the presence of sensitive receivers in the area and the need to avoid impacts		✓	
Locate mechanical plant and equipment as far as practicable from residences		✓	
Consider constructing enclosures around items of plant such as generators where extended use for long periods of time is expected		✓	
Use acoustically treated plant and machinery where practicable and available		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Periods of respite • Provide periods of respite for noisy activities (i.e. concrete/rock breaking/sawing) to only operate for 3 hours at a time • Ensure no more than one high noise emitting item of plant (i.e. rock breaking/sawing, hammer piling, helicopter) is operating simultaneously when working within close proximity to residences (less than 500m)		✓	
Work practices - train/induct workers to minimise noise • Avoid dropping materials form a height • Avoid talking loudly outdoors • Avoid the use of radios outdoors that can be heard at the boundary of residences (where possible) • Turn off equipment when not in use • Carry out high impact noise work predominantly within normal working hours, where reasonably practicable		✓	
Vehicles • Keep truck drivers informed of designated vehicle routes parking locations, acceptable delivery hours or other relevant practices (e.g. minimise use of engine brakes and no extended periods of idling) • Locate site vehicle entrances away from residences • Minimise the number of vehicle trips to and from site • Locate staff parking areas as far from residential receivers as practicable • Minimise site access via residential areas prior to 7am		✓	
Community relations • Appoint a community liaison officer prior to commencement • Community liaison officer to approach all potentially affected residents prior to commencement of any works as an initial introduction to provide contact details • Community liaison officer will explain the project, duration of works, potentially noisy periods as well as determine any particularly sensitive receivers or sensitive time periods and schedule works accordingly as far as reasonably practical • Provide a contact number for any residents to call with complaints or queries • Community liaison officer to maintain contact with the community throughout the works including face to face, letter box drops and/or notice board at the site office or on construction boundary.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Noise complaints • Community Liaison Officer should receive and manage noise complaints • All complaints should be treated promptly and with courtesy • Where a complaint cannot be resolved noise and/or vibration monitoring should be carried in accordance with the procedures outlined in the Day Design Report and actions taken to reduce noise as far as practicable • As part of the CEMP prepare a noise complaints management procedure in accordance with Section 6 of the EPA's Interim Construction Noise Guideline		✓	
Do not affect a receiver for more than two nights in a one-week period unless consultation has been undertaken with all potentially affected residents and an outcome agreed.		✓	
Due to unavoidable work requirements or due to a regulatory licence requirement (e.g. TfNSW) out of hours and/or night works may be required.		✓	
Where the ROL stipulates out of hours work the works must meet the requirements of NS174C Environmental Handbook for Construction and Maintenance, June 2023, out of hours work criteria or a site-specific noise management plan.		✓	

Works would be undertaken between 7am and 6pm Monday to Friday and 8am and 1pm on Saturday. Between 7am and 8am on Saturdays, works that are inaudible to the nearest residential premises are allowed. Audible works may be undertaken outside of these hours if:
• the works are emergency works AND the affected residents have been notified as far as reasonably practicable, OR
• the works fall into one of the following categories AND the affected residents are provided with a notification letter at least four clear business days prior to the works:
  • the delivery of oversized plant or structures that require special approval
  • maintenance and repair of essential public infrastructure that is unable to occur during standard hours
  • public infrastructure works that shorten the length of the work and are supported by the affected community (this would require community consultation).
		✓	

Powerline stringing works may occur on Saturdays, Sundays and Public Holidays 7am to 6pm where works are a minimum of 200m from the nearest sensitive receiver and the activities are unlikely to exceed RBL + 5dB		✓	
For out of hours work, consider notifying local council		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Provide information via a free call 1800 number, email address and Ausgrid's website for people wanting more information	✓	✓	
Provide signage outside the worksite detailing who is undertaking the works and a 24-hour contact number		✓	
Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, time of verbal response and timeframe for written response where appropriate		✓	

6.5 Air quality

6.5.1 Existing environment

No air quality monitoring has been undertaken specifically for the proposal, however EPA operates an air quality monitoring network comprising sites throughout the State, with particular focus on the main population centres of Sydney, the lower Hunter and the Illawarra. The closest monitoring site to the proposal is at Singleton, which is within the study area. Monitoring data and meteorological data was utilised for the air quality modelling and assessment.

Key air pollutants as identified under the National Environment Protection Measure for Ambient Air Quality include carbon monoxide, nitrogen dioxide, lead, sulphur dioxide, photochemical smog and fine particles. Photochemical smog (as ozone) and, to a lesser extent, fine particles remain significant issues in NSW.

Air pollution includes emission of odours, smoke, fuel or any other substances to the air. There are many substances in the air which may impair human health as well as the health of plants and animals or reduce visibility. Impacts from pollutants are governed by the intensity of pollutant discharges, type of discharges and the prevalent weather conditions.

The existing (background) air quality environment is highly influenced by the rural and industrial activities occurring in the vicinity of the proposal. Influences of existing air quality include emissions from existing coal mining operations and transportation. The major industrial sources of air emissions in the vicinity of the proposal include:

- Mount Thorley Mine
- Glendell & Mt Owen Coal Mine
- Ravensworth Operations
- Ashton Coal
- Hunter Valley Operations
- Wambo Coal Mine
- Liddell Operations
- Muswellbrook Coal Mine
- ARTC coal freight network
- Bayswater Power Station

6.5.2 Impact assessment

Direct potential impacts from the proposal to the local air quality would be limited to dust and emissions from vehicles, plant and equipment generated during the construction and to a lesser extent the operational phases. Given the nature of the works, it is unlikely that there would be an odour impact. Exhaust emissions are likely to include nitrogen oxides, carbon monoxide, sulphur oxides, hydrocarbons and total suspended particulates. All equipment would be fitted with approved exhaust systems and maintained to keep vehicle exhaust emissions within accepted standards. Activities that may generate dust include wind erosion of

exposed surfaces, movement of topsoil during excavations and disturbance of stockpiles, movement of vehicles and equipment over unsealed roads, trenching, boring, establishing of access tracks / pads, clearing vegetation, saw cutting, rock breaking and site preparation works.

During construction the work site would be transitory in nature with the excavation and backfilling works progressing down the length of the trench. During the operational phase if faults occur on the overhead powerlines, a small work site and associated access track would be established to bring in plant and equipment to repair the defective asset. Ausgrid's internal guidelines require an erosion and sediment control plan (ESCP) or soil and water management plan (SWMP) for construction works where soil disturbance is greater than 250 m2. The ESCP must be produced in accordance with the 'Blue Book'. The site would be inspected for compliance with the ESCP during the construction phase. During the operational phase works would comply with the erosion and sediment control measures detailed in section 2.2 of NS174C Environmental Handbook for Construction and Maintenance, June 2023.

Impacts to air quality would be predominantly associated with construction activities. A number of mitigation measures (described in section 5.5.3) would be implemented to ensure the amount of dust and emissions generated is minimal and would not affect the surrounding environment.

6.5.3 Environmental mitigation measures

Air quality mitigation measures for the proposal are summarised in the table below.

Table 6-15: Air quality mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with sections 2.1 Erosion and sediment control and 2.2 Air of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of the presence of sensitive receivers in the area and the need to avoid impacts.		✓	
Use water sprays to dampen (but not saturate) disturbed surfaces and stockpiles, at material transfer points and during construction and demolition.		✓	
Visually monitor dust levels during works. If dust is leaving site, causing a safety issue or complaints are received suspend works and consider mitigation options and/or substitute with an alternate process.		✓	
Restrict traffic movement and vehicle speeds over disturbed areas and unsealed roads.		✓	
Stabilise long term stockpiles by covering, or with soil binders such as polyvinyl acetate (PVA) or latex sprays.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Prepare and comply with a site-specific erosion and sediment control plan (ESCP) when disturbing more than 250m^2 at any one time. The ESCP must be prepared in accordance with Managing Urban Stormwater – Soils and Construction (NSW Landcom, 2004), the 'Blue Book'. The ESCP will form part of the CEMP prepared prior to construction. For the substation/switching station sites the ESCP/soil and water management plan (SWMP) must be prepared by a suitably qualified person (i.e. who has completed an International Erosion Control Association (IECA) endorsed course or passed the examination for Certified Professional in Erosion and Sediment Control (CPESC)) in accordance with Managing Urban Stormwater – Soils and Construction.		✓	
Position vehicles and equipment where the fumes will least affect receivers, where practicable.		✓	✓
Do not leave vehicles or equipment idling when not in use.		✓	✓
Handle SF6 and other gases in accordance with approved work practices.		✓	✓

6.6 Water quality and hydrology

6.6.1 Existing environment

The proposal crosses several waterways including the Hunter River. Direct impacts to waterways will be avoided for all new construction works as the overhead component will span waterways.

In some cases, existing access tracks cross waterways, these crossings may require upgrades to enable safe construction access including regrading or shaping of approaches and repair of the crossing bed.

6.6.2 Impact assessment

Bulk earthworks would cause considerable surface disturbance at the Antiene STSS, Sandy Creek STSS and to a lesser extent the Kurri STS site during the initial phases of construction, creating potential for erosion and sedimentation of waterways. During and after wet weather, dewatering may be required to allow work to continue.

Temporary stockpiling of material would be required at all sites including pole sites along the powerline route also creating potential for erosion and sedimentation of waterways.

The construction works would involve vegetation removal at the Sandy Creek STSS site and along the powerline route. This vegetation removal would result in areas of exposed soil material that would be prone to erosion in a rainfall event.

Water quality in the study area may be affected by spills of hydraulic oil and fuels from equipment or vehicles. Quantities of these products would be kept to a minimum and would be stored in a suitably bunded and covered area. Adequate storage and refuelling controls would be installed to mitigate impacts. Plant and equipment would also be maintained to minimise the potential for leakages.

The proposal does not include equipment containing large volumes of oil except for the Kiosk substation to be installed at Antiene STSS which will be self-bunded.

6.6.3 Environmental mitigation measures

Hydrology mitigation measures for the proposal are summarised below.

Table 6-16: Hydrology and water quality mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with sections 2.1 Erosion and sediment control, 3.1 Oil fuel and chemicals and 2.3 Water discharge of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of the presence of sensitive areas and the need to avoid impacts.		✓	
Prepare and comply with a site-specific erosion and sediment control plan (ESCP) when disturbing more than 250m^2 at any one time. The ESCP must be prepared in accordance with Managing Urban Stormwater – Soils and Construction (NSW Landcom, 2004), the 'Blue Book'. The ESCP will form part of the CEMP prepared prior to construction. For the substation/switching station sites the ESCP/SWMP must be prepared by a suitably qualified person (i.e. who has completed an International Erosion Control Association (IECA) endorsed course or passed the examination for Certified Professional in Erosion and Sediment Control (CPESC)) in accordance with Managing Urban Stormwater – Soils and Construction		✓	
Maintain sediment controls, especially during periods of rainfall.		✓	
Remove temporary erosion and sediment controls as the site is stabilised or rehabilitation is complete.		✓	
Where possible, stockpiles must be located away from roadways, gutters, drains, slopes, concentrated flow paths and channels.		✓	
Stabilise disturbed areas promptly, this may include progressive rehabilitation.		✓	✓
Organise a licensed taker to remove the water if the relevant discharge criteria in NS174C cannot be met.		✓	✓
Prior to construction, outline the location of access routes, compound sites, construction boundaries, and exclusion zones on detailed designs, clearly staked and marked onsite.		✓	
Comply with the water quality discharge criteria outlined in section 2.2 of NS174C Environmental Handbook for Construction and Maintenance, June 2023. Where dewatering of groundwater is required, a Licence may be required if annual exemption limits (3ML) are exceeded.		✓	
Include process for safely refuelling onsite plant in the CEMP.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Store oil in a bund unless it meets the definition temporary storage in section 3.1 of NS174C Environmental Handbook for Construction and Maintenance, June 2023..		✓	✓
Ensure appropriate spill kits are readily available and workers and know how to use it.		✓	✓
No dredging (excavating) or reclamation (including concrete, tyres or rocks) within permanent or ephemeral watercourses without approval from Ausgrid's Environmental Officer.		✓	

6.7 Geology and soil

6.7.1 Existing environment

Specialist geotechnical assessment was carried out by Douglas Partners along the proposed powerline route and at the proposed Antiene and Sandy Creek STSS sites (Appendix G).

A review of acid sulfate mapping indicates that works are in areas mapped as having no known occurrence of acid sulfate soils.

The NSW Geology Mapping, overlayed by the borehole locations are presented in Figure 6-11. A summary of the desktop review is also provided in Table 6-17.

Figure 6-9: Mapped Geology along alignment

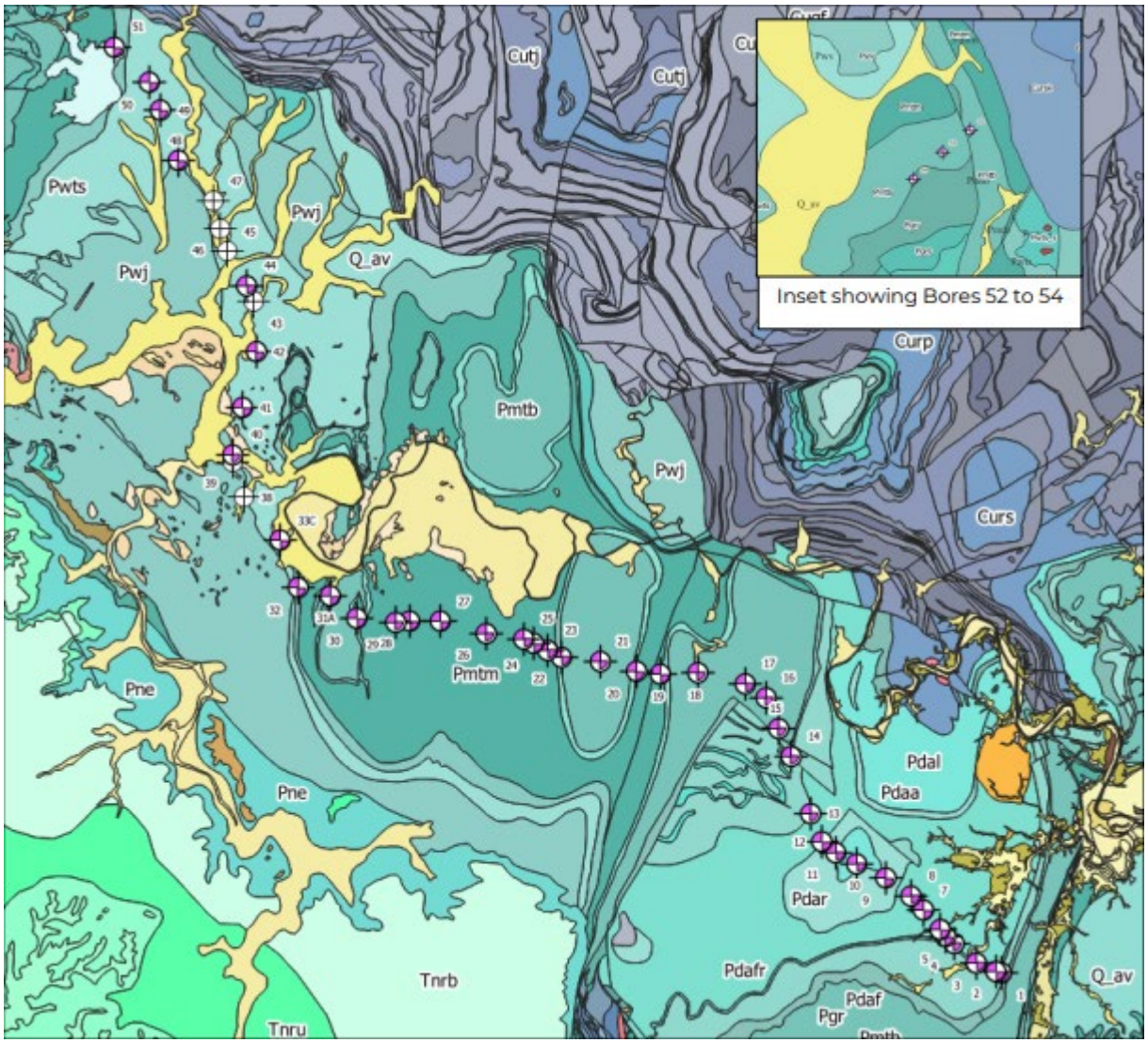


Table 6-17: Summary of desktop review

Pole Location	Geology Code	Geological Name	Soil Landscape Group
1	Pdaf	Farley Formation	Neath
2	Pdar	Farley Formation	Neath
3	Pdar	Rutherford Formation	Neath
4	Pdar	Rutherford Formation	Neath
5	Pdar	Rutherford Formation	Neath
6	Pdar / Q_av	Rutherford Formation (near Alluvial valley deposits)	Neath
7	Pdar	Rutherford Formation	Branxton
8	Pdar	Rutherford Formation	Branxton
9	Pdaa	Allandale Formation	Branxton
10	Pdal / Pdaa	Lochinvar Formation (near Allandale Formation)	Branxton
11	Pdal	Lochinvar Formation	Rothbury
12	Pdar / Pdaa	Rutherford Formation (near Allandale Formation)	Branxton
13	Pdar / Pdaf	Rutherford Formation (near Farley Formation)	Rothbury
14	Pdaf	Farley Formation	Branxton
15	Pmtb	Branxton Formation	Branxton
16	Pmtb	Branxton Formation	Branxton
17	Pmtb	Branxton Formation	Branxton
18	Pmtb / Q_a	Branxton Formation (near Quaternary alluvium)	Branxton
19	Pmtm	Mulbring Siltstone	Rothbury
20	Pmtm / Pmtu	Mulbring Siltstone (near Muree Siltstone)	Rothbury
21	Pmtb	Branxton Formation	Branxton
22	Pmtb / Pmtu	Branxton Formation (near Muree Siltstone)	Rothbury
23	Pmtm	Mulbring Siltstone	Branxton
24	Pmtm	Mulbring Siltstone	Branxton
25	Pmtm	Mulbring Siltstone	Rothbury
26	Pmtm	Mulbring Siltstone	Hunter
27	Pmtm	Mulbring Siltstone	Rothbury
28	Pmtm	Mulbring Siltstone	Branxton
29	Pmtm	Mulbring Siltstone	Rothbury
30	Pmtm / Pmtu	Mulbring Siltstone (near Muree Siltstone)	Rothbury
31a	Pmtb	Branxton Formation	Branxton
32	Pwts	Saltwater Creek Formation	Branxton
33c	Pwv / Q_av	Vane Subgroup (near Alluvial valley deposits)	Hunter
38	Q_av	Alluvial valley deposits	Branxton

Pole Location	Geology Code	Geological Name	Soil Landscape Group
39	Q_av / Pwj	Alluvial valley deposits (near Jerrys Plains Subgroup)	Hunter
40	Q_av	Alluvial valley deposits	Hunter
41	Pwv	Vane Subgroup	Roxburgh
42	Pwv	Vane Subgroup	Roxburgh
43	Q_av	Alluvial valley deposits	Hunter
44	Pwv	Vane Subgroup	Bayswater
45	Q_av	Alluvial valley deposits	Hunter
46	Q_av	Alluvial valley deposits	Hunter
47	Q_av	Alluvial valley deposits	Hunter
48	Pwj	Jerrys Plains Subgroup	Lidell
49	Pwv	Vane Subgroup	Lidell
50	Pwv	Vane Subgroup	Lidell
51	Pwts	Saltwater Creek Formation	Lidell
52	Pmtb	Branxton Formation	Roxburgh
53	Pmtb	Branxton Formation	Roxburgh
54	Pgrr / Pmtb	Rowan Formation (near Branxton Formation)	Roxburgh

Table 6-18: The mapped geological unit characterisation

Neath	micaceous sandy siltstone, silty sandstone, mudstone and shale, sporadic thin limestone.
Rutherford Formation	siltstone, marl and minor sandstone.
Allandale Formation	conglomerate, lithic sandstone.
Lochinvar Formation	basalt, siltstone and sandstone.
Branxton Formation	conglomerate, sandstone and siltstone.
Saltwater Creek Formation	quartz-lithic sandstone, siltstone, tuffaceous claystone, thin coal piles.
Vane Subgroup	quart-lithic sandstone, laminated siltstone, carbonaceous claystone, tuffaceous claystone and mudstone, paraconglomerate, coal seams.
Jerrys Plains Subgroup	sandstone, lithic sandstone, mudstone, coal, carbonaceous claystone, siltstone and paraconglomerate.
Rowan Formation	sandstone, siltstone, claystone, coal and minor conglomerate.
Quaternary Alluvium	silty clay, lithic silt, quartz rich sand, gravel, sporadic palaeosol.

Table 6-19: The mapped soil landscape group limitations

Neath	Undulating low rises and swamps, local relief is under 30 m, slopes up to 3%. Characteristics include very poorly drained, high flood hazard, low to moderate soil salinity, low to high erodibility, very high erosion hazard and nil mass movement hazard.
Branxton	Undulating rises to low hills and creek flats, slopes from 3 to 5%, local relief is 10 m to 40 m. Characteristics include imperfectly to moderately well drained, low flood hazard, low to high soil salinity, low to high erodibility, high erosion hazard and nil mass movement hazard.
Rothbury	Undulating low hills and undulating hills, slopes are 0 to 10%, local relief is 60 m to 120 m. Characteristics include hardsetting, low flood hazard, low soil salinity, low to moderate erodibility, high to very high erosion hazard and low mass movement hazard.
Hunter	Level plains and river terraces, slope are 0 to 3%, local relief is generally less than 10 m. Characteristics include imperfectly to moderately well drained, moderate flood hazard, low to moderate salinity, low to moderate erodibility, moderate to high erosion hazard and nil mass movement hazard.
Roxburgh	Undulating low hills, slopes are 0 to 10%, local relief is 60 m to 120 m. Characteristics include hardsetting, imperfectly to moderately well drained, low flood hazard, low soil salinity, low to moderate erodibility, moderate to very high erosion hazard and low mass movement hazard.
Bayswater	Undulating low hills, slopes are 3 to 10%, local relief is 40 m to 60 m. Characteristics include hardsetting, poorly to well drained, low to moderate flood hazard, low to high salinity, moderate to high erodibility, moderate to extreme erosion hazard and low mass movement hazard.
Lidell	Undulating low hills, slopes are 4 – 7%, local relief is 60 m to 120 m. Characteristics include hardsetting, low to moderate flood hazard, high soil salinity, moderate to high erodibility, high to very high erosion hazard, low mass movement hazard.

The intrusive drilling investigation for the powerline route comprised the drilling of forty-four (44) boreholes. The bores were drilled to depths ranging from 1.4m to 7.6m.

The subsurface conditions encountered at the test locations have been broadly characterised into geotechnical units as follows:

Table 6-20: Subsurface conditions

Subsurface type	Condition description
Fill	Near surface fill was encountered at a number of locations and was generally less than 1m in depth, and consisted of clay or silty soils. Some areas of gravel fill were also encountered. Areas of deeper fill, up to 2m were encountered at some locations.
Topsoil	Generally sandy silt and clayey silt topsoil was encountered in a number of locations and was generally less than 0.3m depth.
Alluvial sand	Generally medium dense to dense, although some zones of loose and very dense. Some near surface cemented sand layers were also encountered at some locations.
Alluvial clay	Generally very stiff to hard (occasionally stiff) clay, sandy clay or silty clay in limited locations.
Residual clay	Very stiff to hard silty clay, sandy clay, clay and gravelly clay with varying proportions of gravel and sand. Occasionally, stiff to very stiff layers were encountered.

Subsurface type	Condition description
Residual soil	Generally characterised by hard clay or sandy clay, which has been weathered from the underlying bedrock but has strength consistent with soil.
Bedrock	Typically coal measures sedimentary rock consisting of coal, sandstone, siltstone and claystone but volcanics (basalt) was also encountered at Bores BH10 and BH11 associated with the Lochinvar Formation. Where coring was not undertaken the strength of the bedrock was estimated from resistance to the auger string. Where penetration using a TC bit was achievable the rock is likely to be of very low to low strength, although this cannot be confirmed without retrieval of rock core. Within the bores which were continued using coring techniques, the rock strength ranged from very low to very high. Reference should be made to the logs for each location for more detail.

The subsurface conditions at Antiene have been categorised into broad geotechnical units according to their inferred geological origin, as follows:

- Unit 1 - Topsoil (organics and silts):
    - Unit 1A – (Clayey silt with organics) topsoil
    - Unit 1B – (Clayey silt): typically very stiff to hard in consistency
- Unit 2 - Residual soils; silty Clay or sandy Clay. Typically very stiff to hard in consistency
- Unit 3 - Rock: siltstone
    - Unit 3A - Extremely weathered material (soil like properties)
    - Unit 3B - Very low to low strength
    - Unit 3C – Low to medium strength
    - Unit 3D – Medium to high strength

The topography of the landscape is relatively flat for most of the route with a steady incline as the route travels northwest. Site elevation ranges from approximately 15m at Kurri STS to 180m Australian Height Datum (AHD) at the Sandy Creek STSS.

The proposed route intersects with the following a mine subsidence areas:

- Greta
- Patrick Plains
- Muswellbrook

A review of the online Naturally Occurring Asbestos Map of NSW determined the site is not located near any geological unit with the potential for naturally occurring asbestos.

6.7.2 Impact assessment

The construction of the proposal would cause some minor soil instability. There would be more than 250m^2 of soil disturbed at any one time at the substation sites and at some pole construction sites, therefore a ESCP/SWMP must be prepared by the construction contractors. The ESCP/SWMP must be prepared by a suitably qualified person (i.e. who has completed an International Erosion Control Association (IECA) endorsed course or passed the examination for Certified Professional in Erosion and Sediment Control (CPESC) in accordance with Managing Urban Stormwater – Soils and Construction.

Soil testing may occur prior to earthworks to determine the nature of the excavated material, presence of ASS and how excavated material would be reused or disposed of according to the NSW Waste Classification Guidelines.

6.7.3 Environmental mitigation measures

Geology and soil mitigation measures for the proposal are summarised in Table 6-21:Geology and soil mitigation measures.

Table 6-21: Geology and soil mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 2.1 Erosion and sediment control of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of the presence of sensitive areas and the need to avoid impacts.		✓	
Prepare and comply with a site-specific erosion and sediment control plan (ESCP) when disturbing more than 250m^2 at any one time. The ESCP must be prepared in accordance with Managing Urban Stormwater – Soils and Construction (NSW Landcom, 2004), the 'Blue Book'. The ESCP will form part of the CEMP prepared prior to construction. The ESCP/SWMP must be prepared by a suitably qualified person (i.e who has completed an International Erosion Control Association (IECA) endorsed course or passed the examination for Certified Professional in Erosion and Sediment Control (CPESC)) in accordance with *Managing Urban Stormwater – Soils and Construction*.	✓	✓	

6.8 Contamination

6.8.1 Existing environment

A desktop assessment of the route showed the existing environment is a mixture of rural, bushland and mining areas. No part of the proposal is listed on council or the EPA's contaminated land register. The route passes near the Kurri Hydro Aluminium remediation site.

A preliminary site investigation (PSI) was undertaken at the proposed Antiene STSS and the proposed Sandy Creek STSS sites (See Appendix H).

The results of the PSI for Antiene indicated that the site had formerly and currently been used for agricultural purposes both prior to and following construction of Lake Lidell, which is located immediately south of the site. Identified contamination sources included the former agricultural site activities and the adjacent road and rail activities.

Based on the site history, site observations and the results of preliminary soil testing, the potential for gross contamination at the site is considered to be low. The site is likely to be suitable for the proposed industrial use.

The results of subsurface investigation at Sandy Creek indicated the following:

- the presence of fill materials (including ash) in the eastern portion of the site

- the presence of some bonded asbestos containing materials (ACM) at the site surface, likely to be associated with former structures or dumping (the extent of which is not known).
- general absence of gross contamination in soil/fill at the locations and depths tested

6.8.2 Impact assessment

Other than the issues identified at Sandy Creek there is no evidence that the route is contaminated.

If asbestos is encountered in soil or old conduits or joint bays during construction, the works would cease, access restricted and the asbestos managed and disposed of in accordance with NS211 Working with Asbestos Products and EPA's Waste Classification Guidelines.

Soil quality may be affected by spills of hydraulic oil and fuels from equipment or vehicles. However, the extent would be localised and appropriate controls would minimise the potential for contamination to occur. Quantities of these products would be kept to a minimum and would be stored in a suitably bunded and covered area. Adequate storage and refuelling controls would be installed to mitigate impacts. Plant and equipment would also need to be maintained to minimise the potential for leakages. Any accidentally contaminated soil would be excavated, stockpiled, chemically classified for disposal and transported to an appropriately licensed waste facility.

The Sandy Creek PSI recommends:

- additional subsurface investigation to further assess the extent of the fill and site conditions in proposed areas of construction
- detailed surface inspection to further assess the presence of surface asbestos impacts
- additional assessment for waste classification to confirm requirements for off-site disposal of impacted soils, where required.

If unexpected contamination is identified during construction, the works would cease, access restricted and the Environmental Officer contacted to determine the nature and extent of the contamination.

6.8.3 Environmental mitigation measures

Contamination mitigation measures for the proposal are summarised below.

Table 6-22: Contamination mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 4.3 Contamination of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of the presence of sensitive areas and the need to avoid impacts.		✓	
Segregate any suspected contaminated spoil from clean spoil to reduce disposal costs.		✓	
Undertake testing to determine the waste classification and subsequent storage, transport, tracking, licensing and disposal requirements.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Temporarily store excavated known or suspected contaminated spoil in a covered, lined/sealed skip or bulk storage bag or sealed container on-site for classification prior to disposal off site. Where there are site restrictions for on-site storage, store offsite. If storing more than 5 tonnes of spoil, use a licensed storage facility. There may also be a requirement for having a licence to transport the spoil (there are exemptions for Ausgrid staff).		✓	
If a worker thinks they have found contamination, they must stop work immediately, restrict access and notify: • their supervisor • Ausgrid's Environmental Services • their local safety advisor for WHS requirements.		✓	
All packages/storage containers are clearly labelled and maintained in good order.			
Engage an Asbestos Hygienist to undertake an EMU pick and provide a clearance prior to commencement of works at Sandy Creek.		✓	
Prior to construction, nominate and sign post a plant refuelling area.		✓	
Consider additional subsurface investigation to further assess the extent of the fill and site conditions in proposed areas of construction (at Sandy Creek STSS).	✓	✓	
Concrete washout to be undertaken in accordance with the TfNSW concrete washout guidelines. Where works are in a sensitive aboriginal area the concrete washout must be of a type that does not involve ground disturbance.		✓	
Refer to Ausgrid's Asbestos register to identify any existing asbestos and/or lead hazards at Muswellbrook STS, Kurri STS and Rothbury Zone.		✓	
Prepare and implement an unexpected finds protocol to outline the manage requirements for unexpected finds of contaminated land during construction. If widespread asbestos is identified at Sandy Creek a Remediation Action Plan will be required and consideration should be given to on-site treatment.		✓	
Obtain approval to install and operate an on-site sewage management system under section 68 of the Local Government Act - On-site Sewage Approvals prior to construction of the system at Antiene STSS.	✓	✓	

6.9 Waste

6.9.1 Existing environment

The existing powerlines are maintained on a regular basis and intermittently generates small amounts of waste including bioguard bandages, cross arms, insulators, green waste and timber poles. These wastes are taken to the local depot for recycling or disposal.

6.9.2 Impact assessment

The proposal may generate various types of waste, some of which would be reused or recycled while others would require disposal. Most waste would be generated during the construction phase. Waste likely to require disposal includes:

- excavated earth material
- waste oils, liquids and fuels from maintenance of construction plant and equipment
- wastes from site compounds (including sewage waste, putrescible waste etc)
- building waste (packaging material, scrap metal, plastic wrapping, cardboard)
- natural timber, treated timber, concrete and steel poles
- aluminium, steel and copper conductors and down leads
- glass, porcelain and polymer insulators
- metal switches, links and fuses
- excess building materials that can't be reused
- vegetation from clearing activities
- cable off-cuts
- timber cable drums
- timber pallets
- redundant equipment
- other general construction waste.

All waste would be re-used where possible, otherwise managed in accordance with the NSW Waste Classification Guidelines.

Where possible excess spoil generated would be beneficially reused onsite to minimise offsite disposal. Excess spoil generated during pole installation works would be lost onsite where practical. Excavated soil at the substation/switching station sites will be reused as part of the cut fill balances at the respective sites. Any unsuitable or excess soil that cannot be beneficially reused onsite would be classified in accordance with the NSW Waste Classification Guidelines and subsequently disposed to a facility that can legally accept the waste

Any soil suspected of being contaminated would be stored separately in a lined stockpile or skip bin, classified and then disposed to an appropriately licensed waste facility (refer to section 6.9.3).

During operation of the proposal, waste generation is anticipated to be limited to maintenance activities and would be minimal.

6.9.3 Environmental mitigation measures

Waste mitigation measures for the proposal are summarised below.

Table 6-23: Waste mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 4.2 Waste management of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of the presence of sensitive areas and the need to avoid impacts.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Prior to construction, prepare a Waste Management Plan (WMP) which contains a list of expected wastes, their volume and their planned reuse, disposal or recycling.	✓	✓	
Classify wastes to determine licensing, waste tracking and disposal requirements.		✓	
Segregate and label waste to improve recycling opportunities, avoid cross contamination and reduce disposal costs.		✓	
Where possible, reuse or recycle or return to the supplier wastes including metal components, transformer oil, spoil and packaging.		✓	✓

6.10 Flora and fauna

6.10.1 Existing environment

The existing flora and fauna environment of the proposed route consists of cleared land, scattered vegetation, open/closed bushland, native vegetation, and riparian vegetation.

An assessment of the existing flora and fauna environment was undertaken by Wildthing Environmental Consultants (Appendix I). Seven TECs listed under the BC Act were identified within the REZ or in close proximity:

- Kurri Sand Swamp Woodland in the Sydney Basin bioregion
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions
- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast bioregions
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin bioregions
- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin bioregions
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands

Four Endangered Populations are listed in the local area:

- Acacia pendula (Weeping Myall) – population in the Hunter Catchment
- Diuris tricolor, the Pine Donkey Orchid population in the Muswellbrook local government area
- Cymbidium canaliculatum population in the Hunter Catchment
- Eucalyptus camaldulensis in the Hunter Catchment.

Threatened flora species recorded during fieldwork were:

- Eucalyptus glaucina (Slaty Gum)
- Eucalyptus parramattensis subsp. decadens (Drooping Red Gum)
- Grevillea parviflora subsp. parviflora (Small-flowered Grevillea)
- Diuris tricolor (Pine Donkey Orchid).

A total of 24 significant (larger trees and/or those containing hollows) trees were recorded along the proposed REZ and may be impacted by the proposal. Fourteen (14) of these trees were found to contain habitat in the form of hollows. A number of these trees will likely require removal or branch trimming.

The vegetation and landforms present along the REZ offer a variety of habitats for native fauna species. The broad habitat types included Open Forest, Woodland Grassland and Aquatic.

The route crosses a number of habitat corridors of various sizes and functionality. As a result of the relatively small size and narrow nature of the REZ the proposal is unlikely to have any significant impact on the movement of any threatened fauna species.

6.10.2 Impact assessment

The proposal will result in the following direct and potential impacts/losses:

- Impact to areas of native vegetation along the powerline corridor largely in the form of branch trimming and less frequent tree removal within 11 Plant Community Types (PCTs):
  - PCT 3630 Kurri Sand Heathy Woodland
  - PCT 3433 Hunter Coast Foothills Spotted Gum-Ironbark Forest
  - PCT 3634 Quorrobolong Sand Flats Forest
  - PCT 3444 Lower Hunter Spotted Gum-Ironbark Forest
  - PCT 3446 Lower North Foothills Spotted Gum-Ironbark Grassy Forest
  - PCT 4023 Coastal Valleys Riparian Forest
  - PCT 3315 Central Hunter Ironbark-Spotted Gum Forest
  - PCT 4015 Central Hunter Swamp Oak Riparian Forest
  - PCT 4073 Lower North Hinterland River Oak Forest
  - PCT 3431 Central Hunter Ironbark Grassy Woodland
  - PCT 3525 Upper Hunter Box-Blakely's Red Gum Grassy Forest
- Impact to 0.2ha of PCT 3630 Kurri Sand Heathy Woodland for approximately 150m new section of easement between the Kurri STS and Hunter Expressway
- Impact to 2.7ha of PCT 3431 Central Hunter Ironbark Grassy Woodland for the upgrade of the Muswellbrook STS. The 2.7ha of PCT 3431 is composed of 1.55ha of woodland with 1.22ha of derived native grassland
- Impact to 7 Ecological Communities listed under the BC Act 2016
- Kurri Sand Swamp Woodland in the Sydney Basin bioregion
- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions
- Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin bioregions;
- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin bioregions
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East;
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Impact to 3 Nationally Listed Threatened Ecological Communities
- Kurri Sand Swamp Woodland of the Sydney Basin bioregion
- Central Hunter Valley Eucalypt Forest and Woodland
- Swamp Oak Floodplain Forest
- White Box – Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland
  - Impact up to 32 specimens of the state and nationally threatened Eucalyptus parramattensis subsp. decadens (Drooping Red Gum)
  - Impact to a small number of specimens of Eucalyptus glaucina (Slaty Red Gum), a state and nationally threatened species
  - Impact to up 24 significant (larger trees) including up to 24 hollow-bearing trees
  - Impacts to habitat for the BC Act listed species threatened fauna species Pomatostomus temporalis subsp. temporalis (Grey-crowned Babbler)
  - Impacts to habitat for the BC Act listed species threatened fauna species Haliaeetus leucogaster (White-bellied Sea-Eagle)
  - Impacts to the BC Act 2026 & national EPBC Act 1999 listed species Climacteris picumnus victoriae (Brown Treecreeper)

- Removal/modification of a suitable habitat for a number of the addressed threatened flora and fauna species.

The proposal may result in the following indirect and potential impacts:

- trees and other native vegetation
- potential impact to a small number of specimens of Diuris tricolor (Pine Donkey Orchid) and Grevillea parviflora subsp. parvifolia (Small-flowered Grevillea) within the existing easement
- impact on native fauna during vegetation removal
- erosion and sedimentation particularly in relation to streambanks
- introduction of priority, other weed species into other areas.

The report in Appendix I has been undertaken in accordance with the requirements of the *Environmental Planning and Assessment Amendment Act 2017 (EP&A Act 2017),* the *Biodiversity Conservation Act 2016 (BC Act 2016)* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999).* It provides the test of significance for EECs and threatened species likely to occur in the study area.

In conclusion, the proposed REZ Project will result in an incremental reduction/modification of habitat, however taking into consideration the mitigation measures the proposal is unlikely to have a significant impact on any addressed threatened species, endangered population or threatened ecological community.

6.10.1 Environmental mitigation measures

Flora and fauna mitigation measures for the proposal are summarised in below.

Table 6-24: Flora and fauna mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 5 Ecology of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
Obtain consent from the NSW Biodiversity Trust for any new works within BCT mapped areas.	✓	✓	
All workers to be made aware of the presence of sensitive areas and the need to avoid impacts.		✓	
Keep to designated roads, pads and access tracks. Restrict vehicle and plant movements to existing cleared areas.		✓	✓
Trees and native vegetation within the subject land are to be avoided wherever possible within the scope of the proposal.	✓	✓	
Works should avoid any impact to native vegetation outside the impact area. Clearing limits will be clearly marked on the ground to prevent unnecessary clearing beyond the extent of the proposal.		✓	
Trees to be removed or trimmed are to be clearly marked to prevent any unintentional impact on trees that are to remain untouched.		✓	
All material stockpiles, vehicle parking and machinery storage will be located outside areas of native vegetation.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Threatened flora species such as Diuris tricolor (Pine Donkey Orchid) and Grevillea parviflora subsp. parvifolia (Small-flowered Grevillea) occurring within the existing easement are to be avoided during the construction of the subtransmission powerlines. The locations of these species should be located and marked as no-go areas, allowing them to be avoided. (refer to Detailed Mapping in Appendix I)		✓	✓
Temporary erosion and sediment controls (e.g. silt fences) are to be installed, if required to avoid disturbance and degradation of soils and nearby features. These controls should conform to the specifications in Soils and Construction 'Blue Book' (Landcom, 2004) and should be maintained throughout the construction process until soil is successfully stabilised.		✓	
Stumps of cut trees required to be removed along waterways such as Glennies and Bowmans Creek must be left *in-situ* to continue to hold the stream bank together.		✓	
Weeds • Prepare a Weed and Pathogen management plan as part of the CEMP. • All movement is to stay within the impacted area. • Use existing routes as identified and agreed with Ausgrid. • Ensure machinery, vehicles clothing and equipment have been cleaned and inspected prior to entering new areas (eg moving between properties) to prevent the spread of new plant propagules (seeds and fragments of plants). Areas to inspect and clean within vehicles include tyres, wheel arches, under carriages, radiator grills, floor mats, load areas, boots, socks or anywhere that seeds and soil can lodge.		✓	✓
The removal of hollow-bearing trees is to be supervised by a suitably qualified fauna ecologist to reduce the impact on any fauna which may be present. Where possible leave hollows onsite to provide reduce habitat loss. Hollows should be placed at the edge of the easement to prevent issues with future vegetation maintenance.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Grey-crowned Babbler • Pre-clearance searches are to be undertaken for Grey-crowned Babbler nests prior to vegetation removal (refer to Detailed Mapping in Appendix I). • Removal of nests is to be avoided where possible within the scope of the proposal. • Where the removal of nests is unavoidable, nests are to be assessed for usage. If nests are found to be active, nests are not to be removed until all young have fledged the nest. • If removal of a nest is unavoidable then the nest is to be removed by a suitably qualified ecologist and relocated nearby within the site.		✓	
Permanent and temporary waterway crossings should be designed and constructed in accordance with Chapters 4.1 and 4.2 of the P&Gs and national guidelines entitled 'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings' (Fairfull and Witheridge 2003).	✓	✓	
There is to be no complete blockage of fish passage during the works.		✓	
Any material removed from the waterway that is to be temporarily deposited or stockpiled on land is to be located well away from the waterway and to be contained by appropriate erosion and sediment control devices.		✓	
On completion of any water crossing works all disturbed soil is to be levelled, smoothed and sown with a mixture of sterile/native grass seeds to encourage rapid revegetation and planted out with native endemic riparian vegetation.		✓	
Machinery is not to enter or work from the waterway.		✓	
Only clean rock (no fines) is to be used during these works.		✓	
Prior to use at the site, machinery is to be appropriately cleaned degreased and serviced. Spill kits are to be available on site at all times during the works.		✓	
Works are to be undertaken during low flows in the waterway.		✓	
Any rock scour protection at the culvert inlet and outlet must abut the aprons at the same level and the stream bed at the same level to ensure that there is no drop in elevation at the joins. This is to maintain fish passage and minimise impact on the morphology of the creek.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
"Removal of large woody debris from NSW rivers and streams" is listed as a key threatening process under Part 7A of the FM Act. A snag is considered to be any piece of woody debris that is both greater than 3m in length and 300mm in diameter, or any rock larger than 500mm in two dimensions, that is located within a waterway (either fresh, estuarine or marine) and is, or would be, wholly or partly submerged at a 'bank-full' flow level or highest astronomical tide level. As a general principle for timber snags, lopping should be considered as the first priority for the management of snags. Where lopping will not solve the immediate problem, re-alignment should be considered as the next possibility, followed by relocation. Removal of a snag is the least desirable option and should only be adopted as a last resort. Proposals for snag removal should be accompanied by a 7 part test and/or Species Impact Statement where proposed in areas that are TYPE 1 aquatic habitats (see Table 1 and 2.1.14 2.6.9 Policy and Guidelines for Fish Habitat Conservation and Management (2013).).		✓	
Any dewatering should not involve pumping the water directly downstream without adequate treatment to remove suspended solids. Dewatering must not result in a visible turbid plume or additional sedimentation into the adjacent environment. Dewatering should incorporate the following: a. dewatering at the worksite is to be undertaken consistent with accepted Best Management Practice (i.e. Landcom [2004], Managing Urban Stormwater: Soils and Construction [4th Edition]). In addition, mitigation controls such as a sediment fence between the sump water release outlet and the waterway are to be employed to ensure that downstream water quality is not adversely affected. b. dewatering at the worksite is to be undertaken with a screen around the pump inlet possessing mesh no greater than 6mm. Netting and removal of fish should be undertaken at late stages of dewatering regardless of any positive identification of fish. Any fish captured via netting should be released unharmed into adjacent waters downstream of the worksite. c. a visual inspection of the waterway is to be conducted at all times during dewatering operations to ensure that no visible plumes are generated within the waterway from dewatering operations.		✓	

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
DPIRD Fisheries (1800 043 536) and the Environment Protection Authority (EPA) (131 555) are to be notified immediately if any fish kills occur in the vicinity of the works. In this situation, all works other than emergency response procedures are to cease until the issue is rectified and approval is given by DPIRD Fisheries and/or the EPA for the works to proceed.		✓	

6.11 Bush fire

6.11.1 Existing environment

Most of the HCC REZ route is mapped as Bushfire Prone Land.

6.11.2 Potential impacts

The risk of causing a bush fire is primarily associated with construction and maintenance activities, not the inherent nature of the proposed infrastructure. The main risks constitute:

- undertaking various kinds of 'hot work' where naked flames are used, such as welding, use of blowtorches, angle-grinding and use of gas torches for shrinking heat shrink components
- use of machinery with the potential to generate sparks, such as jack hammers, rock saws, and angle grinders.

Ausgrid's guideline TG 107 Hot Work During Total Fire Bans restricts hot works during total fire bans and requires risk assessments and precautions to be put in place to minimise the risk of causing a bushfire. These precautions would apply to construction and maintenance for the life of the proposal.

The proposal would be classified by the BCA as a Class 8 development. The NSW Rural Fire Service (RFS) publication Planning for Bush Fire Protection[14] (PBP) is applicable to Class 1, 2 and 3 residential developments as defined within the BCA and hence the provisions of PBP are not strictly applicable to the proposal. Nonetheless, the site is within an area that is classified as being bushfire prone, and a potential threat to Ausgrid infrastructure exists from the surrounding vegetation.

Specialist bushfire threat assessments were undertaken for the Antiene STSS, Sandy Creek STSS, Kurri STS upgrade and Rothbury Zone upgrades in accordance with PBP (Appendix J). The proposal was also assessed against Ausgrid's Network Standard (NS)187 which details minimum requirements for passive fire protection systems to protect switching stations and contains guidance for the protection of the switching station against bushfires.

NS 187 details the maximum allowable radiant heat flux (kilowatts per square metre – kW/m^2) for substation components. The required APZs are detailed in the table below:

Table 6-25: APZ requirements

Aspect	Required APZ(m) to achieve BAL - 12.5			
	Antiene STSS	Sandy Creek STSS	Kurri STS	Rothbury Zone
North	23	25	45	23
South	25	26	22	23
East	25	32	45	23
West	25	32	37	23

Antiene STSS does not require any vegetation removal to achieve compliance with the above measurements. Sandy Creek STSS requires clearing as per above to achieve compliance with BAL 12.5. This clearing should be undertaken as part of the clearing for site prior to commencement of construction.

The Kurri STS proposal will result in the western aspect being located within BAL-40 (using the NBC Bushfire Attack Assessment software. To reduce the heat exposure for critical components to 12.5kW/m^2 vegetation management will be required for 13 metres from the western boundary and to the west – this may be reduced by whatever the distance of the cabling is from the outermost critical components of the substation (i.e. if the cabling is 2 metres from the outermost critical components, then the vegetation management would be reduced to 11 metres). The other option would be to utilise a BAL-19 energy level (i.e. 19kW/m2) which will suit all but some cabling and this would then require a total APZ of 26 metres. In this instance, there will be cable shielding required.

The new Rothbury Zone inductor would be compliant with BAL-12.5 however 2m trimming/clearing would be required to the vegetation east of the existing substation fence to achieve BAL 12.5.

The proposed powerlines have been designed to comply with Ausgrid's Tree Safety Management Plan[15] and ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets[16] which would limit the potential for and impact of a bushfire event. The aims and objective of the NSW Rural Fire Service (RFS) publication Planning for Bush Fire Protection were considered in the proposed powerline design.

6.11.3 Environmental mitigation measures

Bushfire mitigation measures for the proposal are summarised below.

Table 6-26: Bushfire mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 5.3 Total fire bans of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of sensitive areas and the need to avoid impacts.		✓	
Design the switching station to address both passive and active fire protection systems, including: • specification of fire ratings in the building design • application of active fire protection controls as required by the BCA • provision for access and emergency egress in accordance with the relevant statutory regulations.	✓		
Implement and maintain the APZ to provide access for fire fighters to manage a bushfire in line with Table 6-25: APZ requirements above and the reports in Appendix J.	✓	✓	✓
Vegetation clearing and pruning to comply with Ausgrid's Tree Safety Management Plan and ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets.	✓	✓	✓

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Any hot works during a total fire ban must be in accordance with an approved exemption Ausgrid employees to work in accordance with TG107. This includes grinding, welding, brazing, oxy-cutting, heat treatment or processes that generate heat or continuous streams of sparks.		✓	✓
Keep hot work activities clear of combustible matter by at least 3 metres. Keep adequate firefighting equipment immediately at hand. Avoid driving a vehicle through long grass or operating motors and equipment in proximity to vegetation.		✓	✓
Where possible, schedule hot works activities during the more favourable period of the day and week.		✓	

6.12 Aboriginal cultural heritage

6.12.1 Existing environment

The proposal is in an area covered by Mindaribba and Wanaruah Local Aboriginal Land Councils (LALCs).

The study area is within the central lowlands of the Hunter Valley and follows a meandering corridor that extends from Kurri Kurri, approximately 30 km northeast of the city of Newcastle on the coast, to Muswellbrook in the northwest. It is approximately 120m wide and covers a distance of approximately 105km.

With regard to landscape features, the study area contains several waterways including the Hunter River and its tributaries.

A desktop assessment of the NPWS Aboriginal Heritage Information Management System (AHIMS) and the Commonwealth Department of Environment Protected Matters Search Tool revealed 1,167 Aboriginal sites/objects have previously been recorded in proximity to the proposed powerline corridors. There are 140 AHIMS sites registered as being within approximately 50m of the proposed powerline route.

An Aboriginal Cultural Heritage Assessment Report (ACHAR) has been prepared by Apex Archaeology. The aim of the assessment is to identify whether or not Aboriginal objects are, or are likely to be, present in the study area and determine whether or not a proposed activity is likely to harm Aboriginal heritage (if present) and whether an Aboriginal Heritage Impact Permit (AHIP) application is required.

6.12.2 Impact assessment

A specialist heritage assessment was undertaken for the proposed works. The archaeological and cultural assessment for the project found the following:

- the HCC REZ passes through a rich cultural landscape with many previously and newly recorded sites present
- 84 of the previously recorded AHIMS sites are confirmed to be located within a 50m radius of the proposed powerline route
- 26 newly identified sites were also located within a 50m radius of the proposed powerline route
- nine zones of archaeological sensitivity were identified, associated with previously or newly identified sites
- the proposed works have potential to avoid many of the identified sites, either through ensuring pole placement avoids known site locations, or the use of alternative construction methods which reduce or avoid impact
- final recommendations for management of the Aboriginal archaeological sites within the study area would rely on the final design of the REZ.

The proposal is not likely to significantly affect the environment in relation to Aboriginal heritage for reasons including:

- the design has been modified to avoid known aboriginal sites and identified areas of sensitivity where practical
- an Aboriginal Heritage Impact Permit will be obtained for impacts to sites that cannot be avoided and to cover unexpected finds within the project footprint
- the Aboriginal Cultural Heritage Assessment (ACHAR) and AHIP will be developed in consultation with Registered Aboriginal Parties in accordance with the ADD Guideline.

6.12.3 Environmental mitigation measures

Aboriginal heritage mitigation measures for the proposal are summarised in Table 6.27. Aboriginal heritage mitigation measures

Table 6-27: Aboriginal heritage mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 6.1 Aboriginal heritage of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of sensitive areas and the need to avoid impacts.		✓	
IMPORTANT: THERE ARE KNOWN ABORIGINAL OBJECT(S) IN THE AREA. If a worker thinks they have discovered an Aboriginal heritage object or evidence of Aboriginal occupation they must stop work immediately, restrict access and notify their Supervisor to ensure the regulator is contacted. Ausgrid employees should contact Ausgrid Environmental Services. In these cases Ausgrid's Environmental Services will contact the regulator.		✓	✓
Known Aboriginal objects and places, if in close proximity to the worksite, must be identified on the day and barricaded to restrict access. Where it is not practical to isolate the known item, it must be constantly supervised during work to ensure no inadvertent damage occurs.		✓	✓
An Aboriginal Heritage Impact Permit must be obtained for the project from the Office if Environmental and Heritage. The permit will cover the salvage/collection of artefacts that cannot be avoided, protection of sites that can be avoided and detail the process for unexpected finds during construction. Ausgrid and its contractors must comply with the conditions of the project AHIP. Contractors must prepare a plan as part of the CEMP demonstrating how they will implement conditions of the AHIP/ACHAR and this REF.	✓	✓	✓
Prepare and implement an Aboriginal Cultural Heritage Management Plan in consultation with all registered aboriginal parties to manage the operation of the HCC REZ network.			✓

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Detailed design must where reasonable and feasible avoid impact to identified aboriginal sites and areas of sensitivity.	✓		
Final locations of ALL proposed ground disturbance (e.g. excavations for access tracks, construction pads, poles, benching etc) within the identified Aboriginal Sensitive Areas must be approved by the Ausgrid Environmental Management Representative prior to commencement.		✓	

6.13 Non-Aboriginal heritage

6.13.1 Existing environment

A desktop assessment was conducted using the Australian Heritage Database17, NSW State Heritage Inventory and the relevant council Local Environmental Plans. The results of these searches were that there are eight Commonwealth, State or Local Heritage listed items in the study area. The following items were identified within or adjacent to the proposed corridor:

Table 6-28: Non-Aboriginal heritage items

Location	Heritage listing	Details	Distance from the edge of the route
Kurri	South Maitland Railway System (Local)	From 1892 until the 1960s the South Maitland Railway was the largest and busiest private railway in Australia - essential in the export of Australia's richest coal resources as well as moving passengers. It was the focus of some bitter industrial disputes, and of the conflict, competition and co-operation of some of NSW's largest industrial organisations including J&A Brown and the Australian Agricultural Co. The growth and decline of the line provides evidence of the growth and decline of the coal industry around Cessnock. It was the largest rail system to retain steam power until it was finally abandoned in 1983.	The OH powerline crosses the route at Kurri

Location	Heritage listing	Details	Distance from the edge of the route
Branxton	Branxton Railway Station Group (Local/State)	Branxton features some of the earliest buildings on the northern line. The substantial nature of the buildings reflects the importance once attached to the town and its station. The original station incorporated a rare example of a residence (one of five similar structures in the State). The group exhibits the effects of duplication and the addition of structures from later periods including several additions to the 1862 building during the 1880s and again in 1914 to make a substantial main line railway group.	Immediately adjacent
Heddon Greta	Collieries of the South Maitland Coalfields/Greta Coal Measures Group (Local)	The South Maitland coalfields was the most extensive coalfield in NSW until the great coal mining slump of the 1960s. It was discovered by Lieutenant-Colonel William Paterson's party when they were engaged in an exploratory visit to the Hunter Valley during July 1801.	Former Heddon Greta Colliery is adjacent to the Kurri STS. The nearest proposed works are located within the STS site approximately 200m away.
Branxton	Great Northern Railway Network (Local)	The Great Northern Railway (Main North Line) runs from Strathfield to Armidale. It was the original mainline between Sydney and Brisbane. The original section was built in 1857 and ran from the port of Newcastle to East Maitland.	Immediately adjacent
Mount Thorley	Brick farmhouse (Local)	Brick farmhouse and farm complex	200m
Mount Thorley	'Abbey Green' and outbuildings (Local)	Abbey Green is an historically significant building for its associations with George Thomas Loder III, the first owner of Abbey Green, who was a prominent Hunter Valley grazier and founder of an early meat preserving and canning enterprise aimed at expanding the markets for graziers. The Abbey Green homestead, woolshed, slab stables, slab outbuilding and its siting high above a reach of the river illustrate very well the chief characteristics of a prosperous late Victorian Hunter River Homestead Group.	1.3km

Location	Heritage listing	Details	Distance from the edge of the route
Hebden	Fairview (Local)	Fairview has local historic significance for its association with later 19th century land subdivision in the Lake Liddell area. It is one of few remaining groupings of its age and type in that area. It has local scientific significance for its potential to reveal information which could contribute to an understanding of the economic means and lifestyle of the earliest farmers in this area. Timber slab and galvanised iron outbuilding Architectural Style: Victorian Georgian Construction Year: Late 19th/early 20th century modifications: weatherboard rear extension	NA (no longer standing).
Hebden	Hillcrest (Local)	Like Fairview (Item Lidd/R002), Hillcrest has local historic significance for its association with later 19th century and early 20th century land subdivision in the Lake Liddell area. Its greatest significance must be its aesthetic significance which derives from its being a rare regional example of Federation Bungalow executed in timber. It has local scientific significance for its potential to reveal information which could contribute to an understanding of the economic means and lifestyles of the earliest farmers of the land in this area.	500m

6.13.2 Impact assessment

Local – Local heritage within the study area includes:

- Collieries of the South Maitland Coalfields/Greta Coal Measures
- South Maitland Railway System
- Great Northern Railway Network
- Branxton Railway Station
- Brick Farm House
- 'Stafford', homestead and 'Clifford', homestead (ruins)
- Fairview
- Hillcrest

The route crosses directly over the South Maitland Railway at Loxford. Ausgrid may require access to the western side of the rail line to remove/replace an existing pole. Measures will be put in place to prevent any impacts to the rail line. No other local items will be directly impacted by the works.

State Heritage – The existing feeder easement is directly adjacent to the site - Branxton Railway Station group and moveable relics. The stated boundary is within the rail property boundaries along the tracks including platforms, structures, foundations. No works are proposed within the curtilage of the heritage item.

National Heritage – None identified within or adjacent to the proposed corridor.

Commonwealth Heritage – None identified within or adjacent to the proposed corridor.

World Heritage – None identified within or adjacent to the proposed corridor.

In the unlikely event that non-Aboriginal heritage is encountered during ground disturbance works, controls would be implemented for the management of unexpected archaeological finds.

6.13.3 Environmental mitigation measures

Non-Aboriginal heritage mitigation measures for the proposal are summarised below.

Table 6-29: Non-Aboriginal heritage mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Comply with section 6.2 non-Aboriginal heritage of NS174C Environmental Handbook for Construction and Maintenance, June 2023.		✓	
All workers to be made aware of sensitive areas and the need to avoid impacts.		✓	
All works to cease if potential heritage is discovered. Access should be restricted and Supervisor notified to ensure regulator is contacted. Ausgrid employees should contact Ausgrid Environmental Services on (02)9394 6659.		✓	
The location of heritage items should be highlighted to all construction personnel as part of the site induction.		✓	

6.14 Visual and aesthetics

6.14.1 Existing environment

DeWitt Consulting were engaged to undertake a Landscape Character and Visual Impact Assessment (LCVIA). The assessment was completed in accordance with the Guidelines for Landscape and Visual Impact Assessment[18]. Five (5) LCZs were identified in the surrounding landscape (see Figure 6-10: Landscape character zones and viewpoints), including:

- rural/agriculture
- rural/mining
- urban/rural fringe
- vineyards/tourism
- remnant vegetation.

Of these LCZs, the proposed works intersect with:

- rural/mining
- urban/rural fringe
- vineyards/tourism (small extent only).

The proposed powerline upgrades largely span across land zoned as RU1 Primary Production, RU2 Rural Landscape, and SP2 Infrastructure. To a lesser extent, the works cross C3 Environmental Management

zoned land (near Muswellbrook) and proximate to a mix of zones in more urbanised areas of the southern extent of works including land zoned for business, industrial, and residential. The proposed Antiene STSS is located on land zoned RE1 Public Recreation proximate to the Lake Liddell Recreation Area, and the proposed Sandy Creek STSS on land zoned both SP2 Infrastructure and C3 Environmental Management. A plan depicting the surrounding EPI land use zones is provided in Figure 6-11: Landscape character zones and c.

The baseline landscape value scores **low** using the literature-based criteria for preferred characteristics of rural landscapes.

6.14.2 Impact assessment

Construction

The various construction phases of the proposal would have a visual impact on local views due to the presence of plant and equipment, exposed soil and removal of vegetation. The impact would vary throughout construction, with the earthworks stage likely to be most visually prominent. As construction impacts would be short term and the adjoining stakeholders would be consulted about the works, the overall impact during construction is not expected to be significant. Disturbed areas would be reinstated as soon as practicable to further ameliorate short term visual impact.

Operation

Long term visual impact on local views would occur through new steel power poles around 30m high and powerlines erected within existing easements replacing existing powerlines. The impact would be limited due to several factors including topography, large rural allotments, existing infrastructure, screening vegetation and limited numbers of people exposed to the visual impact.

The proposal is designed to be complementary to the local area. Building form, character and position was designed to limit visual impact for the surrounding community. Once constructed, the proposal would not restrict access to recreational space, commercial or industrial development, residential development or water supply catchment. The proposal would require minimal maintenance, reducing the need for plant and equipment to access the site. Maintenance work would form part of Ausgrid's existing maintenance program.

A specialist visual assessment was undertaken for the proposal by deWitt Consulting. The report concluded that the effect of the proposed works on the landscape and its character is determined to be of moderate-low significance overall. Photomontages were created for a number of key viewpoints along the route. Four of these have been presented in the figures below.

Figure 6-10: Landscape character zones and viewpoints

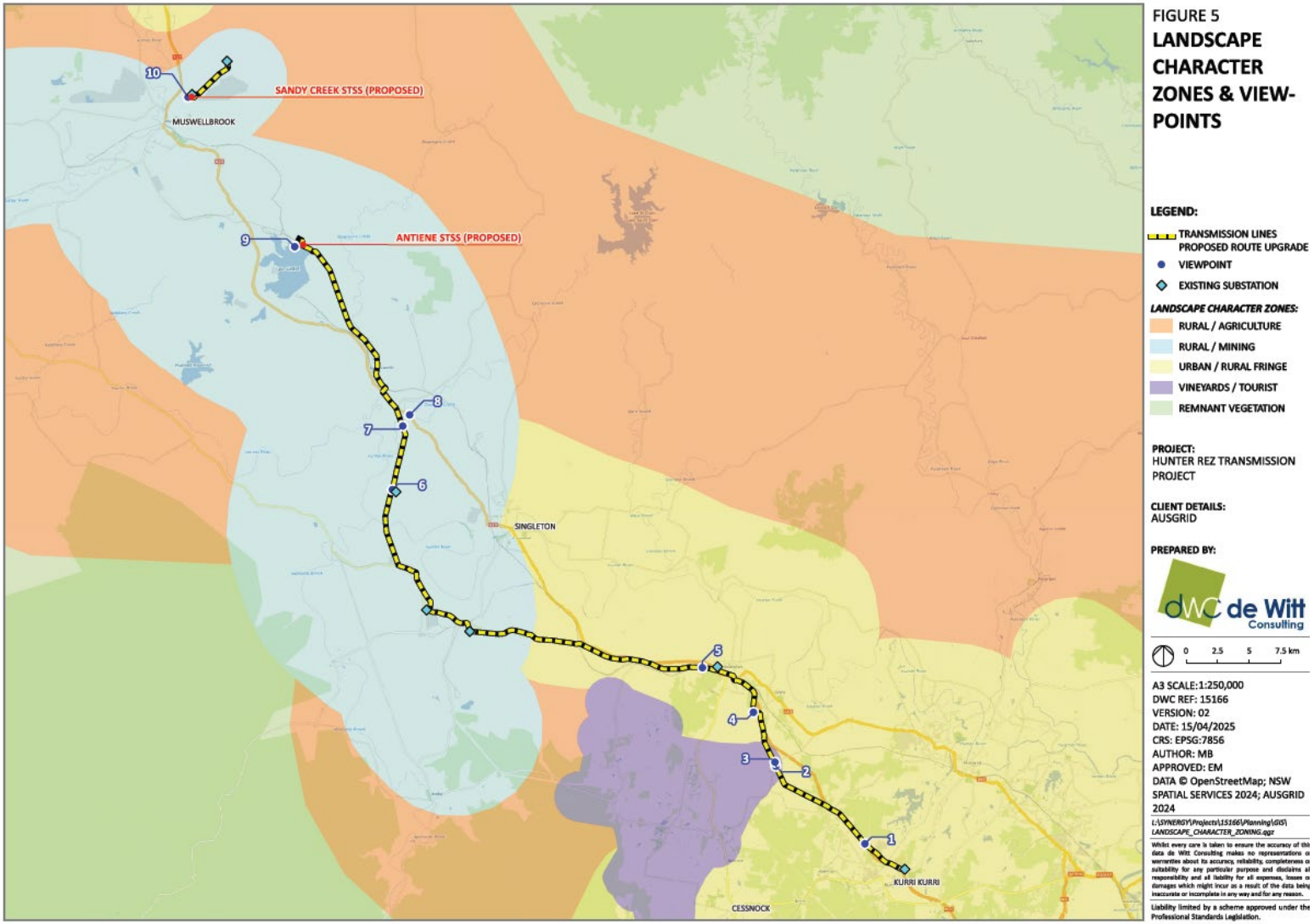


Figure 6-11: Landscape character zones and viewpoints

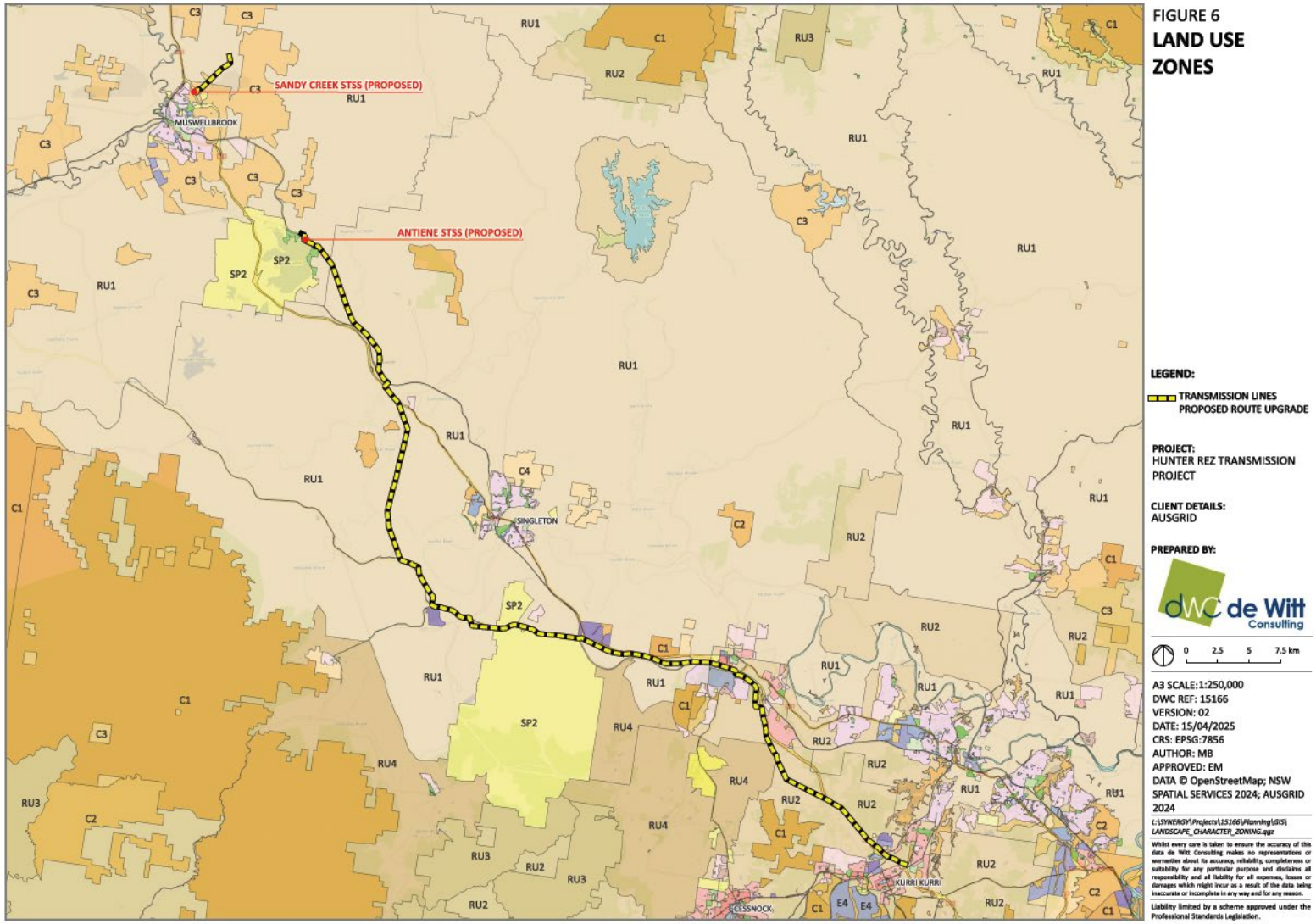


FIGURE 6
LAND USE ZONES

LEGEND:

TRANSMISSION LINES
PROPOSED ROUTE UPGRADE

PROJECT:
HUNTER REZ TRANSMISSION PROJECT

CLIENT DETAILS:
AUSGRID

PREPARED BY:

dwc de Witt Consulting

0 2.5 5 7.5 km

A3 SCALE:1:250,000
DWC REF: 15166
VERSION: 02
DATE: 15/04/2025
CRS: EPSG:7856
AUTHOR: MB
APPROVED: EM
DATA © OpenStreetMap; NSW SPATIAL SERVICES 2024; AUSGRID 2024

L:\SYNERGY\Projects\15166\Planning\GIS\LANDSCAPE_CHARACTER_ZONING.qgz

Figure 6-12: Viewpoint 1 – existing view

Figure 6-13: Viewpoint 1 – proposed view

Figure 6-14: Viewpoint 4 – existing view

Figure 6-15: Viewpoint 4 – proposed view

Figure 6-16: Viewpoint 7 – existing view

Figure 6-17: Viewpoint 7 – proposed view

Figure 6-18: Viewpoint 9 – existing view

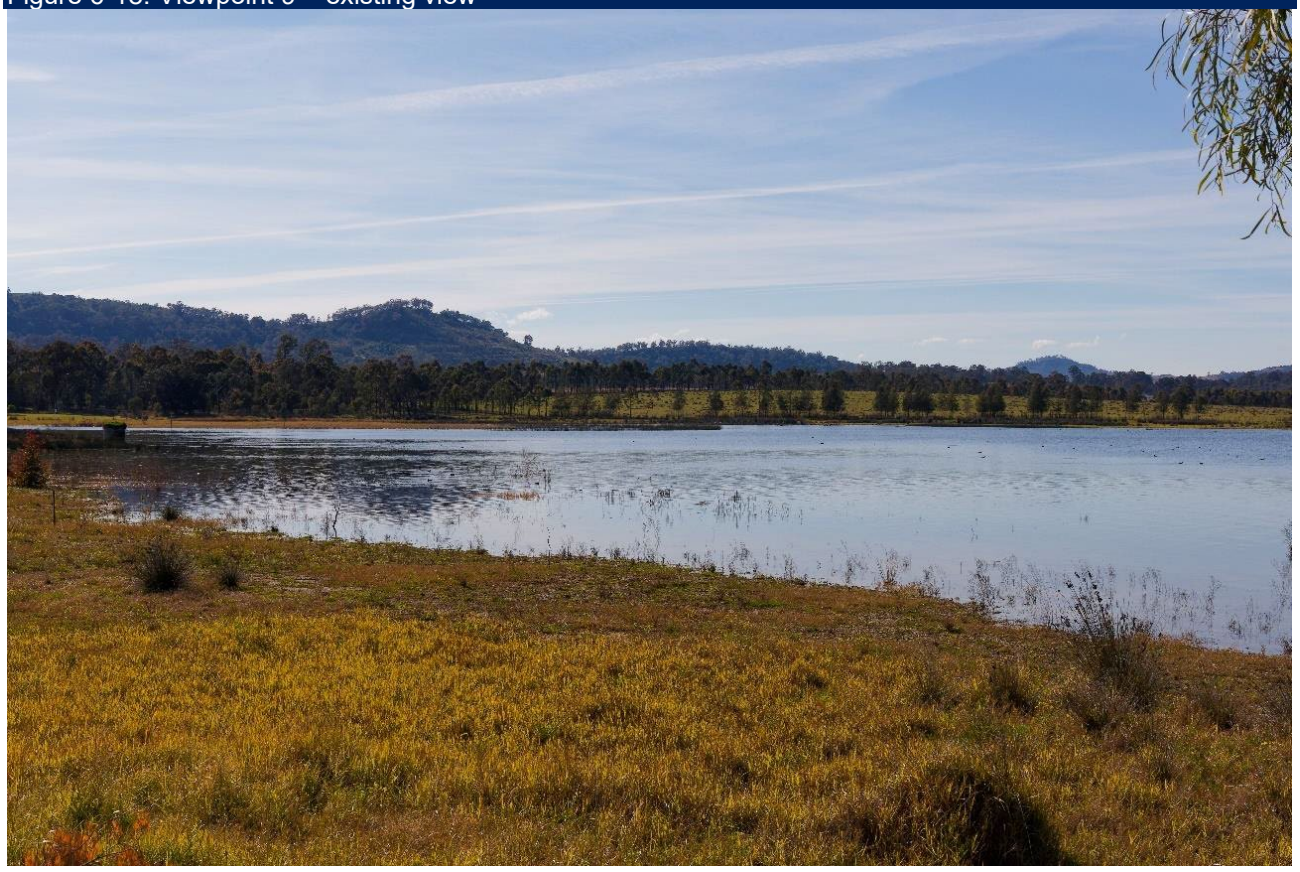
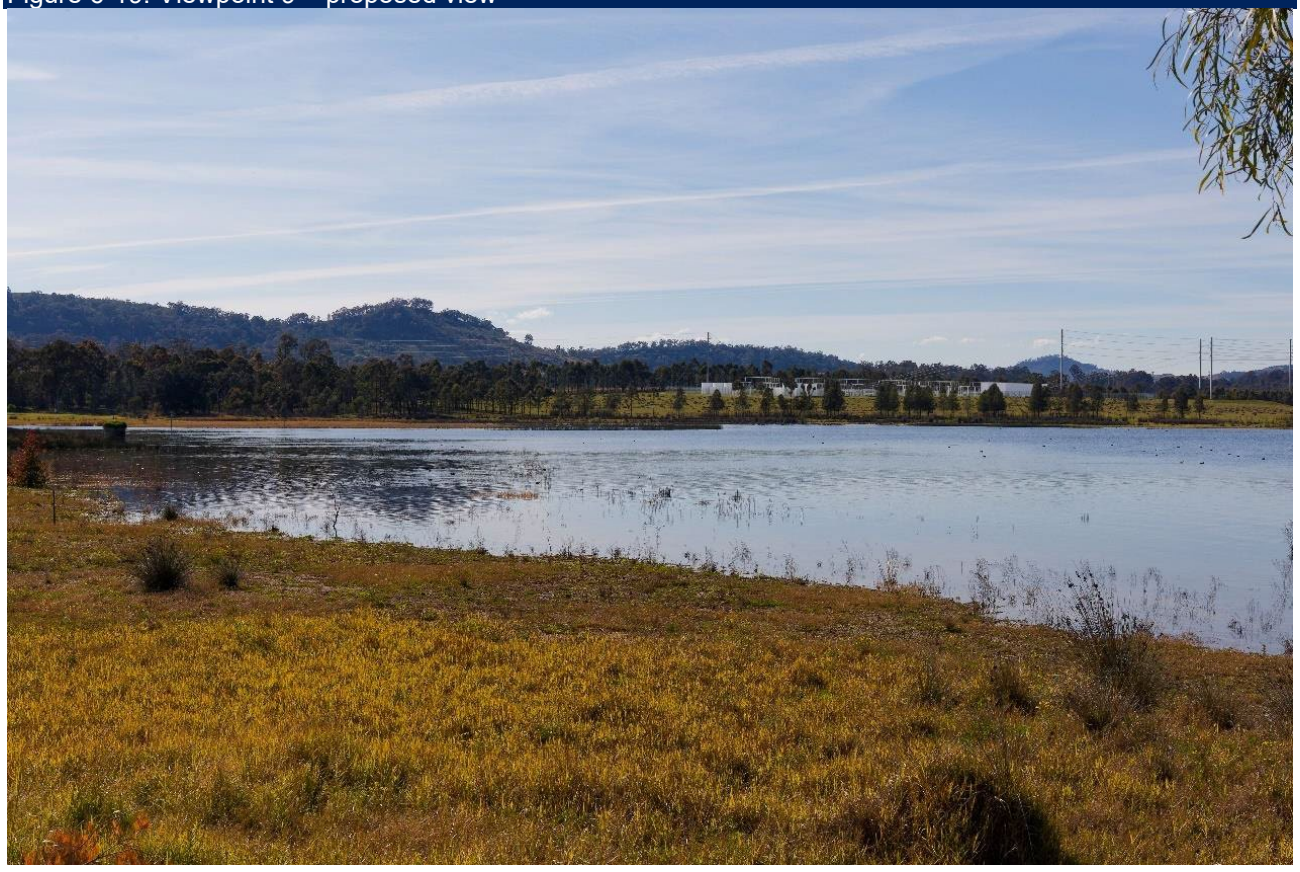


Figure 6-19: Viewpoint 9 – proposed view



6.14.3 Environmental mitigation measures

Visual mitigation measures for the proposal are summarised below.

Table 6-30: Visual mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Consult with affected stakeholders about the proposal.	✓	✓	
Clear the minimum amount of vegetation necessary.		✓	
Reinstate the worksites post works to a suitable condition.			
Viewpoint 2 (De Iuliis Vineyard/Lovedale Wedding Chapel and Reception) • Where possible, use pole colours or materials poles that are consistent with existing poles located along Lovedale Road near Lovedale Road overpass. • Maximise pole spacing to reduce number of new poles. • Consult with customers.	✓	✓	
Clear the minimum amount of vegetation necessary.		✓	
Viewpoint 4 (Sandalwood Vine Resort) – Consultation with customer.		✓	
Viewpoint 9 (Antiene STSS) – • Establish vegetation protection measures during construction and monitoring to protect vegetation along lake foreshore. • Consult with Lake Liddell Recreation Area Manager.		✓	

6.15 Traffic and access

6.15.1 Existing environment

The proposal would generally be within an existing powerline corridor that would be accessed from public roads. There are three Transport for NSW (TfNSW) Classified roads that intersect with the proposed powerline route. They are:

- Hunter Expressway
- New England Highway
- Golden Highway.

Other local and regional roads that intersect with the route include:

- Scales Road, Loxford
- Hart Road, Loxford
- Old Maitland Road, Sawyers Gully
- Lovedale Road, Lovedale
- Talga Road, Lovedale
- Camp Road, Greta
- Tuckers Lane, Greta
- Wine Country Drive, Greta
- Bridge Street, Branxton
- Pothana Lane, Belford
- Belford Street, Belford
- Hermitage Road, Belford
- Range Road, Singleton
- Putty Road, Mt Thorley
- Gouldsville Road, Gouldsville
- Long Point Road W, Gouldsville
- Hebden Road, Ravensworth
- Hebden Road, Hebden.

Transport in the region is heavily reliant on the road network for private vehicle usage and heavy haulage including transport of mining machinery. Any impacts on the road network in the region are quickly amplified with the high volumes of traffic which use the road network daily.

6.15.2 Impact assessment

The proposal involves works within the Hunter Expressway, the Golden Highway and the New England Highway, which are all State Classified roads. An application for consent under S138 of the Roads Act has been submitted to TfNSW. All necessary ROLs and approvals would be gained from the relevant roads authority prior to construction.

During construction approximately up to 150 vehicles would be required on the route at any one time. This is a total across up to 16 separate worksites spread from Kurri to Muswellbrook. Vehicles associated with the proposal would mainly include light vehicles to transport workers to site and heavier vehicles for deliveries and construction. Heavy vehicles along the route are expected to cause some minor disruption to local roads. Construction would also result in temporary changes to traffic arrangements in local roads in some locations along the route. Portions of some roads may need to be blocked and/or speed limited for short periods of time.

Where major road disruption will occur, a traffic management plan (TMP) would be prepared in accordance with the TfNSW Manual Traffic Control at Work Sites and would be implemented during construction. The TMP would also include allocated areas for staff parking.

A traffic control plan (TCP) which shows the traffic control arrangements for the proposed site would be prepared in accordance with Australian Standard 1742.3. The TCP consists of a diagram showing temporary signs and devices arranged to warn traffic and guide it around, past or if necessary, through the proposed site.

Measures would be employed to minimise traffic disruption. The construction would be undertaken by those experienced in such activities along traffic routes. Any disruption, however, cannot be fully avoided, but can be minimised through timing the work to avoid peak traffic flows.

A Road Safety Audit and a Traffic Impact Assessment were completed by Aecom for the existing intersection of the New England Highway with Hebden Road and Hebden Road itself as requested by Muswellbrook Shire Council (see Appendix M). No high risks were identified by the Road Safety Audit. The Traffic Impact Assessment concluded that additional traffic associated with the project would have minor impacts on the surrounding road network.

During operation, the Project would generate up to two vehicle trips per day, occurring infrequently and having negligible impacts on the surrounding roads, including Hebden Road and the New England Highway.

6.15.3 Environmental mitigation measures

Traffic and access mitigation measures for the proposal are summarised below.

Table 6-31: Traffic and access mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Where works are proposed on a classified road, consent is required under section 138(1) of the Roads Act 1993.		✓	
An ROL must be obtained from TfNSW where works are proposed within the boundary of a State Classified Road.		✓	
An ROL must be obtained from Council where traffic will be impacted during the works on Regional Classified and Local Roads.		✓	
Prepare and implement a Traffic Management Plan in accordance with TfNSW/Council requirements.		✓	
Prior to construction, prepare a TCP in accordance with the Australian Standard 1742.3.		✓	
All potentially affected residents and businesses are to be provided with 48 hours' notice of any access changes to properties. Where residents and businesses are directly affected by the work (i.e. their access will be restricted), one week's notice must be given.		✓	
Reinstate roads and public land post works in consultation with council/TfNSW.		✓	
Consider risks identified in the Aecom Road Safety Audit in Traffic Management Plans for works that use Hebden Road.		✓	
Where possible construction activities should avoid the PM peak hour to minimise impacts on the New England Highway and Hebden Road intersection		✓	
Consider reducing the speed limit on Hebden Road between the New England Highway and the site access during peak construction activities.		✓	

6.16 Social and economic

6.16.1 Existing environment

The proposal is located within the Cessnock, Singleton and Muswellbrook Shire LGAs. Land use within the area is characterised by industrial, agricultural, viticulture, mining, defence, bushland and transport corridors.

There is a sport and recreation centre adjacent to the proposed Antiene STSS site. The closest residential area to the proposed Sandy Creek STSS is 430m. The powerlines easements run though residential areas, as well as mining, industrial and agricultural areas.

6.16.2 Impact assessment

6.16.2.1 Employment

About 280 FTE people would be employed during construction of the project. There would be increased demand for skilled and unskilled workforce during construction of the project, which may lead to increased temporary employment opportunities for local and regional residents.

An increased demand in the local labour market due to workforce requirements for the project may result in reduced workforce availability and increased labour cost for local employers, due to the limited available workforce within the local and regional social localities. This may impact the livelihoods of local employers.

6.16.2.2 Local businesses

There is potential for a small number of local and regional businesses to participate in procurement opportunities during construction.

Local businesses may also benefit from construction workers spending wages at local businesses, particularly retail and food and beverage businesses located in nearby suburbs such as Singleton and Muswellbrook which may be visited by workers during their breaks. This may increase revenue at these businesses in the short-term.

Under the NSW Aboriginal procurement policy, it is expected that at least 1.5 per cent of the contract value would contribute towards First Nations businesses, workforce employment, education, training or capability building, which may lead to enhanced opportunities for Indigenous livelihoods, businesses and employment in the local and regional social localities.

6.16.2.3 Social infrastructure

It is expected that most construction workers would be sourced from the Central Coast, Sydney, or Newcastle. These workers are not expected to require accommodation, as they would likely travel to the project site each day for their shifts. A small number of workers with specialist skills may be sourced from further afield. These workers may require temporary accommodation in the local area. Due to the short-term nature of construction contracts, these workers are likely to be accommodated in short-term accommodation options such as tourist parks and holiday accommodation.

While the workforce needs of the project have the potential to result in minor reduced availability for tourists, use of short-term accommodation by construction workers would also be a short-term benefit for local accommodation providers.

6.16.2.4 Traffic

Hebden Road and Sandy Creek Road would be used as haulage routes during STSS construction and would be used by construction traffic. This has the potential to result in intermittent minor delays for people travelling along these routes, however, this is expected to be minor to negligible.

Changes to perceptions of safety for some road users due to increased heavy vehicle traffic along local roads, which may lead to feelings of decreased safety.

Refer to section 6.15.

6.16.2.5 Noise and vibration

The proposal would not exceed the operational criteria, as determined by the Noise and Vibration Impact Assessment.

Refer to section 6.4.

6.16.2.6 Biosecurity

Machinery, vehicles and people entering properties during construction of the project would increase biosecurity threats to local agricultural businesses and farmers.

Biosecurity risks can be effectively managed with controls in NS174C Environmental Handbook for Construction and Maintenance, June 2023.

6.16.2.7 Health

The proposal will operate well within ICNIRP guidelines and produce levels of EMF that are consistent with those that currently exist in the surrounding environment.

The proposal is within bushfire prone land and would comply with all relevant standards. Potential impacts would be appropriately managed with the specific construction controls and setbacks to vegetation.

No residential dwellings would be subject to acquisition for the project, however there may be the requirement to adjust infrastructure on private residential properties (such as agricultural sheds, fencing and gates). Residential development would not be permitted within the transmission line easements.

Refer to sections 6.3 and 6.11.

6.16.2.8 Culture

Potential impacts on First Nations cultural values and wellbeing in the local social locality due to changes to the landscape, access and sites of cultural heritage significance could affect sense of place and cultural connection to Country. The project would result in direct and indirect impacts to a number of Aboriginal sites along the route. Ausgrid has completed extensive assessment of the route in consultation with the aboriginal community. No sites will be disturbed without an approved Aboriginal Heritage Impact Permit.

The proposal will not directly impact any non-Aboriginal heritage.

Refer to sections 6.12 and 6.13.

6.16.2.9 Community investment, social cohesion and resilience

Once operational, the proposal would benefit communities, businesses and industry by increasing the reliability and supporting the growth of renewable energy sources helping drive the transition to net zero and mitigating climate change impacts.

The proposal would contribute to the NSW and Australian governments commitments for increasing the use of clean energy by facilitating an increase in the use of renewable energy.

Other financial benefits may be provided to the community to offset some of the impacts.

6.16.2.10 Visual

Construction of the proposal would result in temporary visual impacts. The main receptors would be road users who pass or those who can see the infrastructure from neighbouring properties. However, this impact would be short term and be mitigated with progressive rehabilitation of disturbed areas and maintaining construction areas in a tidy condition throughout construction.

The effect of the proposal on the landscape and its character is determined to be of moderate-low significance overall.

Vegetation screening will be considered on the Antiene STSS site in consultation with the Lake Liddell Recreation Area and the local land care group.

Refer to section 6.14.

6.16.3 Environmental mitigation measures

Mitigation measures proposed to avoid or minimise potential social and economic impacts during construction, operation, and decommissioning and rehabilitation of the project are listed in Table 6.32

Table 6-32: Social and economic mitigation measures

Outcome	Mitigation measure	Timing
Implementation of ongoing, regular, and transparent communication with stakeholders	Ausgrid would continue to manage and deliver community and stakeholder engagement in the lead up to construction of the project. This would help to ensure that: • the community and stakeholders have a high level of awareness of all processes and activities • he community and stakeholders are made aware of any potential disturbances and/or disruptions well in advance of them occurring • accurate and accessible information is made available • a timely response is given to issues and concerns raised by the community • feedback from the community is encouraged • opportunities for input are provided	Pre-construction
Ongoing community engagement during construction activities	A project-specific communication management plan would be developed in accordance with the Community and Stakeholder Engagement Strategy and implemented to define the specific requirements for engagement during delivery of the project. This would be developed and implemented to ensure that residents and stakeholders are notified in a timely manner about works activities and potential for impacts, accurate information is accessible, and enquiries and complaints are managed in a timely manner. The plan would include approaches and protocols to: • communicating and notifying potentially affected residents and stakeholders about work activities and potential for impacts • communicating accurate project information. • requirements for the complaints management system to be implemented throughout the duration of the project, including phone line, postal and email address for written enquiries, and publication of contact details.	Construction
Local and Indigenous employment and procurement	Ausgrid would develop and implement an industry and Aboriginal participation plan. This will include: • investigating opportunities for the delivery of training and upskilling programs for local labour force • strategies for maximising local training and employment opportunities for residents, especially for First Nations people • initiatives to promote local employment, such as early engagement with local employment agencies and council, communication of employment opportunity via relevant local mediums of information, contract workers through existing local businesses, etc.	Pre-construction and construction

Outcome	Mitigation measure	Timing
Property value/acquisition	Ausgrid would develop a Landowner Engagement Strategy will be developed and implemented for the project which will include the following: • appointment of a dedicated Land Acquisition Manager to oversee the implementation of the strategy • ensure personnel appointed to engage with landowners have been suitably trained to undertake engagement with vulnerable people and those potentially affected by mental health issues.	Pre-construction and construction
First Nations liaison	Ausgrid has a project specific First Nations Officer who will focus on identifying and implementing strategies to enhance and maximise opportunities for employment, procurement, education and other potential project related benefits.	Pre-construction and construction
Complaints management	A complaints management system will be maintained throughout the construction period. The complaints management system will include the following (at a minimum): • contact details for a response phone line and email address for ongoing stakeholder contact throughout the project • details of all complaints received will be recorded • verbal and written responses describing what action will be taken will be provided to the complainant (or as otherwise agreed by the complainant).	Pre-construction and construction

In relation to the economic benefits of the project, the project represents a direct capital investment of approximately $0.6 billion in the state of NSW which is further increased through the multiplier effect when considering indirect employment and other flow-on economic benefits.

6.17 Cumulative impact

6.17.1 Existing environment

Cumulative impacts may be experienced due to the interaction of elements within the proposal, or with other existing or proposed developments within the locality. Where possible, the cumulative impact associated with the proposal has been incorporated into the assessments within this REF.

Ausgrid projects typically have related projects and flow on activities due to the interconnected nature of the network (refer to section 1.4). Other Ausgrid activities with potentially cumulative impacts include:

- Early works distribution 11kV/400V network relocations to facilitate main subtransmission work
- Secondary systems upgrades: Upgrade of 132kV feeder protection relays at various substation in the Upper and Lower Hunter Networks to meet compliance requirements with the National Electricity Rules
- Berowra to Somersby Optical Pilot Ground Wire (OPGW) and All-Dialiectric Self-Supporting fibre (ADSS): Replacement of approximately 30km of Overhead Earthwire (OHEW) with Optical Pilot Ground Wire (OPGW) and All-Dielectric Self-Supporting fibre (ADSS) on existing overhead lines between Berowra and Somersby
- Antiene STSS to Muswellbrook BSP underground Fibre Optic cable installation.

Other non-Ausgrid activities with potentially cumulative impacts include:

- Firm Power Battery Energy Storage System
- Hunter Transmission Project
- Muswellbrook Solar Farm

- Terrain Solar (solar farm in Maison Dieu)
- Port to REZ – 11kV underbore of Mitchell Line Rd (May 2025)
- Port to REZ – upgrade of Mitchell Line Rd and Putty Rd intersection
- Emigrant Creek crossing upgrade (Mitchell Line Rd)
- Muddies Creek crossing upgrade (Mitchell Line Rd)
- Singleton Bypass (in construction)
- Muswellbrook Bypass (pending approval).

6.17.2 Impact assessment

The potential impact due to the interaction of elements within the proposal, or with other existing or proposed developments within the locality is summarised below.

Table 6-33: Summary of cumulative impacts

Potential impact	Other activities with cumulative impacts	Contribution to overall impact	REF section
Noise	*Construction and operational noise from the proposal is listed in section 6.4.*	Council was consulted in relation to other development in the area. *Council submissions have been given due consideration.* *Noise impacts during the construction phase would be localised and short term.* *The specialist noise assessments considered the cumulative impact of the construction and operation of the HCC REZ.*	*6.4*
EMF	*Existing Ausgrid and Transgrid powerlines, existing Muswellbrook STS, Kurri STS, Rothbury ZS.*	*The specialist EMF assessment considered the cumulative impact of the operation of the HCC REZ.* *Council was consulted in relation to other development in the area. Council submissions have been given due consideration.*	6.3
Traffic	*Traffic from construction and operation listed in section 6.15*	*The specialist Traffic assessment considered the cumulative impact of the operation of the HCC REZ at Hebden Road.* *Council was consulted in relation to other development in the area. Council submissions have been given due consideration.*	6.15
Flora and fauna	*Flora and fauna impacts from powerline and switching station construction activities listed in section 6.10.*	*The specialist flora and fauna assessment considered the cumulative impact of the construction of the HCC REZ.* *Council was consulted in relation to other development in the area. Council submissions have been given due consideration.*	6.10

Potential impact	Other activities with cumulative impacts	Contribution to overall impact	REF section
Visual	*Visual impacts from construction and operation activities listed in section 6.14.*	*The specialist Landscape Character and Visual Impact Assessment considered the cumulative impact of the construction of the HCC REZ.* *Council was consulted in relation to other development in the area. Council submissions have been given due consideration.*	6.14
Resources	*Materials as listed in section 2.1.14 and 2.2.14 are required for the proposal.*	*These materials are not currently in short supply, and it is not anticipated that the proposal would substantially increase the demand on these resources.* *The proposal would not have a major impact on the demand on resources.*	2.1.14 and 2.2.14

6.17.3 Environmental mitigation measures

Cumulative mitigation measures for the proposal are summarised in Table 6-34.

Table 6-34: Cumulative impacts mitigation measures

Mitigation measures	Implementation of mitigation measures		
	Design	Construction	Operation
Attend EnergyCo coordination meetings	✓		
Consult with HTP to minimise cumulative impacts at Mt Thorley		✓	
Consult with Firm Power re: construction impacts at Muswellbrook STS site		✓	
Undertake regular consultation with TfNSW, Cessnock Council, Singleton Council and Muswellbrook Council during design development and construction phases to minimise cumulative impact on community and other projects		✓	

7 Consideration of environmental factors

7.1 Section 171 factors

In accordance with section 171 of the EP&A Regulations, the following factors were considered for the proposal.

Table 7-1: Consideration of section 171 factors

Section 171 factors	Key REF sections giving consideration to the factors
Impact on a community	3 Stakeholder and community consultation, 6.1 Land use, 6.3 Electric and magnetic fields, 6.4 Noise and vibration, 6.14 Visual and aesthetics, 6.15 Traffic and access, 6.16 Social and economic.
Transformation of a locality	6 Environmental assessment
Impact on the ecosystem of the locality	6.10 Flora and fauna and 6.11 Bush fire

Section 171 factors	Key REF sections giving consideration to the factors
Reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	6 Environmental assessment
Effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	6 Environmental assessment
Impact on the habitat of protected fauna	6.10 Flora and fauna
Endangering any species of animal, plant or other form of life, whether living on land, in water or in the air	6.10 Flora and fauna
Long-term effects on the environment	6 Environmental assessment
Degradation of the quality of the environment	6 Environmental assessment
Risk to the safety of the environment	6.2 Climate change, 6.3 Electric and magnetic fields, 6.4 Noise and vibration, 6.8 Contamination, 6.9 Waste
Reduction in the range of beneficial uses of the environment	6.1 Land use
Pollution of the environment	6.4 Noise and vibration, 6.6 Water quality and hydrology, 6.8 Contamination, 6.9 Waste
Environmental problems associated with the disposal of waste	6.9 Waste
Increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	2 Description of the proposal and 7.2 Matters of national environmental significance
Cumulative environmental effect with other existing or likely future activities	6.17 Cumulative impact
Impact on coastal processes and coastal hazards, including those under projected climate change conditions	6.2 Climate change and 6.6 Water quality and hydrology

7.2 Matters of national environmental significance

In accordance with the EPBC Act, the following matters of NES were considered for the proposal[xix].

Table 7-2: Consideration of matters of NES

Matters of NES	Comment	Likely impact
World Heritage Properties	No world heritage properties would be potentially affected by the proposal	Nil
National Heritage Places	No national heritage places would be potentially affected by the proposal	Nil
Wetlands of International Importance	No wetlands of international importance would be potentially affected by the proposal	Nil

Matters of NES	Comment	Likely impact
Commonwealth listed Threatened Species and Ecological Communities	Three threatened species, no populations and three ecological communities listed within Commonwealth (or State) legislation would be potentially affected by the proposal	Minor
Commonwealth listed migratory species	Eleven migratory species would be potentially affected by the proposal	Minor
Nuclear action	The proposal would not involve any nuclear action nor would it require any nuclear action to be undertaken	Nil
Commonwealth marine areas	No Commonwealth marine areas would be potentially affected by the proposal	Nil
Great Barrier Reef Marine Park	The Great Barrier Reef Marine Park would not be affected by the proposal as it is not located within Ausgrid's network area	Nil
Water resource, in relation to coal seam gas development and large coal mining development	The proposal would not involve any coal seam gas development or large coal mining development	Nil

7.3 Ecologically sustainable development

The proposal has been assessed against the following four principles of ecologically sustainable development (ESD) as listed in the *Protection of the Environment Administration Act 1991 (NSW)*.

7.3.1 Precautionary principle

The precautionary principles (s. 6 (2) (a)) states that: *'If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.*

When the precautionary principle applies, measures taken must be proportionate to the level of threat. In assessing the level of threat and determining a proportional response, Ausgrid is guided by the relevant regulators and health authorities who are charged with the responsibility for providing such advice.

A range of specialist environmental investigations including ecology, Aboriginal heritage, noise, visual, traffic and EMF have been undertaken during the preparation of this REF to ensure that the potential environmental impacts are understood with a degree of certainty. The design for the proposal has evolved to avoid environmental impacts where practical and mitigation measures have been recommended to minimise adverse impacts to within acceptable levels.

The proposal is therefore considered to be consistent with the precautionary principle.

7.3.2 Inter-generational equity

The principle of inter-generational equity (s. 6 (2) (b)) states 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.'*

A key environmental benefit of the proposal is that it would enable greater renewable integration by providing storage, energy firming and improving system strength. As such the proposal would help reduce GHG emissions that would otherwise be generated from conventional thermal power plants. The reduction in GHG emissions would have a positive impact on climate change and help facilitate the transition to a more diversified energy mix where renewable energy plays a larger part in providing electricity in line with NSW government policies and strategies.

The proposal is consistent with the principle of inter-generational equity.

7.3.3 Biodiversity conservation

The principle of biological diversity and ecological integrity (s. 6 (2) (c)) states that: *'Conservation of biological diversity and ecological integrity should be a fundamental consideration.'*

A flora and fauna assessment was undertaken to give due consideration to the proposal's potential impact on the biological diversity and ecological integrity of the study area. (Refer to section 6.10 and Appendix I).

The assessment concluded that the proposed REZ Project will result in an incremental reduction/modification of habitat, however taking into consideration the mitigation measures the proposal is unlikely to have a significant impact on any addressed threatened species, endangered population or threatened ecological community.

7.3.4 Improved valuation of resources

The principle of improved valuation of environmental resources (s. 6 (2) (d)) states that: *'Environmental factors should be included in the valuation of assets and services.'*

This principle explains that those who generate pollution and waste should bear the cost of containment, avoidance and abatement; the users of goods and services should pay prices based on the full life cycle of costs; and environmental goals should be pursued in the most cost-effective way.

All costs associated with the containment, avoidance and abatement of pollution have been factored into the design of this proposal and Ausgrid's operations generally.

The proposal is consistent with the principle of improved valuation of environmental resources.

8 Summary of impacts

A summary of the individual impacts for the proposal is presented below Table 8-1.

Table 8-1: Summary of impacts

Issue	Comment	Likely significant impact
Land use	Apart from some short term construction impacts, the proposal would not restrict access and is consistent with current land uses. The proposal would facilitate existing and future surrounding land uses by providing a reliable and sustainable supply from the electricity network.	No
Climate change	The proposal has taken into account predicted climate change impacts. The proposal will facilitate NSW's transition to clean energy and, as such, the proposal is facilitating a positive impact on the environment.	No
Electric and magnetic fields	EMF levels will be well within the ICNIRP 2010 Public Reference Levels and there are no further ways to reduce exposure consistent with prudent avoidance (i.e. very low cost and without unduly compromising other issues).	No
Noise and vibration	The proposal may result in some minor exceedances of the noise management levels at Antiene and Kurri as determined by the Noise and Vibration Impact Assessment. Potential impacts would be appropriately managed with the specific construction controls. The proposal would not exceed the operational criteria, as determined by the Noise and Vibration Impact Assessment.	No
Air quality	Impacts to air quality would be predominantly associated with construction activities. Several mitigation measures (described in section 5.5.3) would be implemented to ensure the amount of dust and emissions generated is minimal and would not affect the surrounding environment.	No
Hydrology	The proposal may involve discharges of accumulated water however, potential impacts would be appropriately managed with the specific construction controls. Adequate storage and refuelling controls would be installed to mitigate impacts from leaks and spills associated with oils, fuels and chemicals.	No
Geology and soil	Potential impacts would be predominantly associated with construction activities and sediment control. Potential impacts would be appropriately managed with a proposal specific ESCP/SWMP.	No
Contamination	No part of the proposal is listed on council or the EPA's contaminated land register. Minor known contamination identified at one location would be managed in accordance with the mitigation measures outlined in section 6.8.	No
Waste	Waste generated by the proposal would be classified, handled, transported, stored, tracked and disposed in accordance with relevant guidelines, procedures and existing licences.	No

Issue	Comment	Likely significant impact
Flora and fauna	A number of threatened species, and ecological communities would be potentially affected by the proposal. However, impacts are considered incremental and a Specialist Assessment concluded that the proposal is unlikely to have a significant impact on any addressed threatened species, endangered population or threatened ecological community.	No
Bushfire	The proposal is within bushfire prone land and would comply with all relevant standards (including Ausgrid's NS187 and TG 107). Potential impacts would be appropriately managed with the specific construction controls and setbacks to vegetation.	No
Aboriginal heritage	The proposal has been modified to avoid known aboriginal sites and identified areas of sensitivity where possible. An Aboriginal Heritage Impact Permit will be obtained for impacts to sites that cannot be avoided and to cover unexpected finds within the project footprint. The Aboriginal Cultural Heritage Assessment (ACHAR) and AHIP will be developed in consultation with Registered Aboriginal Parties in accordance with the ADD Guideline.	No
Non-Aboriginal heritage	There will be no impacts to Non-Aboriginal heritage items.	No
Visual and aesthetics	The proposed powerlines would generally be constructed along Ausgrid's existing 66kV and 132kV powerline corridors. All reasonable ways to further reduce visual impacts have been considered. A specialist assessment concluded that the effect of the proposed works on the landscape and its character is determined to be of moderate-low significance overall.	No
Traffic and access	Works on a classified road would comply with the relevant TfNSW approval and road occupancy licence (ROL) requirements. No other significant access corridors would be restricted. Affected residences and businesses would be consulted about the schedule of work. The proposal would not prevent access or mobility for people with disabilities.	No
Social and economic	The proposal may result in positive impacts for employment and local businesses in the area. Once operational, the proposal would benefit communities, businesses and industry by increasing the reliability and supporting the growth of renewable energy sources helping drive the transition to net zero and mitigating climate change impacts. The proposal will comply with all relevant guidelines in relation to noise, EMF and traffic and access. Other impacts can be effectively managed with controls outlined in this assessment.	No
Cumulative impact	Cumulative impacts from other projects/proposals within the area would be effectively managed with the specific construction controls.	No

Several potential environmental impacts from the proposal have been avoided or reduced during the design development and options assessment. The residual impacts will comply with relevant standards and legislative requirements and can be effectively managed with existing procedures including the controls in NS174C Environmental Handbook for Construction and Maintenance, June 2023.

A key driver for this proposal is to facilitate NSW's transition to clean energy and, as such, the proposal is facilitating a positive impact on the environment.

On this basis, it is concluded that the proposal and adopted mitigation measures will result in an overall environmental impact that is minor and neither extensive nor complex and is not likely to significantly affect the environment.

9 Environmental management

9.1 Construction environmental management

A construction environmental management plan (CEMP) outlines the environmental objectives of a proposal, the environmental construction mitigation measures to be implemented, the timing of implementation, responsibilities for implementation and management, and a review process to determine the effectiveness of the strategies.

Once the construction methodology is known, the construction contractors would be responsible for developing a CEMP that addresses their scope of works to be undertaken, including site specific, measurable and achievable actions to the CEMP and the preparation of any appropriate work methods or sub plans.

The CEMP documents all the procedures and processes necessary to ensure that all personnel comply with:

- legislative requirements and relevant non-statutory policies
- specific environmental construction mitigation measures described in section 6 of this REF
- requirements outlined in any relevant approvals, permits or licences
- NS174C Environmental Handbook for Construction and Maintenance, June 2023.

The CEMP would typically:

- establish environmental goals and objectives
- detail the conditions of approval
- list actions, timing and responsibilities for implementation that arise from the construction mitigation measures recommended in this REF
- detail statutory requirements
- provide a framework for reporting on relevant matters on an ongoing basis
- detail training requirements for personnel in environmental awareness and best practice environmental management system
- detail emergency procedures, including contact names and corrective actions
- detail process surveillance and auditing procedures
- list complaint handling procedures
- detail quality assurance procedures.

The CEMP would be submitted to Ausgrid a minimum of two weeks prior to the commencement of works. The CEMP would be reviewed by an Environmental Officer prior to the commencement of any site works for an adequacy review to determine that the CEMP effectively addresses the scope of works to be undertaken, addresses the objectives described above and generally meets the requirements outlined in the Guideline for the Preparation of Environmental Management Plans[xx].

No works covered by this REF would be permitted to commence until a suitable CEMP is prepared and reviewed as adequate by Ausgrid.

It is also noted that the CEMP would be a working document and would be amended and continually improved over time. This would occur when there is a change in scope, during the review process or when processes or strategies are found to be inadequate to mitigate potential environmental harm.

If an activity falls outside the scope of the REF (as defined by section 2) or if the mitigation measures outlined in section 6 cannot be implemented, then an additional approval would be required. The activity is not permitted to continue without an appropriate environmental assessment under the EP&A Act.

9.2 Implementation

The construction contractors would be responsible for implementing these controls during construction.

All personnel working on the proposal must be aware of their environmental obligations, responsibilities and have received the necessary training to meet the environmental obligations associated with their duties, as specified in the CEMP. Site induction training would be undertaken for all personnel to highlight sensitive

work areas, explain the requirements of the CEMP, outline an individual's responsibilities and inform all personnel of emergency response procedures. Documented evidence of such training would be available before commencing work on-site.

Prior to works commencing:

- emergency procedures would be displayed in a prominent position within the site working area
- a person would be allocated for the dissemination of general information on the site operations
- a contact person and contact numbers would be identified for receiving comments or complaints from the community
- a register for complaints would be established and maintained for the full duration of the work. The register would record details of complaints, complainant contact information and action taken to address complaints.

Auditing of the construction would be undertaken in accordance with the relevant international and Australian standards[xxi] to establish whether the Contractor is conducting activities in accordance with their current CEMP and whether the CEMP is an effective tool to control adverse environmental impacts. Recommendations regarding improvements to the CEMP must be incorporated as soon as practicable.

An Environmental Officer would be appointed to the proposal. The Environmental Officer has the authority to stop works if it is deemed necessary to mitigate potential environmental harm.

9.3 Operational environmental management

An operation environmental management plan (OEMP) may be required to minimise the potential environmental impacts from operational and maintenance activities conducted as a result of the proposal.

Usually, it will be the case that Ausgrid network standards, operating procedures and environmental guidelines will be sufficient to fulfil the requirements of an OEMP

However, where current Ausgrid network standards, operating procedures and environmental guidelines do not address specific requirements of the REF or a licence, permit or approval of a regulatory authority a specific OEMP may be required to be prepared. The specific OEMP would allow for operational and maintenance procedures and activities post construction to be consistent with the environmental outcomes stipulated in the REF.

The requirement of an OEMP would generate a "Hold Point" in the REF and would be required to be released prior to operation of the asset commencing. The need for OEMP has been assessed as part of this REF. Given the HCC REZ project would become a part of the overall Ausgrid network once commissioned, a specific OEMP is not required.

10 Summary and conclusion

This REF assesses the potential impacts of the proposal to construct, operate and maintain REZ network infrastructure (RNI) required to achieve the 1GW network capacity for the Hunter-Central Coast Renewable Energy Zone. Ausgrid as an Authorised Network Operator is a prescribed Determining Authority for the purposes of Division 5.1 of the EP&A Act and is defined as a “Public Authority” under Schedule 1 of the EP&A Regulations.

This prescription allows Ausgrid to be a Part 5 Determining Authority for Development for the purposes of an electricity transmission or distribution network. As a Determining Authority, Ausgrid can assess and self-determine activities that are not likely to significantly affect the environment and are conducted by, or on our behalf, for the purpose of electricity transmission or distribution.

This REF forms that Part 5 assessment and was undertaken in accordance with section 171(2) of the Environmental Planning and Assessment Regulation 2021 (NSW) and the Planning Code.

Based on this REF, it is concluded that the proposal:

- is not likely to significantly affect the environment
- is not likely to significantly affect threatened species, ecological communities or their habitats
- will not be carried out on land that is, or is part of a declared area of outstanding biodiversity value
- is not likely to have a significant impact on matters of NES, or a significant impact on the environment (for actions on Commonwealth land) or a significant impact on the environment on Commonwealth land (for actions outside Commonwealth land).
- in making these conclusions, consideration of environmental significance was made with regard to clause 171 of the EP&A Regulations and the Planning Code.

The Hunter-Central Coast REZ Project REF assesses the potential impacts of the proposal to construct, operate and maintain the HCC REZ package of works.

Ausgrid is a statutory State-Owned Corporation and is a determining authority as defined in the EP&A Act. The proposal satisfies the definition of an activity under the EP&A Act, and as such, Ausgrid as a proponent and determining authority, must assess and consider the environmental impacts of the proposal before determining whether to proceed.

This REF examines and takes into account to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activities outlined in the section 21.3. This REF fulfils the requirements of section 5 of the EP&A Act and clause 171 of the EP&A Regulation, which sets out environmental factors to be considered in making the assessment.

On the basis of this REF, it is concluded that the proposal:

- is not likely to significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats
- is not on land that is part of critical habitat
- is not likely to have a significant impact on matters of NES, or a significant impact on the environment (for actions on Commonwealth land) or a significant impact on the environment on Commonwealth land (for actions outside Commonwealth land).

In making these conclusions, consideration of environmental significance was made regarding clause 171 of the EP&A Regulations and the *Code of Practice for Authorised Network Operators.*

REF Sign off Page to be completed post Exhibition.

APPENDIX A Drawings

APPENDIX B Desktop assessment results

APPENDIX C Consultation

APPENDIX D Approvals

APPENDIX E EMF Assessment

APPENDIX F Noise Impact Assessment

APPENDIX G Geotechnical Investigations

APPENDIX H Contamination Reports

APPENDIX I Ecological Assessment Report

APPENDIX J Bushfire Assessment Reports

APPENDIX K Aboriginal Heritage

APPENDIX L Landscape Character and Visual Impact Assessment

APPENDIX M Traffic Assessment

APPENDIX N Glossary

Term	Meaning
Aboriginal heritage	Any deposit, object, place or material evidence relating to Aboriginal habitation or places having significance to Aboriginal culture as declared by the Minister which is protected under the NPW Act and EPBC Act.
AHD	Australian Height Datum
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASS	Acid sulfate soils: are naturally occurring sediments and soils containing iron sulphides (principally pyrite) and/or their precursors or oxidation products. This includes Actual and Potential acid sulfate soils. Both can be found within the same soil profile.
BC Act	*Biodiversity Conservation Act 2016*
BCA	*Building Code of Australia* (Australian Building Codes Board, 2011): is Volumes One and Two of the National Construction Code (NCC) which is an initiative of the Council of Australian Governments developed to incorporate all on-site construction requirements into a single code. The BCA is produced and maintained by the Australian Building Codes Board on behalf of the Australian Government and State and Territory Governments. The BCA has been given the status of building regulations by all States and Territories.
BESS	battery energy storage system
Blue Book	*Managing Urban Stormwater - Soils and Construction* (Landcom, 2004)
CEMP	construction environmental management plan
Classified road	The *Roads Act 1993* provides for roads to be classified as Freeways, Controlled Access Roads, Tollways, State Highways, Main Roads, Secondary Roads, Tourist Roads, Transitways and State Works.
CPESC	Certified Professional in Erosion and Sediment Control
dB(A)	decibels (A) weighted
Determining authority	Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out.
DPHI	Department of Planning, Housing and Infrastructure (NSW)
EEC	Endangered Ecological Community: an assemblage of plant species that is recognisably different from other communities due to differences in species present and structure. The species form complex interactions with not only other species, but also elements of the landscape including underlying geology, aspect and altitude, and external influences such as fire frequency. Many ecological communities have limited natural distributions and are vulnerable to change, while others historically occurred over a wider area and are threatened by changes due to broad scale clearing, fragmentation, invasion by weeds, fire frequency or hydrological regime.
EIS	environmental impact statement
ELF	extremely low frequency
Embodied energy	Embodied energy corresponds to the energy consumed by all of the processes associated with the production of building materials and components.

Term	Meaning
EMF	Electric and Magnetic Fields: are part of the natural environment and are also produced wherever electricity or electrical equipment is in use. Powerlines, electrical wiring, household appliances and electrical equipment all produce EMF. The electric field is proportional to the voltage and remains constant. The magnetic field is proportional to the load and varies continually depending on the time of day, week and year. As electric fields are naturally shielded, the electricity network generally contributes very little to the electrical fields measured inside a home or office building. For this reason most discussion on EMF usually focuses on magnetic fields.
Environmental impact	Any change in the environment whether adverse or beneficial, wholly or partially resulting from organisation activities, products or services.
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EP&A Regulations	*Environmental Planning and Assessment Regulation 2021*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ES Act	*Electricity Supply Act 1995* (NSW)
ESCP	erosion and sediment control plan
GHG	greenhouse gas
GIS	gas insulated switchgear
Hazards SEPP	*State Environmental Planning Policy (Resilience and Hazards) 2021*
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IECA	International Erosion Control Association
kg	kilogram
kV	kilovolts
L_{eq}	
Likelihood	A qualitative description of probability or frequency
Local heritage item	A place, building, work, relic, tree, archaeological site or Aboriginal object that is identified as a heritage item (or by a similar description) in a local or regional environmental plan; or an item of local heritage significance, as defined by the *Heritage Act 1977*, that is the subject of an interim heritage order in force under that Act or is listed as an item of local heritage significance in the State Heritage Inventory under that Act.
M	metre
mm	millimetre
mG	milligauss
MW/MWH	Megawatt/megawatt hour
NES	national environmental significance

Term	Meaning
Non-Aboriginal heritage	Any deposit, object or material evidence which relates to the settlement of NSW, not being Aboriginal settlement, with local or state significance under the *Heritage Act 1977*.
NPW Act	*National Parks and Wildlife Act 1974*
PCS	power conditioning system
PHA	preliminary hazard analysis
Planning Code	*NSW Code of Practice for Authorised Network Operators, 2015*
Planning SEPP	*State Environmental Planning Policy (Planning Systems) 2021*
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Powerlines	Powerlines are structures used to transmit electrical energy, consisting of conductors suspended by towers or poles.
Proponent	The person proposing to carry out the activity, and includes any person taken to be the proponent of the activity by virtue of section 110B of the EP&A Act.
Road	Includes the airspace above the surface of the road, the soil beneath the surface of the road and any bridge, tunnel, causeway, road-ferry, ford or other work or structure forming part of the road. The road reserve is inclusive of the carriageway and the footpath.
Roadwork	Includes any kind of work, building or structure (such as roadway, footway, bridge, tunnel, road-ferry, rest area, transit way station or service centre or rail infrastructure) that is constructed, installed or relocated in the vicinity of a road for the purpose of facilitating the use of the road as a road, the regulation of traffic on the road or the carriage of utility services across the road, but does not include a traffic control facility. Carry out road work includes any activity in connection with the construction, erection, installation, maintenance, repair, removal or replacement of a road work.
SER	Summary environmental report
SF6	Sulphur hexafluoride
SHR	State Heritage Register
SRZ	Structural Root Zone
SSD	State Significant Development
SSI	State Significant Infrastructure
Subtransmission	That part of the power system that delivers electricity from the transmission system to the distribution network. In the Ausgrid network subtransmission voltages range from 33kV to 132kV.
SWMP	soil and water management plan
TCP	traffic control plan
TfNSW	Transport for NSW
TMP	traffic management plan
Transport & Infrastructure SEPP	*State Environmental Planning Policy (Transport and Infrastructure) 2021*
V	volt: the unit of measure for voltage which is the pressure that electricity is pushed through the wire.

Term	Meaning
Vibration	Mechanical oscillations about an equilibrium point. Vibration can be caused by many different external sources, including industrial, construction and transportation activities. The vibration may be continuous (with magnitudes varying or remaining constant with time), impulsive (such as in shocks) or intermittent (with the magnitude of each event being either constant or varying with time).
WHO	World Health Organisation

References

[1] Transport for NSW, Concrete Washout Guideline, June 2023
[2] NSW Department of Primary Industries, Policy and guidelines for fish habitat conservation and management update 2013
[3] Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries.
[4] Landcom, Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004
[5] Department of Environment, Climate Change and Water (DECCW), Aboriginal cultural heritage requirements for proponents, 2010,
[6] NSW Department of Planning and Environment, NSW Code of Practice for Authorised Network Operators, September 2015
[7] Ausgrid, NS174C Environmental Handbook for Construction and Maintenance, June 2023
[8] Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia
[9] ICNIRP, 2010, Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)
[10] IEEE, 2019, C95.1, Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz
[11] ARPANSA, Extremely low frequency electric and magnetic fields <www.arpansa.gov.au>
[12] Gibbs, Sir Harry (1991). Inquiry into community needs and high voltage transmission line development. Report to the NSW Minister for Minerals and Energy. Sydney, NSW: Department of Minerals and Energy, February 1991
[13] Peach H.G., Bonwick W.J. and Wyse T. (1992). Report of the Panel on Electromagnetic Fields and Health to the Victorian Government (Peach Panel Report). Melbourne, Victoria: September, 1992. 2 volumes: Report; Appendices
[14] NSW Rural Fire Service, Planning for Bush Fire Protection 2019
[15] Ausgrid, Tree Safety Management Plan, September 2023
[16] ISSC3, Guide for the Management of Vegetation in the Vicinity of Electricity Assets, November 2016
[17] Commonwealth Department of Environment, *Australian Heritage Database*, Canberra, viewed date month 2011, <www.environment.gov.au/cgi-bin/ahdb/search.pl>
[18] Landscape Institute & IEMA, Guidelines for Landscape and Visual Impact Assessment, Third Edition 2013
[xix] Commonwealth Department of Environment, *Protected Matters Search*
[xx] Department of Infrastructure, Planning and Natural Resources (DIPNR), *Guideline for the Preparation of Environmental Management Plans*, 2004,
[xxi] ISO, *ISO 14001:2015 Environmental management systems - Requirements with guidance for use,* 2004.