SER Decision Statement

Newcastle 330 kV substation – new synchronous condenser

Proposed activity summary

Transgrid is the proponent for the installation and operation of two new synchronous condensers (syncons) and associated equipment at the existing Newcastle 330 kV substation (the proposed activity). The proposed activity would include construction of a new access road off Killingworth Road, new bench and 330kV busbar extension and installation of the new sycon and associated equipment.

The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the NSW power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their *2022 System Strength Report* (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

A Summary Environmental Report (SER) was prepared by AECOM (November 2025) to assess the potential impacts of the proposed activity. The SER was prepared in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), clause 171 of the *Environmental Planning and Assessment Regulation 2021* and the NSW Code of Practice for Authorised Network Operators (the Code).

Determination

I, GRANT WARNSBY, as an authorised person on behalf of Transgrid, have examined and considered the SER for the installation and operations of two syncons and associated equipment at the existing Newcastle 330 kV substation in accordance with section 5.5 of the EP&A Act.

As per the requirements of section 2.5.1 of the Code, I have not been involved in conducting the assessment.

The proposed activity is not likely to significantly affect the environment, and is not likely to significantly affect threatened species, ecological communities or their habitats and is not to be carried out on a declared area of outstanding biodiversity value.

I determine, on behalf of Transgrid, that an Environmental Impact Statement and Species Impact Statement are not required in respect of the proposed activity. The proposed activity may now proceed subject to the implementation of the mitigation measures in the SER.

This is not a conditional decision and no further conditions are required (other than the mitigation measures stipulated in the SER).

[redacted]

Grant Warnsby
General Counsel/ Corporate
Transgrid
Date: 26/11/25

Transgrid

People. Power. Possibilities.

Summary Environmental Report (SER)

Newcastle 330 kV Substation – new synchronous condenser

Part 5 EP&A Act Environmental Impact Assessment

November 2025

Document preparation history

Revision	Reviewed by	Date
0	Alice Thurgood	29 July 2025
1	Neil Standen	28 August 2025
2	Neil Standen	08 October 2025
2.1	Neil Standen	27 October 2025
3	Neil Standen	14 November 2025

Certification

I certify that I have prepared the contents of this SER, and, to the best of my knowledge, it is in accordance with the *NSW Code of Practice for Authorised Network Operators* approved under clause 198 of the *Environmental Planning and Assessment Regulation 2021*, and the information it contains is neither false nor misleading. It addresses, to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposed activity. It has been prepared by persons appropriately trained and qualified in accordance with Transgrid's Authorisation to Work Procedure.

Environmental impact assessment prepared by	Neil Standen
Signed	
Date	14 November 2025
Designation	Associate Director
Qualification	BSc (Hons) Environmental Biology
	MSc Environmental Studies
Organisation	AECOM

Contents

1. Introduction

1.1. Proposed activity overview and need

Transgrid is proposing to install two synchronous condensers (syncons) at the existing Newcastle 330 kV substation (the proposed activity). The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the New South Wales (NSW) power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their *2022 System Strength Report* (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

The subject of this Summary Environmental Report (SER) is the construction, commissioning and operation of two new syncons and associated infrastructure at the existing Newcastle 330 kV substation.

The proposed activity is described in more detail in Section 2.

1.2. Purpose of the SER

NSW Electricity Networks Operations Pty Ltd, as a trustee for NSW Electricity Operations Trust (known as Transgrid), is an authorised network operator and must complete an environmental assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in accordance with the *New South Wales Code of Practice for Authorised Network Operators* (the Code). The appropriate assessment and approvals process for the proposed activity in accordance with the Code is Class 3 – SER.

The purpose of this SER is to determine if the proposed activity would significantly affect the environment and/or significantly affect threatened species, ecological communities or their habitats. This SER documents the proposed activity, assesses the potential environmental impacts and provides environmental management measures to be implemented to minimise the risk of adverse environmental impacts during construction and operation.

2. Proposed activity description

2.1. Proposed activity scope

The proposed activity involves the installation and operation of two syncons and associated infrastructure at the existing Newcastle 330 kV substation.

The scope of works would include:

- Site establishment activities, including installation of construction offices and amenities, equipment storage and construction laydown areas and vegetation removal
- Construction of a new internal access road from Killingworth Road and upgrades to Killingworth Road to support the transport of equipment and vehicle movements to and from site
- Installation of a new bench (concrete slab, foundations and associated earthworks), with an indicative maximum footprint of around 130 by 150 metres (m), immediately south of the existing Newcastle 330 kV substation to house the syncons and associated infrastructure
- 330 kV busbar extension with a new switch bay, which comprises a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester
- Installation of the two new syncons and associated equipment, including:
    - Power transformer with firewalls
    - Auxiliary transformers
    - Syncon building and gantry crane
    - Oil lubrication and water-cooling systems
    - Control room and battery room
    - Low voltage AC and DC systems
    - Protection and control systems
    - Backup diesel generator
    - Pony motor
- Installation of a new demountable secondary systems building
- Installation of new spill oil tank, secondary containment dam(s) and drainage systems to cater for the new transformers, diesel generator and the syncon oil lubrication system
- Extension of the substation's stormwater drainage system, to cater for the new bench area
- Installation of new lighting protection masts
- Rehabilitation of the site including:
    - Removal of temporary construction facilities and equipment
    - Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by Transgrid's environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction
    - Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

Details of the scope of works for the proposed activity are presented in Section 2.3.

Figure 2-1 shows an example of a building housing two syncons and the associated equipment from another Transgrid project. The exact size of the syncon building would be determined during detailed design.

Figure 2-1 Photograph of a syncon housed within a building (example only)

2.2. Proposed activity location and property identification

The Newcastle 330 kV substation site (the substation site) is located off Killingworth Road, Killingworth within the Lake Macquarie local government area (LGA). The nearest major township is Killingworth, situated around 400 m to the south. The substation is within Lots 1 and 2 of DP619513, which is owned by the Electricity Transmission Ministerial Holding Corporation (ETMHC) and leased and managed by Transgrid. The Newcastle 330 kV substation is located within the proposed impact area shown in Figure 2-2.

The substation site is located on land zoned as Infrastructure SP2.The substation site is located in a vegetated rural area surrounded by cleared transmission line easements, with Burkes Creek traversing the southern corner of the substation site. Beyond the study area, there is low density residential land around 100 m to the south, densely vegetated land around 450 m to the southwest and southeast, and the M1 Pacific Motorway is around 700 m to the west. The nearest residential area is approximately 275 m south of the proposed impact area.

For the purpose of this SER, the impact area is defined as an indicative maximum footprint in which the construction and operation of the syncons would be carried out (refer to Figure 2-2). The impact area also includes areas required to facilitate connection to the proposed syncons, as well as a portion of Killingworth Road, which requires upgrading. The impact area may be reduced as the design is further developed, and the site layout is confirmed. The impact area would provide sufficient space for various configurations of syncon infrastructure (including different options for the location/configuration of the syncons, associated infrastructure, asset protection zones and surrounding enclosure). The impact area would also accommodate a site compound and laydown area(s) to support construction.

The study area is defined as a 200 m area surrounding the proposed impact area and is shown in Figure 2-2.

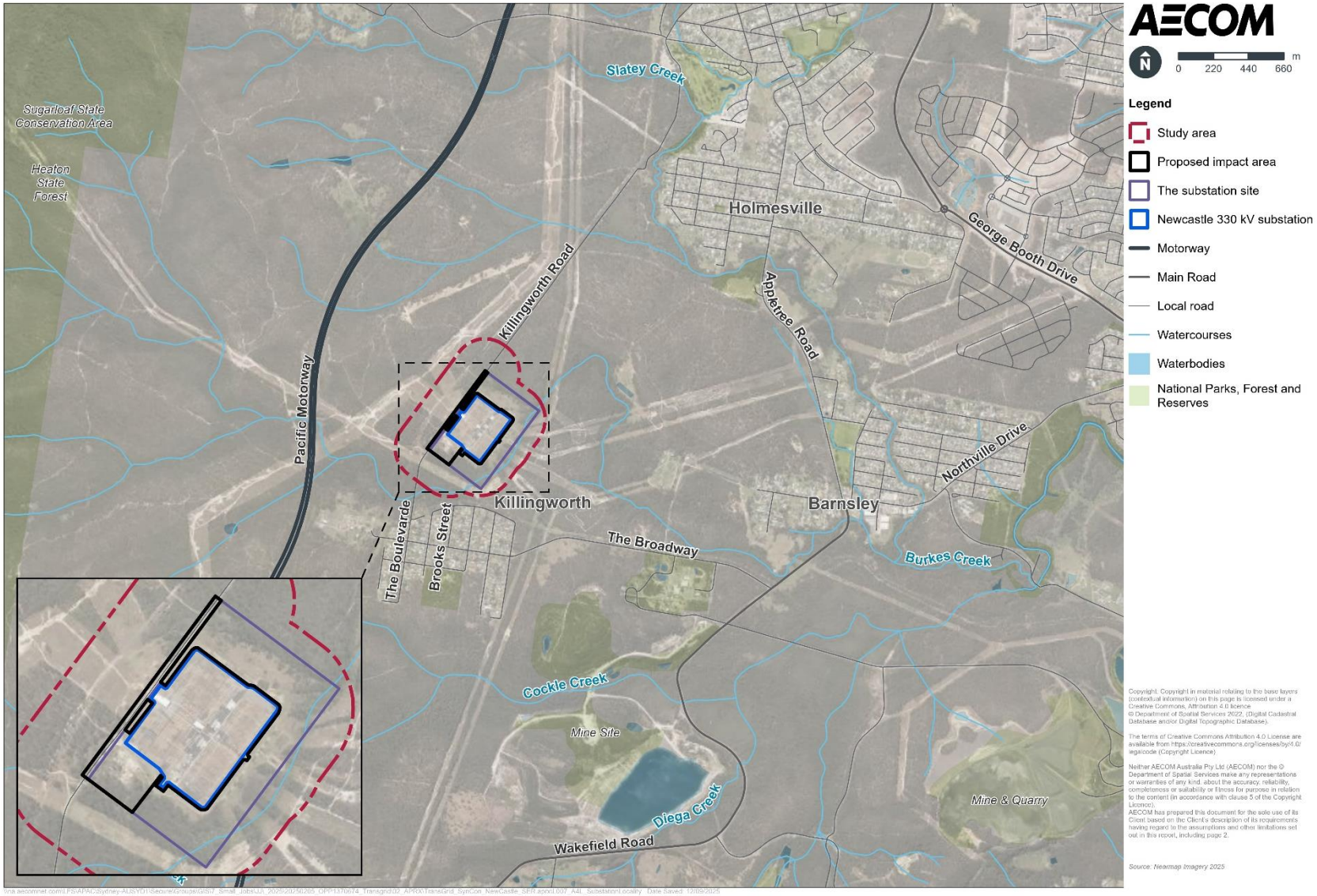


Figure 2-2 Proposed activity locality

2.3. Construction activities

2.3.1. Construction methodology

An overview of the construction methodology and key activities is outlined in Table 2-1. The indicative construction site layout is shown in Figure A-2 in Appendix A.

Table 2-1 Construction methodology and activities

Stage	Activity	Overview
Site establishment	Site area establishment	Prior to main construction works commencing, construction offices and amenities, equipment storage and the main laydown areas would be installed at a suitable location adjacent to the Newcastle 330 kV substation, within the proposed impact area. The portion of the impact area subject to the proposed bench extension would be cordoned with fencing (or similar measures) during the construction works. The southwestern portion of the proposed impact area, which is proposed for the bench extension, would require existing vegetation to be cleared and would be excavated to match existing substation levels. Excess spoil would be tested for contamination and be stockpiled onsite if suitable for reuse or disposed of at a licensed waste facility capable of receiving the material if contamination is found.
Main construction works	Access road construction	A new internal access road would be constructed to facilitate the delivery of equipment and materials during construction, and access for ongoing maintenance activities during operation. Upgrade to Killingworth Road (local road), which provides access to the substation site, would also be carried out in accordance with agreed standards through consultation with Lake Macquarie City Council's Roads team.
	Syncon bench installation	New foundations, footings and/or piles would be constructed for the new bench, syncon equipment, power transformer bund and buildings. A new spill oil tank would be installed within the bench to cater for the new transformers, diesel generator and the syncon oil lubrication system. Secondary oil containment dam(s) and drainage systems would be installed within the proposed impact area to cater for the new equipment. The substations stormwater drainage systems would be expanded if required to manage stormwater drainage for the increased impervious surfaces.
	Syncon building construction	The syncon building would be constructed on top of the new bench. The construction of the syncon building would involve the installation of metal frames and structures using mobile cranes. Cladding and roofing would be erected once all structures are complete.

	Miscellaneous civils works including drainage, cable trenches and conduits, and fencing	Sub-surface drainage systems, including pits and pipes, would be constructed. Cable trenches and/or cable pits and conduits would be constructed within the new bench and would connect to the existing substation. Cables would be connected to the existing control building. New fencing would be constructed around the perimeter of the new bench.
	Syncon and associated equipment installation	The syncons and associated equipment would be installed, including: • Power transformer with firewalls • Auxiliary transformers • Gantry crane • Oil lubrication and water-cooling systems • Control room and battery room • Lighting protection masts • Low voltage AC and DC systems • Protection and control systems • Backup diesel generator • Pony motor. Major plant equipment, such as transformers and demountable secondary systems building(s), would be installed using cranes. Minor plant equipment would be installed using machinery such as cranes, forklifts, telehandlers and elevated work platforms. Low voltage cables would be installed throughout the impact area, and the existing switchyard conduits/cables and trenches would be utilised to install cables to the existing control building. Power transformers would require on site oil filling to the required levels in order to be ready for energisation. The syncon oil lubrication system and water-cooling systems would also require on site filling. Sulfur hexafluoride (SF_6) gas containing equipment (such as the 330 kV circuit breaker and any gas insulated switchgear) would be filled on site.
Works within the existing substation switchyard	Installation of control/protection panels within the existing control room buildings	Works within the existing substation communications and control room. This would not require any ground disturbance works.
	Installation of new conduits/trenches	New trenching within the existing substation yard.
	Switch bay works	New switch bay works, including 330 kV busbar extension comprising a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester.

Testing and commissioning	Syncon and associated equipment testing and commissioning	The syncons and associated equipment would undergo a testing phase prior to being commissioned and connected to the Newcastle 330 kV substation. The proposed syncon connection would be off the 330 kV busbar extension and would remain disconnected until such time the syncons are ready for connection to the grid.
Rehabilitation	Demobilisation and rehabilitation of disturbed areas	Following completion of the construction activities, the disturbed areas that are not required for the operation of the syncons or existing Newcastle 330 kV substation would be rehabilitated to as close to pre-construction conditions as possible. Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by the environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction. Temporary construction facilities and equipment would be removed.

2.3.2. Construction material, plant and equipment

Typical key plant, vehicles, equipment and materials that would be used during construction include:

- Excavators
- Vacuum truck
- Concrete trucks
- Concrete saw
- Cranes
- Forklift/Telehandler
- Light vehicles
- Heavy vehicles
- Oversize/Overmass vehicles
- Steel and structural supports for new voltage transformers
- Steel and structural supports
- Electrical conduit and cables
- Roller
- Bore piling rig
- Elevated work platforms
- Hiab truck/trucks
- General hand tools (powered and unpowered)
- Welder
- Pumps
- Oil storage and pumping plant
- Erosion and sediment controls
- Diesel storage tanks/generators
- Onsite concrete mixing plant
- Electrical conduit and cables
- Imported fill and aggregate as required
- Concrete
- Pavement laying machine
- Asphalt truck and sprayer

2.3.3. Construction schedule

Construction is anticipated to commence in Q2 2026 and would take around 2 years to complete. The proposed activity start date may be altered with the revision of Transgrid's project program, although the duration of the construction activities would remain the same.

Construction activities would be conducted during standard construction hours, in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). Standard hours include:

- 7:00 am – 6:00 pm Monday to Friday
- 8:00 am – 1:00 pm Saturdays
- No work on Sundays or Public Holidays.

Work outside normal hours, on Sundays and public holidays would only comprise:

- The delivery or materials outside normal hours requested by police or other authorities for safety reasons
- Emergency work to avoid the loss of lives and/or property
- Work timed to correlate with system planning outages
- Vacuum and oil filling of equipment.

2.4. Operation and maintenance

The proposed activity would result in additional operational and maintenance activities at the Newcastle 330 kV substation. The syncons would operate continuously 24/7, as required by the electricity network requirements for minimum fault levels. The syncons would be switched on automatically as needed by the control system. Ongoing maintenance for the equipment would include daily and weekly visual inspections, as well as routine planned maintenance for the associated systems. However, these activities are not expected to result in a significant change to the number of personnel accessing the substation.

An indicative operational site layout is shown in Figure A-3 in Appendix A.

2.5. Alternative options considered

Four options were considered for the proposed activity, as identified in Table 2-2, including the preferred option.

Table 2-2 Alternative options considered and preferred option

Option	Overview and justification	Preferred option
Do nothing	The do-nothing option would be the base case where Transgrid do not progress a syncon at the Newcastle 330 kV substation site. This option would involve Transgrid operating and maintaining the transmission network in a manner that would not meet the system strength requirements published by AEMO (2022).	No
Option 1	Option 1 would involve constructing the new syncons and 330 kV gantries in the northwest corner of the Newcastle 330 kV substation. This option was not selected due to the presence of poor ground conditions in that area, which would have introduced significant construction challenges. Additionally, a high-pressure gas pipeline is located near this area, which would require complex excavation mitigation and pose a risk to the project.	No

Option	Overview and justification	Preferred option
Option 2	Option 2 would involve constructing the new syncons and 330 kV busbar at the northern end of the Newcastle 330 kV substation. This option was not selected due to the presence of poor ground conditions in that area, which would have introduced significant construction challenges.	No
Option 3 – Preferred option	Option 3 involves the construction of the new syncons and 330 kV gantries to the south of the existing Newcastle 330 kV substation. This option minimises potential environmental and operational impacts during the construction and operation of the proposed activity. This option would meet the projected system strength shortfall in the transmission network and address the system requirements established by AEMO (2022) and was deemed to be the preferred option.	Yes

3. Planning context

3.1. Approvals pathway

3.1.1. *Environmental Planning and Assessment Act 1979*

The EP&A Act and the *Environmental Planning and Assessment Regulation 2021* (the EP&A Regulation) provide the framework for development assessment in NSW. The EP&A Act and the EP&A Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision-making process prior to works proceeding.

As described below, the proposed activity would be permitted without development consent from Council in accordance with the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (TISEPP), and the proposed activity is therefore subject to the assessment requirements of Part 5 of the EP&A Act.

Transgrid is an Authorised Network Operator (ANO) under the *Electricity Network Assets (Authorised Transactions) Act 2015*. Transgrid is also a prescribed determining authority under Section 5.6 of the EP&A Act and Clause 3(3) and Schedule 1(4) of the EP&A Regulation, for development for the purposes of an electricity transmission or distribution network that is permitted without consent (within the meaning of the TISEPP) and is operated or to be operated by the ANO. Accordingly, Transgrid is the proponent and determining authority for this proposed activity.

This SER has also been prepared in accordance with the *NSW Code of Practice for Authorised Network Operators* (the Code, September 2015), which sets out the environmental assessment requirements for ANOs.

3.1.2. State Environmental Planning Policy (Transport and Infrastructure) 2021

The TISEPP aims to facilitate the delivery of infrastructure across NSW. Section 2.44 of the TISEPP provides that development for the purpose of an electricity transmission or distribution network may be carried out by or on behalf of an electricity supply authority or public authority without development consent on any land.

Section 2.43 of the TISEPP defines '*electricity transmission or distribution network*' as including the following components:

> *(a) above or below ground electricity transmission or distribution lines (including related bridges, cables, conductors, conduits, poles, towers, trenches, tunnels, access structures, access tracks and ventilation structures) and telecommunication facilities that are related to the functioning of the network,*
>
> *(b) above or below ground electricity switching stations or electricity substations, feeder pillars or transformer housing, substation yards or substation buildings,*
>
> *(c) systems for electricity storage associated with a component specified in paragraphs (a) and (b).*

As this proposed activity meets the definition of development for the purposes of an electricity transmission or distribution network under Section 2.44 of the TISEPP and would be carried out by Transgrid (an ANO), it is permitted without consent from the Council. Transgrid is the proponent and determining authority for the proposed activity.

3.1.3. Duty to consider environmental impacts

For activities subject to assessment under Part 5, Section 5.5 of the EP&A Act imposes a duty on a determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment' by reason of the proposed activity (refer to Section 6.1). In addition, Clause 171 of the EP&A Regulation identifies factors which must be taken into account when considering the likely impact of an activity on the environment. These factors have been considered in Section 6.2.

3.2. Other relevant Commonwealth and NSW legislation

Other environmental planning instruments and legislation that are directly relevant to the determination and/or assessment of the proposed activity are considered in Table 3-1.

Table 3-1: Relevant Commonwealth and NSW legislation

Legislation	Potential approval requirements	Relevance to the proposed activity	Permit/approval/ licence requirements
Commonwealth legislation			
Environment Protection and Biodiversity Conservation Act 1999 **(EPBC Act)**	Under the EPBC Act, matters of national environmental significance (MNES) are considered to assist in determining whether the proposed activity should be referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water.	EPBC Act protected matters have been considered in Section 6.3 (Table 6-3). As no significant impacts are predicted, an approval under the EPBC Act would not be required.	None required.
NSW legislation			
Biodiversity Conservation Act 2016 **(BC Act)**	The BC Act lists a number of threatened species, populations, ecological communities and declared areas of outstanding biodiversity value to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the proposed activity, an assessment of significance that addresses the requirements of Section 7.3 of the BC Act must be completed to determine the significance of the impact.	The proposed activity would not impact any threatened species, populations, ecological communities and would not be carried out on a declared area of outstanding biodiversity value listed under the BC Act. Overall, the proposed activity is unlikely to result in a significant impact upon biodiversity values. Therefore, no permits or approvals are required under the BC Act. Section 5.4 provides further details of the impacts to ecology.	None required.

Legislation	Potential approval requirements	Relevance to the proposed activity	Permit/approval/ licence requirements
Heritage Act 1977 **(Heritage Act)**	Approval under Section 57(1) is required for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. Section 57(2) provides that an exemption from the approval requirements of Section 57(1) can be sought in certain circumstances. An excavation permit is required under Sections 139(1) and (2) to disturb or excavate any land containing or likely to contain a relic. Section 139(4) provides that exceptions from the approval requirements of Sections 139(1) and (2) can be sought in certain circumstances.	There are no State heritage listed items near the proposed activity and the activity would not involve disturbing or excavating land on which a relic is located or where there is reasonable expectation that the excavation or disturbance is likely to result in a relic being discovered, exposed, moved, damaged or destroyed (see Section 5.6). Therefore, no permits or approvals are required under the Heritage Act.	None required.
National Parks and Wildlife Act 1974 **(NPW Act)**	An Aboriginal heritage impact permit (AHIP) under Section 90 of the NPW Act is required to harm or desecrate an Aboriginal heritage object. If works are located in land reserved under the NPW Act, approval from the NSW Department of Climate Change, Energy, the Environment and Water's (DCCEEW) National Parks and Wildlife Service (NPWS) is required.	The proposed activity would not impact any registered Aboriginal heritage sites and therefore a permit under Section 90 of the NPW Act is not required. The proposed activity would not impact any land reserved under the NPW Act and therefore would not require approval from NSW DCCEEW and NPWS.	None required.

Legislation	Potential approval requirements	Relevance to the proposed activity	Permit/approval/ licence requirements
Roads Act 1993 **(Roads Act)**	Under section 138 of the Roads Act, a person must not impact or carry out work in, on or over a public road without consent of the appropriate road's authority.	The proposed activity involves carrying out works on a public local road (Killingworth Road).	As Transgrid is a network operator under the Electricity Supply Act 1995, approval is not required from council under section 138 of the Roads Act to undertake works in, on or over unclassified roads (local roads) due to the application of Schedule 2, Part 2, Division 1, Section 5 of the Roads Act. Killingworth Road is an unclassified road in accordance with Transport for New South Whales road network classifications.

4. Consultation

This section provides an overview of the consultation carried out in relation to the proposed activity.

Email consultation with Lake Macquarie City Council was undertaken by Transgrid and NSW Department of Climate Change, Energy, Environment and Water (NSW DCCEEW) on 8 April 2025 as part of the submission to the NSW Infrastructure Planner for consideration of the syncon project as a Priority Transmission Infrastructure Project (PTIP) by the NSW Minister for Energy. Feedback from Council has been fed into the Community and Stakeholder Engagement Plan prepared by Transgrid in June 2025 and will guide engagement with the broader community. The comments received by Council on 8 May 2025 and how these are addressed in this SER are summarised in Table 4-1.

In accordance with clause 45 of the *Electricity Supply Act 1995* and Section 2.10 and Section 2.45 of the TISEPP, written notice of the intention to carry out the proposed activity was given to Lake Macquarie City Council on 23 May 2025. This consultation described the scope of the proposed activity. In accordance with Section 45 of the *Electricity Supply Act 1995*, Council was provided 40 days to provide a response to be considered in the planning and assessment phase. The issues raised by Council on 2 July 2025 and how these are addressed in this SER are summarised in Table 4-1.

In accordance with Section 2.45 of the TISEPP, a written notice of the intention to carry out the proposed activity was given to Hunter Central Coast Development Corporation (HCCDC) on 10 September 2025 as the owner of land adjoining the Newcastle 330 kV Substation, inviting a submission within 21 days from the date on which the notice was given. Acknowledgement from HCCDC was received on 10 September 2025 stating that the review request has been forwarded on to their West Wallsend Team for review. No further response received.

In accordance with Section 2.15(2)(f) of the TISEPP and Section 22 of the *Coal Mine Subsidence Compensation Act 2017*, written notice of the intention to carry out the proposed activity was also given to Subsidence Advisory NSW on 5 December 2024 due to the proposed activity being located within the Killingworth-Wallsend Mine Subsidence District. In accordance with Section 2.15(1)(b) of the TISEPP, Subsidence Advisory NSW was provided 21 days to provide a response to be considered in the planning and assessment phase. The issues raised by Subsidence Advisory NSW on 17 December 2024 and how these are addressed in this SER are summarised in Table 4-1.

Table 4-1 Issues raised during consultation and how addressed

Stakeholder	Issues raised	How addressed
Lake Macquarie City Council – DCCEEW Consultation	**Community and engagement** • The community values environmental protection, climate resilience, and affordable clean energy. • Risks to the community of inadequate system strength need to be minimised. • Desire for meaningful engagement and proactive communication with the community (including notices of power outages) from Transgrid.	• The proposed activity reduces risk to system strength by addressing AEMO's (2022) system strength requirements. The proposed activity also supports clean energy reliability and affordability. • A Community and Stakeholder Engagement Plan (CSEP) has been prepared for the project, covering how Transgrid will manage engagement through:

Stakeholder	Issues raised	How addressed
	• Need for community education on energy transition. • Insights from local panels/committees (e.g., REZ Regulator Panel) could provide Transgrid with insight into community sentiment from similar projects.	- Early and proactive engagement - Communication of environmental management measures and project benefits - Consultation with local community panels/committees and adjacent landowners. The CSEP also outlines a hotline and email contact for communities to ask questions and provide feedback on the proposed activity.
	Traffic and Logistics • Early and ongoing consultation with Council and impacted communities regarding traffic and construction impacts, and detours required. • Coordination required for potential Weir Road closure due to Council's Racecourse Road bridge upgrade plans before 2028-29. • Major roads are preferred over residential streets for construction access. • Council recommends: - A detailed Temporary Traffic Management Plan - Certified traffic controllers and clear detour signage - Ongoing updates on traffic arrangements for the entirety of the project - Road condition surveys and repairs at proponent's expense - Mitigation of impacts on emergency services, public transport, and school traffic.	• Early consultation with Council was undertaken as outlined in this Section of the SER. Ongoing consultation with Council's and impacted communities would be undertaken in accordance with Trangrid's CSEP. • As detailed in Section 5.8, major roads would be used for construction access where possible. • As outlined in mitigation measures in Appendix B, traffic and transportation impacts, and access mitigation and management strategies would be implemented in accordance with Transport for NSW and Council requirements and documented in the CEMP, which will be updated as required. Transport and equipment delivery movements on public roads will be managed as outlined above and will include considerations on impacts to public transport and school traffic. No negative impacts to emergency services are expected.
	Housing • Short term accommodation is in short supply within the LGA. The sentiment is unlikely to be positive from the community regarding workers seeking short term accommodation. Workers utilising short term accommodation may also negatively impact local tourism.	• Where possible workers will be encouraged to organise longer term housing options. • Transgrid's Procurement Management Framework ensures local employment opportunities are provided where possible. Transgrid would also implement an Australian Industry

Stakeholder	Issues raised	How addressed
	• Preference for employing local skilled workers, especially those affected by the Eraring Power Station closure. • The community would expect greater clarity on where the work force will be housed.	Participation Plan, which encourages local employment through its supply chain to create positive socio-economic opportunities. Community consultation will be undertaken in accordance with Transgrid's CSEP.
	Environment • There are endangered ecological communities and flood markers on site. • Hunter and Central Coast Development Corporation (HCCDC) should be engaged as a surrounding landowner. • Residents are likely to seek information regarding potential noise and health impacts of the proposed activity.	• As detailed in Section 5.4 and Appendix C, a Flora and Fauna Assessment report has been prepared to support this SER. The proposed activity is not expected to substantially impact threatened ecological communities (TECs), threatened flora or fauna species, or their habitat. • Consultation with HCCDC was undertaken in accordance with Section 2.45(2)(a) of the TISEPP. • As detailed in Appendix F, a Noise and Vibration Impact Assessment has been prepared to support this SER. A number and email contact details will be provided to community members to ask questions and provide feedback regarding the proposed activity in accordance Transgrid's CSEP.
Lake Macquarie City Council – Statutory Consultation	**Assessment and planning** • Lake Macquarie City Council assumes that Transgrid will prepare a Review of Environmental Factors (REF). • Lake Macquarie Local Environment Plan 2014 (LEP) and Lake Macquarie Development Control Plan 2014 (DCP) should be considered in the REF.	• As detailed in Section 1.2, the proposed activity is subject to a SER , which is an assessment under Part 5 of the Environmental Planning & Assessment Act (EP& A Act) in accordance with the Code for a proposal expected to have minor impacts and is neither extensive or complex. Notwithstanding, issues raised in Council's response have been considered in this SER (see below). • The LEP and DCP were reviewed and considered as part of the preparation of this SER and relevant technical assessments.

Stakeholder	Issues raised	How addressed
	Environment • Request for a detailed Statement of Heritage Impact to be provided to Council for comment. • Preparation of an acoustic impact assessment to determine that all sensitive receivers in the vicinity of the development can maintain acceptable internal comfort levels without mitigation works. • Potential impacts to threatened ecological communities (TECs) (such as Alluvial Floodplain Cabbage Gum Forest), threatened species and threatened species habitats. • A Biodiversity Assessment Report is required under the NSW Biodiversity Conservation Regulations 2017 if native vegetation clearing exceeds 0.5ha threshold. • Preparation of a preliminary site investigation to assess land suitability, identify ongoing management needs, and ensure appropriate disposal of any excavated material.	• Section 2.11 of TISEPP states a developer must consult with councils if the impact to local Heritage items as a result of the development is in a way that is more that minor or inconsequential. Appendix E comprises a Statement of Heritage Impact, having been prepared to support this SER which has concluded a less than minor impact to the heritage item's significant elements and a negligible impact on the overall significance of the 'Elcom Newcastle Substation', therefore, no further consultation requirements in accordance with Section 2.11 of TISEPP was undertaken. Further, a copy of the Historic Heritage Assessments was sent to the council for communication on 24 October 2025. • Appendix F comprises a Noise and Vibration Impact Assessment report, having been prepared to support this SER. Sensitive receivers have been identified and mitigation measures outlined to ensure no adverse impacts from noise impacts on the nearby receivers. • As detailed in Section 5.4 and Appendix C, a Flora and Fauna Assessment report has been prepared to support this SER. The proposed activity is not expected to significantly impact TECs, threatened flora or fauna species, or their habitat. The Alluvial Floodplain Cabbage Gum Forest TEC, has not been identified through desktop and field assessments within or in the vicinity of the substation site. • According to Section 7.2(2) of the BC Act 2016, the biodiversity offsets scheme threshold does not apply to developments that are

Stakeholder	Issues raised	How addressed
		assessed under Part 5 of the EP&A Act. The proposed impact area as outlined in Figure 5-3 is a conservative footprint. Design refinements will ensure that Zone 2 vegetation disturbance will be avoided where possible. • As detailed in Section 5.2, no known contaminated land has been identified within the study area; therefore, a preliminary site investigation is not warranted. Contamination may be present associated with the historical use of the substation site. However, this would be adequately managed through the implementation of mitigation measures provided in Appendix B.
	Road Works • Engage with Council's Asset Management – Roads team to determine the standards required and with Council's Quality and Surveillance team to determine notification and inspection processes.	• Transgrid will contact Council prior to commencing works on Killingworth Road regarding standards, notification and inspection requirements.
Subsidence Advisory NSW	**Mine subsidence assessment** An investigation and report relating to mine subsidence risk assessment should be undertaken by a suitable qualified and experienced consultant. Subsidence Advisory has offered to review the mine subsidence risk assessment when complete.	• The mine subsidence risk assessment was prepared by a suitable qualified and experienced consultant who was accepted by Subsidence Advisory NSW (SMEC – Stephen Martin). The report was provided to Subsidence Advisory NSW for review on 24 April 2025, which was subsequently approved on 6 May 2025.

5. Environmental impact assessment

This section provides an assessment of the potential environmental impacts of the proposed activity. All mitigation measures required to avoid or minimise the environmental impacts below are consolidated in Appendix B.

5.1. Land use

5.1.1. Existing environment

The proposed activity is located on land zoned as Infrastructure SP2 for the purposes of an Electricity Substation under the Lake Macquarie LEP (refer to Figure 5-1). The substation site is currently used for the purpose of electricity transmission as a substation.

The proposed impact area is largely located across Lots 1 and 2 of DP619513, which is owned by the ETMHC and leased and managed by Transgrid. A portion of the proposed impact area includes part of Killingworth Road, adjacent to the substation site, which is a local road owned by Lake Macquarie City Council.

Land use within the study area comprise densely vegetated land with corridors of cleared easements. Beyond the study area, there is low density residential land around 100 m to the south, densely vegetated land around 450 m to the southwest and southeast, and the M1 Pacific Motorway is around 700 m to the west.

The nearest residential dwelling is located around 275 m south of the proposed impact area.

5.1.2. Impact assessment

Construction

The construction of the proposed activity would be located entirely within Transgrid's existing property boundary, with the exception of the proposed upgrades to Killingworth Road. The proposed activity would not impose any new restrictions on land use within the study area and would not require access to privately owned land. Therefore, no land use impacts are anticipated during construction.

Operation

Under the Lake Macquarie LEP, the zoning objectives of SP2 Infrastructure are:

- To provide for infrastructure and related uses
- To prevent development that is not compatible with or that may detract from the provision of infrastructure
- To provide land required for the development or expansion of major health, education and community facilities.

The proposed activity is consistent with the existing land use of the proposed impact area, being a substation, and the zoning objectives of SP2 Infrastructure under the Lake Macquarie LEP.

As the proposed activity would be located within Transgrid's existing property, no additional property acquisition would be required. The proposed activity is consistent with existing site operations, being for the development and operation of an electricity substation and associated transmission purposes. As such, no permanent land use changes are anticipated.

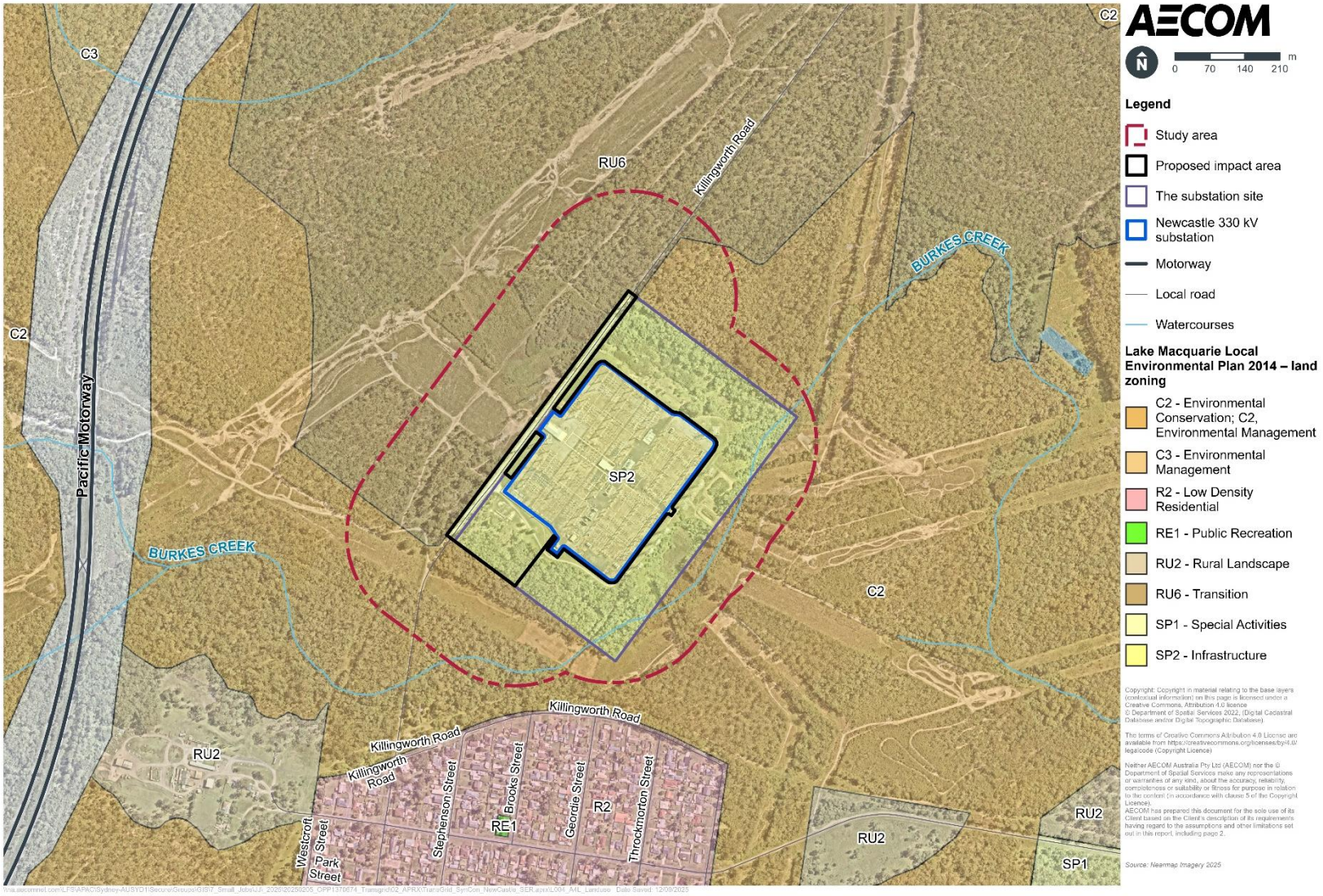


Figure 5-1 Land zoning

5.2. Geology and soils

5.2.1. Existing environment

The topographic landscape of the proposed impact area is typically flat, with an elevation of 24 m Australian height datum (AHD). The broader study area has elevations from 36 to 20 m AHD, with the landscape sloping towards Cockle Creek to the east. The study area is predominantly located on alluvial deposits with some areas of sedimentary rock. The soil types in the study area are kurosols and dermosols.

A summary of the existing geology and soils environment is provided in Table 5-1.

Table 5-1 Existing geology and soils environment

Geology and soils	Existing environment
Acid sulfate soils	A review of the NSW Government's Central Resource for Sharing and Enabling Environmental Data in NSW (SEED map) on 4 April 2025 found that acid sulfate soils are unlikely to be present in the study area.
Contaminated land	A review of the NSW Environment Protection Authority's (EPA) contaminated land register and list of notified sites on 11 April 2025 found that there is no known contaminated land within the study area. Contamination may be present associated with the historical use of the substation site. However, this would be managed through mitigation measures in Appendix B.
Naturally occurring asbestos	A review of the NSW Government's SEED map on 11 April 2025 found that the study area is not identified as having a risk of naturally occurring asbestos.
Salinity	A review of the NSW Government's SEED map on 11 April 2025 found that the study area is unlikely to present a salinity risk.
Mine subsidence	A review of the NSW Government's Planning Portal Spatial Viewer on 11 April 2025 found that study area is located within the Killingworth-Wallsend Mine Subsidence District.

5.2.2. Impact assessment

Construction

During construction, the key potential impacts associated with geology and soils relate to:

- The potential erosion of disturbed or excavated soils by surface water flows or wind
- Accidental spills or leaks from construction plant and equipment contaminating the ground
- Unexpected ground conditions.

The proposed activity would result in the disturbance, excavation, handling and storage of soils. The key activities that would disturb soils relate to the excavation of the proposed impact area to existing substation levels, installation/upgrade of oil and stormwater drainage systems, and activities associated with the construction of the bench. If not properly managed, surface water flows and high winds could result in the mobilisation of excavated soils and the erosion of stockpiles, excavations and areas of bare ground. These risks are expected to increase during high wind and rainfall events.

Whilst soil erosion may occur, the potential impacts would be localised to the proposed impact area. Whilst potential erosion impacts would be minor, the mitigation measures presented in Appendix B would be sufficient to avoid and/or mitigate these impacts.

Soil contamination may occur as a result of accidental spills or leaks of fuels, oils or other chemicals from plant, equipment and vehicles used during construction. Spill kits would be required on site during construction, with their use supported by management measures and controls to minimise both the likelihood of spills and the potential consequences should they occur (refer to Appendix B).

Contamination may be present associated with the historical use of the substation site. Contaminated soils excavated during construction would be managed in accordance with mitigation measure GS4 in Appendix B. An unexpected finds procedure would be developed as part of the Construction Environmental Management Plan (CEMP) for the proposed activity. This procedure would outline how potential contamination risks, including potentially contaminated soils, would be identified and managed during construction.

The proposed activity would be located on land mapped within the Killingworth-Wallsend mine subsidence district. Consultation with Subsidence Advisory NSW has been undertaken, as outlined in Section 4.

As described in Section 5.2.1, it is unlikely that acid sulfate soils, salinity risks, and naturally occurring asbestos would be encountered during the construction of the proposed activity.

Operation

The main operational risk to geology and soils would be potential oil contamination from faulty equipment, namely the new power transformer. To mitigate this, a new spill oil tank, drainage system and possible secondary containment dam would be installed to service the new transformers, diesel generator and the syncon oil lubrication system. With these safeguards in place, the operation of the proposed activity is unlikely to result in significant impacts on geology and soils. Notwithstanding, maintenance activities may pose a minor risk of accidental spills of fuels, oils and other chemicals from plant and equipment, which would be managed through standard environmental management procedures.

The risk to underlying geology and soils as part of the ongoing operation of the new syncons is considered to be low with the implementation of mitigation measures outlined in Appendix B.

5.3. Hydrology and water quality

5.3.1. Existing environment

The proposed activity is located within the Macquarie Tuggerah catchment, which covers an area of 1,630 square kilometres and is bordered by a series of east flowing streams in the north, and the Sugarloaf Ranges to the north-west (NSW DCCEEW, 2025).

The study area is located in a vegetated rural area, surrounded by cleared transmission line easements. Burkes Creek traverses the study area from south to northeast (refer to Figure 2-2). Burkes Creek is a tributary of Cockle Creek, which is one of the major tributaries of Lake Macquarie. Burkes Creek is a fourth-order non-perennial stream and is mapped as key fish habitat (KFH).

NSW DCCEEW's *Estuary Report Card 2023-2024 - Lake Macquarie* (NSW DCCEEW, 2024) states that the Cockle Creek estuary has a 'fair' grade for overall water quality in 2023-2024, with chlorophyll-a concentrations and turbidity exceeding the 80th percentile trigger values.

The study area is located within the Water Sharing Plan (WSP) for the Hunter Unregulated and Alluvial Water Sources 2022 and the WSP for the North Coast Fractured and Porous Rock Groundwater Sources 2016.

A search of groundwater bores in the proposal area was completed using the Australian Government's Australian Groundwater Explorer on 30 April 2025. The search found one groundwater bore within 2 kilometres (km) of the study area. The status of the groundwater bore is listed as 'unknown', and groundwater depth has not been recorded. Geotechnical investigations conducted by SMEC on 3 – 6 March 2025 to inform the design of the proposed activity found that the groundwater level in the vicinity of the proposed impact area is 3.4 m below ground level.

The study area is not located within a drinking water catchment.

The Upper Cockle Creek Flood Study 2019 (WMA Water, 2019) indicates that parts of the study area are mapped within the 1% Annual Exceedance Probability (AEP) flood extent.

5.3.2. Impact assessment

Construction

During construction, the key risks to hydrology and water quality primarily relate to stormwater runoff during wet weather events and potential contamination of the receiving environment. Potential impacts may include:

- Discharge of sediment-laden runoff from exposed surfaces and stockpiled materials into receiving waterways, particularly Burkes Creek, resulting in increased turbidity and deterioration of water quality
- Elevated concentrations of dissolved nutrients (nitrogen and phosphorous) in runoff which may stimulate nuisance plant, algal, or cyanobacterial growth in downstream watercourses
- Leaks or spills of fuels, oils, petroleum hydrocarbons, heavy metals or other chemicals from machinery or equipment, with potential transport to downstream ecosystems via surface water runoff
- Accidental release of alkaline concrete wash water used to clean concrete off equipment or plant, resulting in localised soil, surface water or groundwater contamination and possible downstream ecological impacts
- Leaching and groundwater migration of contaminants (fuels, oils, petroleum hydrocarbons, heavy metals or chemicals) into downstream waterbodies and wetlands from accidental leaks/spills.

The risk of surface water contamination during construction could increase in the event of an extreme flood (between 1% AEP and probable maximum flood event), where flood waters may inundate the site and mobilise contaminants into downstream waterways. However, with the implementation of mitigation measures recommended in Appendix B, the probability of contamination occurring in receiving waterways would be low.

The construction of the proposed activity would not alter flood patterns to more than a minor extent. Erosion and sediment controls would be installed and maintained throughout construction to prevent potential degradation of drainage lines and flood-prone areas.

Excavations of up to 20 m deep are likely to intercept groundwater, with geotechnical investigations recording the water table at around 3.4 m below ground level. Localised perched water may also be encountered during excavation works.

Groundwater quality risks include potential contamination from accidental spills or leaks infiltrating soil and entering groundwater. With implementation of the mitigation measures described in Appendix B, the likelihood of significant impacts to groundwater quality is considered low.

Groundwater levels may be temporarily affected where inflows are intercepted during excavation. Any accumulated groundwater would be managed in accordance with the CEMP and mitigation measures in Appendix B. Dewatering requirements are expected to remain below three megalitres per year (including construction inflows and managed discharges), which, under advice from the NSW Department of Primary Industries - Water, does not require a licence. Given the short-term nature of dewatering and limited flow volume, no long-term impacts on regional groundwater levels are anticipated.

Operation

The proposed activity would introduce approximately 0.39 ha of newly impervious surface over areas currently grassed or vegetated. Potential impacts during operation of the proposed activity could include:

- Increased surface water runoff due to an increase in impervious area and compacted surfaces
- Changes to flow rates and volumes entering receiving waterways, leading to potential scouring/erosion
- Increase in contaminants and litter in runoff that would discharge to the receiving waterways.

Permanent onsite oil and stormwater drainage systems would be installed/upgraded if required during construction, which would largely mitigate the above potential impacts during operation. As such, potential hydrology and water quality impacts as a result of the proposed activity are considered to be negligible.

5.4. Ecology

A Flora and Fauna Assessment (AECOM, 2025b) was undertaken to assess the potential biodiversity impacts of the proposed activity during construction, commissioning and operation. The Flora and Fauna Assessment is attached in Appendix C.

The Flora and Fauna Assessment was undertaken in the form of desktop research as well as a site visit on 26 February 2025 to verify desktop findings within the area where vegetation removal would be undertaken (biodiversity impact area).

5.4.1. Existing environment

Vegetation communities

Review of the NSW State Vegetation Type Map identified several plant community types (PCTs) within 2km of the biodiversity study area (refer to Table 5-2). Of these, on the western side of Killingworth Road is a patch of vegetation mapped as *PCT: 3433 Hunter Coast Foothills Spotted Gum Ironbark Grassy Forest* (refer to Figure 5-2). This community is equivalent to NSW Lower Hunter Spotted Gum Ironbark Forest TEC. This community is listed as endangered under the BC Act. This community is not listed under the EPBC Act. This TEC is located adjacent to, but not within, the biodiversity impact area.

Vegetation within the biodiversity impact area comprises *PCT: 4042 Lower North Riverflat Eucalypt Paperbark Forest* which has no associated TEC.

None of the land in or around the biodiversity study area is listed as an area of biodiversity value.

Table 5-2 Plant community types identified near the biodiversity study area

PCT	Associated TEC
3150 Hunter Coast Ranges Turpentine Wet Forest	None
3234 Hunter Coast Lowland Spotted Gum Moist Forest	**BC Act,** Endangered: Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion
3244 Lower North Spotted Gum-Mahogany-Ironbark Sheltered Forest	None
3432 Hunter Coast Foothills Apple-Ironbark Grassy Forest	None
3433 Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	**BC Act**, Endangered: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions
3582 Hunter Coast Lowland Apple-Bloodwood Forest	None
3583 Hunter Coast Lowland Scribbly Gum Forest	None
3998 Lower North Creekflat Mahogany Swamp Forest	**BC Act**, Endangered: Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
4020 Coastal Creekflat Layered Grass-Sedge Swamp Forest	None
4042 Lower North Riverflat Eucalypt-Paperbark Forest	None

Figure 5-2 shows the mapping of the above PCTs in and around the biodiversity study area. None of the PCTs with associated TECs in this location (PCT 3234, PCT 3433 and PCT 3998) are present within the biodiversity impact area.

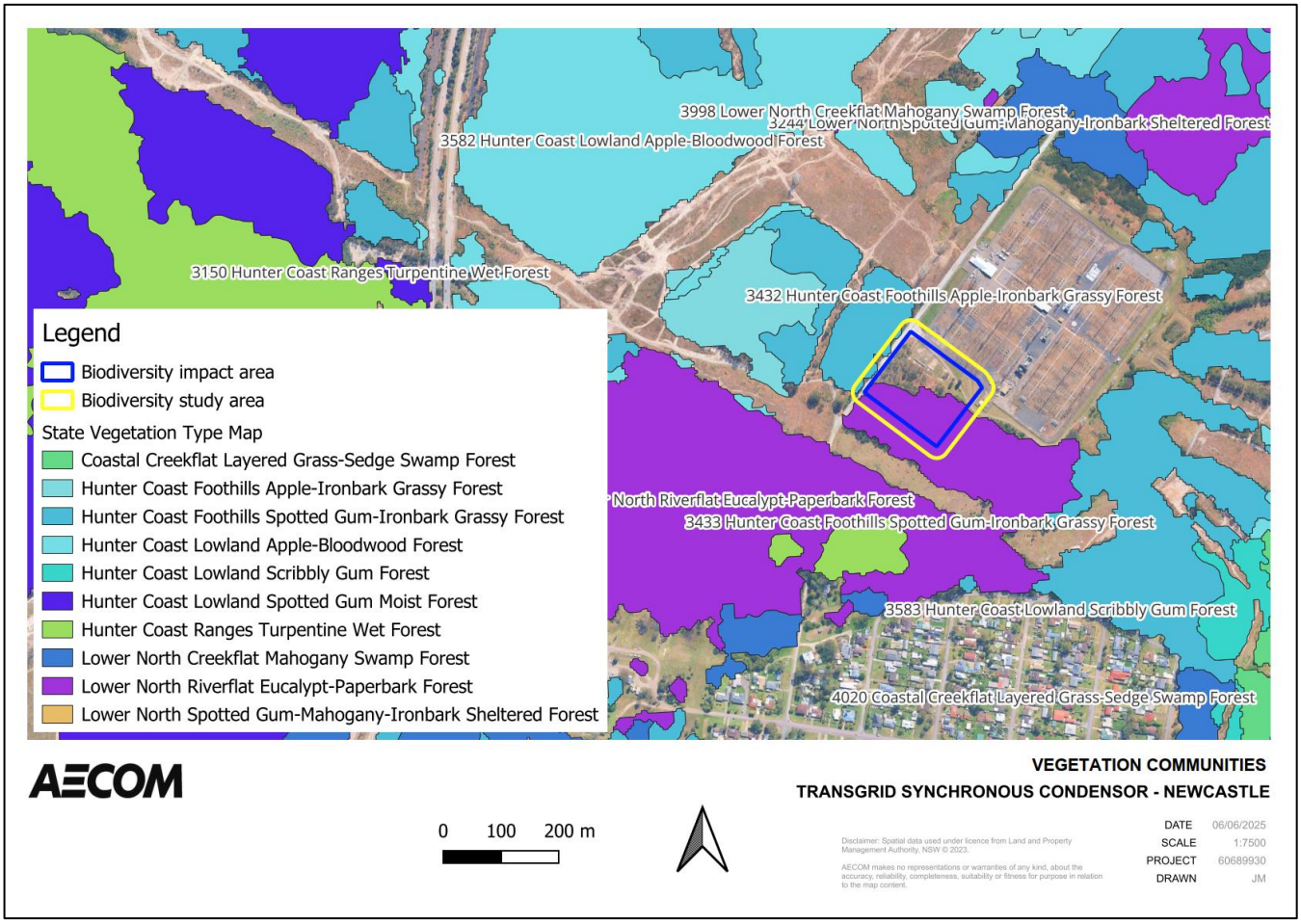


Figure 5-2 Vegetation communities (AECOM, 2025b)

The vegetation within the biodiversity study area is characterised by three vegetation zones (refer to Figure 5-3) including:

- Vegetation Zone 1: regrowth native vegetation (areas previously cleared in the process of regeneration)
- Vegetation Zone 2: remnant native vegetation (vegetation in good condition)
- Vegetation Zone 3: cleared and maintained vegetation.

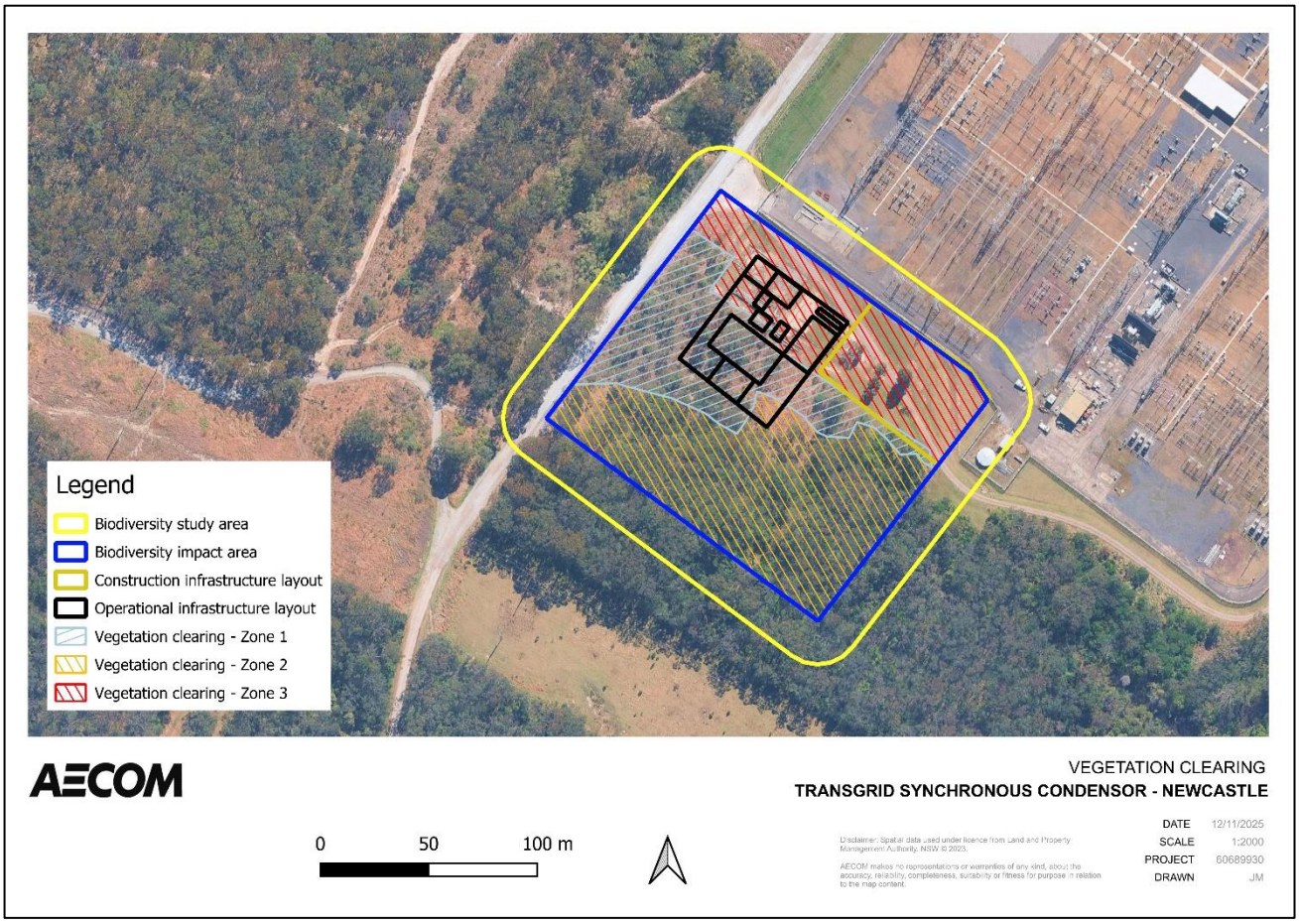


Figure 5-3 Vegetation zones (AECOM, 2025b)

Threatened species and habitat

Desktop searches were undertaken on 16 May 2025 to indicate the potential threatened species that may occur within the biodiversity study area.

The nearest threatened fauna species records to the biodiversity study area are the Koala, Large-eared pied Bat and Grey-headed flying-fox. Habitat for these fauna species is present within the biodiversity study area, though is largely limited to Zone 2, with some habitat within Zone 1. The cleared land comprising Zone 3 (and the substation itself) is likely to present some degree of aerial foraging habitat for bats and other threatened birds.

None of the above fauna species and habitats were observed during the field survey.

None of the land in or around the biodiversity study area is listed as critical habitat for any species.

Priority weeds

Priority weeds are plants classified under the *Biosecurity Act 2015* as presenting a biosecurity risk to the State or a particular region. Of those listed for the Lake Macquarie LGA, the following species were recorded:

- Lantana (*Lantana camara*) - Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale
- Pampas grass (*Cortaderia selloana*) - Land managers should eradicate the plant from the land and keep the land free of the plant. A person should not deal with the plant, where dealings include but are not limited to buying, selling, growing, moving, carrying or releasing the plant.

5.4.2. Impact assessment

Construction

Vegetation communities

The construction of the syncons and its associated infrastructure would result in a direct impact on vegetation due to localised vegetation clearance. Figure 5-3 shows conservative areas of vegetation clearing required to facilitate construction and operation of the proposed activity. It is likely that the eventual clearing will be less than this as ongoing design development and construction would seek to minimise the clearing required, particularly in Zones 1 and 2 outside the operational footprint. Zone 3 is generally devoid of native vegetation, with the exception of three isolated paddock trees.

The conservative clearing of native vegetation within each vegetation zone would comprise:

- Zone 1: around 5,520 m^2
- Zone 2: around 9,352 m^2
- Zone 3: 0 m^2 (as this zone does not comprise native vegetation, but rather approximately 5,875 m^2 of non-native vegetation and hardstand area).

A conservative estimate of the overall area of native vegetation required to be removed is calculated to be 1.49 ha.

Of all the zones, clearing within Zone 2 would result in the greatest degree of biodiversity impact, given the amount of remnant vegetation present. Clearing within this zone would be minimised as part of the detailed design.

The removal of native and non-native vegetation in the biodiversity impact area would not affect any TEC.

Flora

The removal of native and non-native vegetation in the biodiversity impact area would not affect any threatened flora species.

Indirect off-site impacts to potential threatened flora, such as edge effects related to weeds, light penetration, pests and sedimentation, are not considered likely to be significant provided the proposed mitigation measures outlined in Appendix B are implemented.

Fauna

Several threatened microbat species have been previously recorded in the vicinity of the biodiversity study area. The removal of vegetation, particularly in Zone 2, would reduce foraging and potentially roosting habitat for forest-dwelling bats. Within that zone, the most sensitive habitat feature for these species (and many others) is the large mature Eucalyptus trees. Clearing these would be avoided as far as possible, as detailed in mitigation measure in Appendix B.

Noting local records of Koala, the clearing of native vegetation, particularly within Zone 2, could result in an adverse impact on this species. The vegetation in this area includes known feed trees for this species, and Koalas are also known to move throughout the landscape along waterways. The removal of vegetation for the proposed activity would not prevent such movement, though it would contribute to an ongoing loss of habitat in the region and more broadly. The impact of the proposed activity is highly restricted and localised and would not be significant, though it is recommended that the clearing footprint be minimised as far as possible in future design stages, with an emphasis on protecting vegetation within Zone 2, particularly large mature trees. Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

Overall, construction of the proposed activity is not expected to result in any significant impacts upon local fauna or their habitat.

Spread of weeds, pests and pathogens

The proposed activity has the potential to result in the infestation of the biodiversity impact area by new weeds, or the spread of existing weeds to locations outside the biodiversity impact area. The movement of vehicles and personnel into and throughout the biodiversity impact area has the potential to facilitate the spread of weeds. However, with the implementation of the mitigation measures outlined in Appendix B the overall impact of weeds associated with the construction phase of the proposed activity would be low.

The proposed activity is unlikely to alter the occurrence of pest species in and around the biodiversity impact area, either positively or negatively, due to the localised nature of the works. As such, the overall impact in this regard is considered to be negligible.

The proposed activity also has the potential to spread pathogens into the proposed activity area. Assuming that these pathogens are not currently present and providing suitable biosecurity hygiene mitigation measures in accordance with Appendix B are implemented, the risk of the introduction of such pathogens is expected to be low.

The proposed activity would be unlikely to significantly affect any threatened species, populations, or ecological communities and would not be carried out on a declared area of outstanding biodiversity value.

Operation

The operation of the proposed activity is not expected to generate substantial noise or air emissions and would include night-time lighting for security purposes, which are not expected to disturb fauna. Further, the proposed activity would include hardstand area which may lead to increased water runoff, which is expected to have no more than more impacts to biodiversity values.

Potential impacts to ecology during operation would be adequately managed with the implementation of the mitigation measures in Appendix B. The proposed activity would be unlikely to significantly affect any

threatened species, populations, or ecological communities and would not be carried out on a declared area of outstanding biodiversity value.

5.5. Aboriginal heritage

An Aboriginal Archaeological Due Diligence Assessment (AECOM, 2025a) was undertaken in accordance with Heritage NSW's *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010* (DECCW, 2010). The Aboriginal Archaeological Due Diligence Assessment is attached in Appendix D.

The Aboriginal Archaeological Due Diligence Assessment was undertaken in the form of a desktop assessment and site inspection on 26 February 2025 to identify areas of archaeological sensitivity and previously identified Aboriginal sites within the proposed impact area.

The desktop assessment included the following searches:

- Aboriginal Heritage Information Management System (AHIMS) database for a 5 x 5 km area surrounding the proposed impact area on 18 February 2025
- National Native Title Tribunal's online mapping tool 'Native Title Vision', the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) relevant to the proposed impact area on 25 March 2025.

5.5.1. Existing environment

Landscape context

The proposed impact area and surrounding region includes terrain considered to be indicative of the potential presence of Aboriginal artefacts such as topography consisting of a lower slope and flat with a low gradient, and a nearby watercourse.

No watercourses are located directly within the proposed impact area, but the closest watercourse, Burkes Creek, is located around 180 m to the south. Native vegetation within the proposed impact area has been extensively modified as a result of historical land use activities, particularly due to the construction of the substation.

Overall, all land within the proposed impact area is considered to be moderately disturbed. Vegetation clearance and impacts associated with the construction of the substation have actively disturbed land across the area. This has resulted in a loss of archaeological integrity and substantially reduced the likelihood of the presence of culturally scarred trees.

Recorded sites

A search of the AHIMS database on 18 February 2025 identified a total of 45 Aboriginal archaeological sites within 2.5 km of the proposed impact area. These sites comprised:

- 29 open artefact sites (i.e., isolated artefacts and artefact scatters)
- Eight grinding grooves
- Six modified trees
- Two areas of Potential Archaeological Deposit.

No recorded sites are located within the proposed impact area with the closest site, [redacted] (refer to Figure 5-4). [redacted]

During the site inspection, no areas of Aboriginal archaeological sensitivity were identified within the proposed impact area.

Native Title

A search of the National Native Title Tribunal's online mapping tool 'Native Title Vision', the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) relevant to the proposed impact area was undertaken on 25 March 2025. The search results indicated that there are currently no active native title claims, determinations or relevant Indigenous Land Use Agreements within the proposed impact area.

5.5.2. Impact assessment

Construction

There are no known Aboriginal objects or sites within the proposed impact area, and the risk of potential impacts to Aboriginal heritage values is considered to be low.

The Aboriginal Archaeological Due Diligence Assessment concluded that the archaeological sensitivity of the proposed impact area is also low, based on landform variables and past disturbances. As such, it is considered unlikely that construction of the proposed activity would impact unknown Aboriginal objects or sites.

Impacts to Aboriginal heritage would be adequately managed with the implementation of the mitigation measures in Appendix B and no further assessment is required.

Operation

The operation of the proposed activity would not result in potential impacts to Aboriginal heritage.

[This figure has been redacted]

Figure 5-4 AHIMS sites near the proposed impact area

5.6. Historic heritage

A Historic Heritage Assessment (AECOM, 2025c) was undertaken in accordance with the NSW Heritage Office and Department of Urban Affairs and Planning *NSW Heritage Manual* (1996) and the Department of Planning and Environment *Guidelines for Preparing a Statement of Heritage Impact* (2023). The Historic Heritage Assessment is attached in Appendix E.

The Historic Heritage Assessment was undertaken in the form of desktop research. The purpose of the Historic Heritage Assessment was to assess potential impacts on any nearby heritage items, as a result of the construction and operation of the proposed activity.

5.6.1. Existing environment

Historical context

The exploitation of two major resources, timber and coal, dominated the early history of the Lake Macquarie region, initiating the establishment of villages and towns including Killingworth, West Wallsend, Cardill and Dudley. Killingworth was established on the original 2,560 acres granted to William Bucknell in 1888.

The Newcastle 330 kV substation was developed around 1975, with little change to the proposed impact area observed thereafter, apart from being used for stockpiling and building access tracks to the substation.

Heritage items

A search of the following databases was undertaken on 3 April 2025 to identify items and places of historic heritage recorded within the study area:

- Australian Heritage Database (World, National, Commonwealth heritage lists)
- NSW State Heritage Inventory (SHI)
- Schedule 5 of Lake Macquarie LEP.

Table 5-3 provides a summary of the database search results.

Table 5-3 Heritage database search results

Heritage register	Results	Location
World Heritage List	None	N/A
National Heritage List	None	N/A
Commonwealth Heritage List	None	N/A
Register of the National Estate	None	N/A
NSW SHI	None	N/A
Lake Macquarie LEP	‘Elcom Newcastle Substation’ (LEP #108)	Within the proposed impact area
	Former Killingworth Hotel (LEP #109)	Around 200 m south of the study area

Heritage register	Results	Location
	Soldier's Memorial (LEP #110)	Around 260 m south of the study area
	Seaham, West Wallsend, Fairley and Killingworth Railway (LEP #10)	Around 50 m south of the study area

As shown in Table 5-3 and Figure 5-5, there is one historic heritage item located within the proposed impact area. The existing Transgrid Newcastle 330 kV substation is listed as 'Elcom Newcastle Substation' and is registered on Schedule 5 of the Lake Macquarie LEP (item #108). It is of local and regional heritage significance as one of the largest substations in NSW and a vital and highly visible link in the generation and transmission of high-voltage electric power (Heritage NSW, 2008). Its significant elements include the physical fabric of the substation (consisting of the fenced yard with high-voltage transformers and switchgear, and many overhead high-voltage lines on steel towers), its role as a vital link in NSW's power transmission system and its visual setting with surrounding infrastructure.

Archaeological potential

The archaeological potential for remains associated with the 'Elcom Newcastle Substation' to be present within the proposed impact area, such as building footings, rubbish/discarded material, historical road construction, fence lines and electrical equipment was considered. The assessment found there to be low potential for all identified types of archaeological remains to be present within the vicinity of the proposed impact area. The proposed activity is therefore unlikely to result in impacts to historic heritage archaeology.

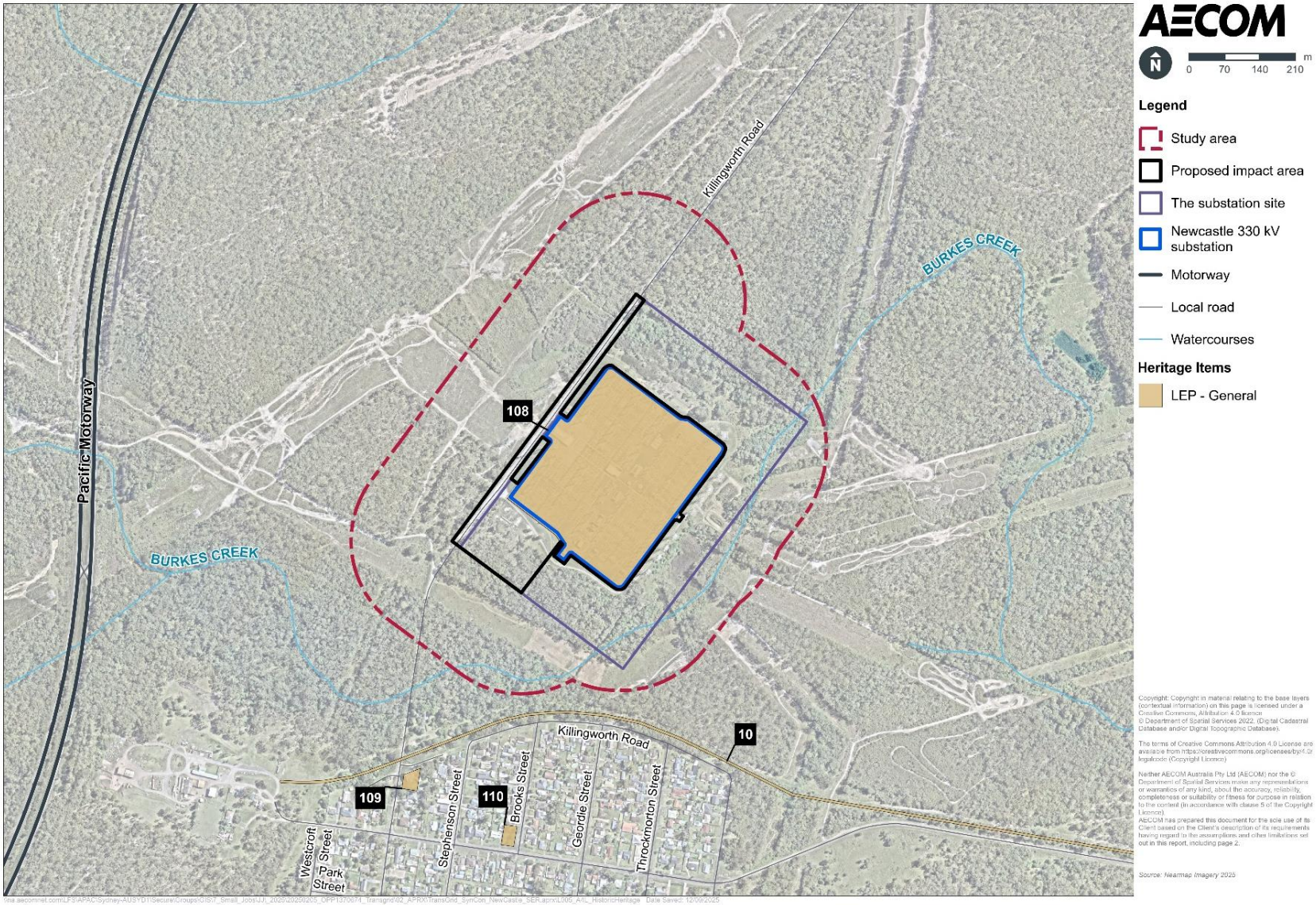


Figure 5-5 Locations of historic heritage items within and outside of the study area

5.6.2. Impact assessment

Construction

The proposed activity has the potential to impact the 'Elcom Newcastle Substation' during construction as it will be occurring within the heritage item's curtilage and connect directly to the substation. Construction of proposed foundations, footings and/or piles for syncon infrastructure would involve subsurface disturbance adjacent to existing substation infrastructure. There would be no physical impacts to listed significant fabric/elements of the heritage item, with the exception of new cables to be connected to the existing control building. Therefore, this would be considered a neutral impact.

Short-term visual impacts would occur during construction works within the proposed activity area, but these would not be permanent and would not impact the existing heritage significance of the item.

Given there is low potential for archaeological deposits to be present within the vicinity of the proposed impact area, it is considered unlikely that the proposed activity would result in impacts to historic archaeological deposits.

Operation

The proposed activity would result in positive indirect visual impacts to the heritage site 'Elcom Newcastle Substation'. Currently, the clearing adjacent to the 'Elcom Newcastle Substation' is sometimes utilised for stockpiling, which can visually detract from the heritage item. The installation of new/additional electrical infrastructure (the syncon building) would be consistent with the current use of the site as a substation and contribute positively to the views towards the heritage site.

The heritage significance of the 'Elcom Newcastle Substation' is associated with its vital link in NSW's power transmission system. The proposed activity aims to ensure the substation systems strength is available to maintain its use within the NSW power system.

Overall, the proposed activity would result in a less than minor impact to the heritage item's significant elements. The proposed activity would have a negligible impact on the overall significance of the 'Elcom Newcastle Substation'.

5.7. Noise and vibration

A Noise and Vibration Impact Assessment (AECOM, 2025d) was undertaken to support this SER. The Noise and Vibration Impact Assessment is attached in Appendix F.

This Noise and Vibration Impact Assessment considered the potential noise and vibration impacts of the proposed activity on nearby receivers during construction, commissioning and operation of the proposed activity. The existing noise levels have been compared against predicted noise levels during construction, commissioning and operation of the proposed activity.

5.7.1. Existing environment

The existing acoustic environment around the proposed activity is largely defined by distant road traffic noise from the M1 Pacific Motorway located about 800 m west of the proposed impact area and local road traffic noise on Killingworth Road.

The closest residential receivers are located around 275 m to the south of the proposed impact area, and there are no non-residential noise sensitive receivers within 1.5 km of the proposed impact area. A total of 18 residential receivers representative of residential receivers at a variety of distances away were identified for consideration of potential noise and vibration impacts (refer to Figure 5-6).

5.7.2. Impact assessment

Construction

Predicted noise levels

Based on the construction scenarios defined in Table 2-1 and their associated construction plant/equipment requirements and sound power levels, the following scenarios and their approximate construction timeframe were identified as the noisiest and therefore assessed:

- Scenario 1 – Site establishment (approximate duration 2 months)
- Scenario 2A – Access road construction (approximate duration 6 months)
- Scenario 2B – Syncon bench installation. (approximate duration 12 months)

All three scenarios were assessed as standard hours construction work. All major construction work is expected to be completed during standard hours only.

The modelling results are presented in Table 5-2 of Appendix F. The results show that construction noise levels are predicted to exceed the noise management level (NML) during standard hours for 11 assessment residential receivers (R1 and R4 – R13) during site establishment, and for seven assessment residential receivers (R1, R5-R9 and R12) during access road construction. The exceedances range from 1 to 5 dB(A) for both scenarios. The receivers predicted to experience NML exceedances are all located in Killingworth.

There are no residential receivers predicted to experience NML exceedances during the syncon bench installation scenario. There are also no residential receivers predicted to be 'highly affected' for the three construction scenarios assessed.

Construction noise impacts will be managed by implementing a Construction Noise and Vibration Management Plan that includes standard mitigation measures, as detailed in Appendix B.

Traffic noise

Based on the predicted construction traffic volumes required for the proposed activity during the peak construction period, it is considered unlikely that this traffic increase would lead to an increase of more than 2 dB(A), which is imperceptible to the human ear.

Vibration

No vibration-intensive equipment is proposed for use in any construction scenario. In addition, the nearest sensitive receiver is located around 275 m from the proposed activity. Therefore, potential construction vibration impacts are considered unlikely.

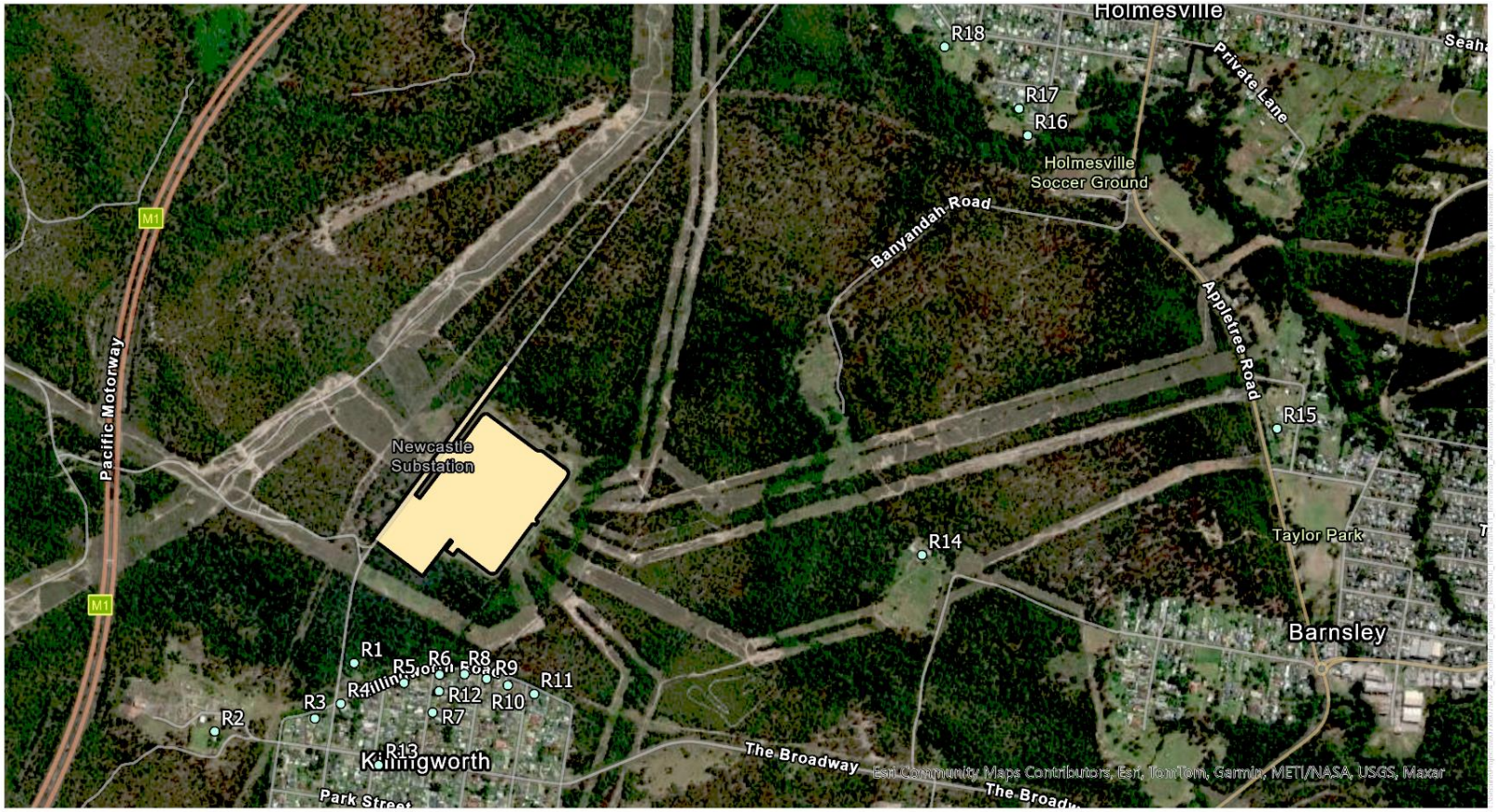


Figure 5-6 Noise assessment receiver locations (AECOM, 2025d)

Operation

The syncon units and some cooling plant will be located within a building. The future operational scenarios were modelled assuming various building construction and acoustic parameters to determine when compliance at receivers was achieved. The required acoustic treatments adopted for the proposed activity (which includes a building with a minimum insertion loss of 26 dB to the most affected receiver and walls around the external cooling plant) are detailed in Appendix B, and have been included in the operational noise modelling and predicted noise levels below.

Predicted noise levels with generator testing

Diesel generator testing will be undertaken once a month. In accordance with the *Noise Policy for Industry* during operations, noise from the diesel generator testing has been treated separately to the operation of other syncon components as it will be a single-event continuous noise for a period of 15 minutes to one hour. Therefore, this testing is given an allowable exceedance of 5 dB(A) of the project noise trigger level during the daytime period.

Predicted operational noise levels at nearby noise sensitive receivers for the daytime scenario with the diesel generator operating for testing purposes under neutral and noise-enhancing meteorological conditions are presented in Table 6-5 of Appendix F. Under neutral meteorological conditions, the predicted operational noise emissions from the proposed activity comply with the adjusted daytime noise criteria at all assessed residential receivers when the diesel generator is in operation. Under noise-enhancing meteorological conditions there is a negligible exceedance of 1 dB(A) at one receiver. Exceedances of up to 2 dB(A) are considered negligible as they are not discernible to the average listener and therefore would not warrant receiver-based treatments or controls, assuming all feasible and reasonable treatments at source have been implemented.

Predicted noise levels without generator testing

Predicted operational noise levels at nearby noise sensitive receivers for the daytime and evening scenario, without the generator operating, are presented in Table 6-6 of Appendix F. In the daytime scenario, operational noise levels are predicted to comply at all receivers under both neutral and noise-enhancing meteorological conditions.

Predicted noise levels for the night-time scenario are presented in Table 6-7 of Appendix F. The night-time operational noise levels are predicted to comply at all receivers under neutral meteorological conditions. Under noise-enhancing meteorological conditions, negligible exceedances of up to 1 dB(A) are predicted at three receivers (R6, R8 and R9). This exceedance would not be perceptible

With the implementation of the noise and vibration mitigation measures in Appendix B, the proposed activity is not expected to exceed the project noise trigger levels at most sensitive receivers during operation. Some receivers may experience a negligible exceedance of 1 dB(A) under noise-enhancing meteorological conditions.

Traffic noise

Traffic movements are expected to remain largely unchanged from existing operation and maintenance activities, therefore predicted traffic noise increases of more than 2 dB(A) are considered unlikely to occur.

5.8. Traffic and access

5.8.1. Existing environment

Access to the existing Newcastle 330 kV substation is provided by an existing driveway off Killingworth Road. Killingworth Road is a local road with a speed limit of 50 km per hour and is owned by Lake Macquarie City Council. Adjacent to the proposed impact area, and to its south, Killingworth Road is sealed. North of the proposed impact area, Killingworth Road is unsealed. Currently, the substation site is accessed by operational personnel, Transgrid employees and periodic contractors for business, maintenance and operational purposes.

Other local roads that are in the vicinity of the study area (and are likely used on approach to the substation site) include The Boulevard, The Broadway and Wakefield Road.

The Pacific Motorway (M1) runs in a north-south direction around 800 m to the west of the proposed impact area. The Pacific Motorway (M1) is a key north-south corridor linking Sydney to the Central Coast, Newcastle and the Hunter region that forms part of the National Land Transport Network (NLTN). The NLTN is a network of nationally important road and rail infrastructure links and their intermodal connections. The Pacific Motorway (M1) is a dual carriageway with two lanes in each direction, with an average speed limit of 110 km per hour.

Existing off-street parking is readily available within the substation site and internal access roads are located throughout the substation site.

There is one public bus route in the vicinity of the study area, with route 268 Killingworth to Glendale departing from The Broadway opposite Brooks Street, Killingworth.

5.8.2. Impact assessment

Construction

A new internal access road would be constructed to facilitate delivery of equipment and materials during construction, and access for ongoing maintenance activities during operation. The access road would provide a direct route for the construction vehicles to reach the construction site office and construction laydown area via Killingworth Road.

The proposed activity includes upgrades to Killingworth Road (further described in Section 2). If road or lane closure is required during the upgrade of the road, this will be managed in consultation with Lake Macquarie City Council to minimise impacts The works associated with upgrading Killingworth Road could potentially cause delays to road users, but would be manageable with the implementation of mitigation measures in Appendix B.

During construction, it is anticipated that up to 50 workers would be on site at any one time. Up to 55 light vehicles and 70 heavy vehicles are expected per day during construction. Heavy vehicles would be required for the delivery of construction equipment, removal of spoil (if required) and the delivery of the various syncon components. Heavy vehicles would utilise major roads where possible.

During construction, there would be a minor increase in traffic on the surrounding road network associated with the delivery of equipment, machinery and plant, transportation of waste off site and the daily arrival and departure of the construction workers. Local roads in the vicinity of the study area that may experience an increase in traffic include Killingworth Road, The Boulevard, The Broadway, and Wakefield Road. While

the increase in traffic may be noticeable on local roads, it is not anticipated that the vehicles would affect the safety or functioning of the existing road network. Any works that may impact traffic flows on a public road, such as works on the access road, will be managed through consultation with Council and Transport for NSW where relevant to determine applicable permit requirements and documented within the project CEMP.

In addition to light and heavy vehicles, oversize/overmass (OSOM) vehicles are expected to be required to deliver large or prefabricated elements for the construction of the proposed activity (e.g. transformer and secondary systems building). Up to 30 OSOM vehicles per day would be required during peak construction periods. On the days when there are OSOM vehicles, the number of heavy vehicles will be reduced.

The maximum volumes for light, heavy and OSOM vehicles present worst-case scenarios during peak construction periods and therefore a conservative approach to the assessment. Actual vehicle movements on some days would be far less.

OSOM deliveries would be conducted in accordance with the relevant permits from Lake Macquarie City Council and Transport for NSW. OSOM deliveries would require progressive road closures, which has a potential to disrupt the local road network. However, OSOM deliveries are likely to be undertaken outside peak traffic hours. As such, the potential disruption to local road network is considered minor.

There would be limited disturbance to bus operations. Bus routes would be temporarily impacted during construction works by temporary increases in construction vehicles using the same roads as the bus route, such as The Broadway and Wakefield Road.

Operation

During operation, the proposed activity would result in additional operational and maintenance activities at the Newcastle 330 kV substation. However, these are not expected to result in a significant change to the number of personnel accessing the substation. Therefore, potential traffic and access impacts during operation are expected to be negligible.

5.9. Air quality

5.9.1. Existing environment

The study area is located around 17 km inland of the east coast of Australia in the Hunter region of NSW. The nearest weather stations that provide relevant climate data are Brunkerville (weather station ID: 061424), located around 7.4 km southwest of the study area, and Cooranbong (weather station ID: 061412) located around 19.3 km southwest of the study area (BOM, 2025). The Lake Macquarie region experiences the warmest temperatures between November and March, with a mean maximum temperature of 28.7°C in January for years recorded between 2008 and 2025. Cooler temperatures are experienced between May and September, with July being the coldest month on average, recording a mean minimum temperature of 5.1°C between 2008 and 2025. On average, the area receives 1,118.7 mm of rainfall annually, and the mean number of days receiving more than 1 mm of rain per year is 96.7.

Air quality in the vicinity of the study would be typical for a coastal, semi-rural landscape. Likely sources of air quality pollution proximate to the study area include hazard reduction burning, dust from unvegetated areas and industry, vehicle emissions (notably, from the Pacific Motorway (M1)), and bushfires.

Australian industrial facilities that meet reporting criteria are required under legislation to report annually to the National Pollutant Inventory (NPI), kept and managed by the Commonwealth Department of Climate Change, Energy, the Environment, and Water (Cth DCCEEW, 2025) A search of the NPI undertaken on 5 May 2025 identified two pollutant sources within 5 km of the study area, including:

- Macquarie Coal Preparation Plant – Coal mining
- Edgeworth Wastewater Treatment Works – Sewerage and drainage services.

Sensitive receivers to air quality during construction and operation of the proposed activity include residents within the township of Killingworth, located from approximately 275 m south of the proposed impact area.

5.9.2. Impact assessment

Construction

Construction works are likely to generate dust emissions from the movement of vehicles, heavy machinery, and ground disturbance works (filling and excavation) for construction of the bench and potential installation/upgrade of oil and stormwater drainage systems, particularly during dry conditions. To mitigate dust impacts on sensitive receivers, dust suppression activities would include water spraying via water carts.

Other construction impacts include fuel emissions generated from site vehicles, trucks transporting materials and machinery, water carts, diesel generators, and certain machinery used onsite, such as excavators. Fuel emissions would be mitigated by conducting regular vehicle and machinery maintenance checks and having vehicles and machinery serviced regularly. Vehicles and machinery would be turned off while idle, where safe to do so. The impact of the proposed activity on the air quality in the surrounding environment would be negligible with appropriate implementation of mitigation measures in Appendix B.

Operation

The new 330 kV circuit breaker and gas insulated switchgear would be filled with sulfur hexafluoride (SF_6) gas, which is a commonly used insulation gas. SF_6 has a high global warming potential, meaning its release into the atmosphere, especially in large quantities, can contribute to the greenhouse effect (United States EPA, 2025). Within the high voltage equipment, SF_6 is sealed within gastight compartments, however, there is potential for leaks to occur.

In the event of an unplanned release of SF_6 from the equipment, the quantity of SF_6 that would potentially be emitted into the atmosphere would be minor in nature and would be a negligible contribution to the effects of climate change. Notwithstanding, measures outlined in Appendix B would be implemented to control any release of SF_6.

With the implementation of the mitigation measures in Appendix B, adverse construction and operational impacts to air quality as a result of the proposed activity are not considered to be significant.

5.10. Hazards and risks

5.10.1. Existing environment

Electric and Magnetic Fields

Electric and Magnetic Fields (EMF) are part of the natural environment, and EMF is produced wherever electricity or electrical equipment is in use. The higher the voltage, the stronger the electric field. Electric fields are strongest closest to the wires and electrical equipment, and their level reduces quickly with distance. Most materials act as a shield or barrier to electric fields. Magnetic fields are also highest closest to the wires and electrical equipment, and their level also reduces quickly with distance. Most materials, however, would not act as a shield or barrier to magnetic fields.

Transgrid's design and maintenance process is managed to enable its assets to be built and maintained in accordance with relevant Australian and International standards for EMF. In particular, Transgrid endeavours to comply with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines (2010) for limiting exposure to EMF. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a federal agency responsible for protecting human and environmental health from EMF. ARPANSA has adopted the ICNIRP guidelines, which set exposure limits for various types of electrical equipment and the nature of the exposure to that equipment.

EMF is currently produced by the busbars, transformers, switchgear and other overhead and underground connections and cables within the substation.

Bushfire prone land

Parts of the study area are mapped as Vegetation Buffer, Category 1, and Category 3 bushfire prone land as identified by the NSW Rural Fire Service (2015). The categorisation of bushfire prone land is as follows:

- Category 1: Highest risk for bushfire. Vegetation category consists of areas of forest, woodlands, heaths (tall and short), forested wetlands and timber plantations
- Category 2: Lower bushfire risk than Category 1 and Category 3 but higher than the excluded areas. Vegetation category consists of rainforests and lower risk vegetation parcels
- Category 3: Medium bushfire risk vegetation (higher than Category 2, and the excluded areas, but lower than Category 1. Vegetation category consists of grasslands, freshwater wetlands, semi-arid woodlands, alpine complex and arid shrublands
- Vegetation Buffer: Bushfire prone vegetation buffer polygons.

Figure 5-7 shows bushfire prone land in the vicinity of the study area. The proposed impact area largely comprises Vegetation Buffer land. A small portion in the southwest corner of the proposed impact area is mapped as Category 1 bushfire prone land.

5.10.2. Impact assessment

Construction

Bushfire

Construction activities could pose risks for onsite ignitions that could result in a fire escaping to the surrounding land. These are mainly associated with hot work (activities involving high temperatures), fire risk work (activities involving heat or with the potential to generate sparks), vegetation clearing and

management and use of vehicles onsite. Hot work and fire risk work during construction has the potential to cause fire ignition.

Occupational fire risk could also be present during construction. Occupational fire risk is the risk of a bushfire to those working in the proposed impact area. Bushfires can be caused by a variety of factors, including sparks from construction equipment and machinery and electrical incidents such as fallen power lines. The overall risk is low given the majority of the proposed impact area is Vegetation Buffer land. There is a higher risk for the small portion in the southwest corner of the proposed impact area mapped as Category 1 bushfire prone land, but this risk would be manageable with the implementation of mitigation measures in Appendix B.

Transgrid's *Hot Works and Fire Risk Procedure* would be adhered to for planning and undertaking all hot works and fire risk works. The implementation of this procedure would reduce the likelihood of construction of the proposed activity resulting in a bushfire.

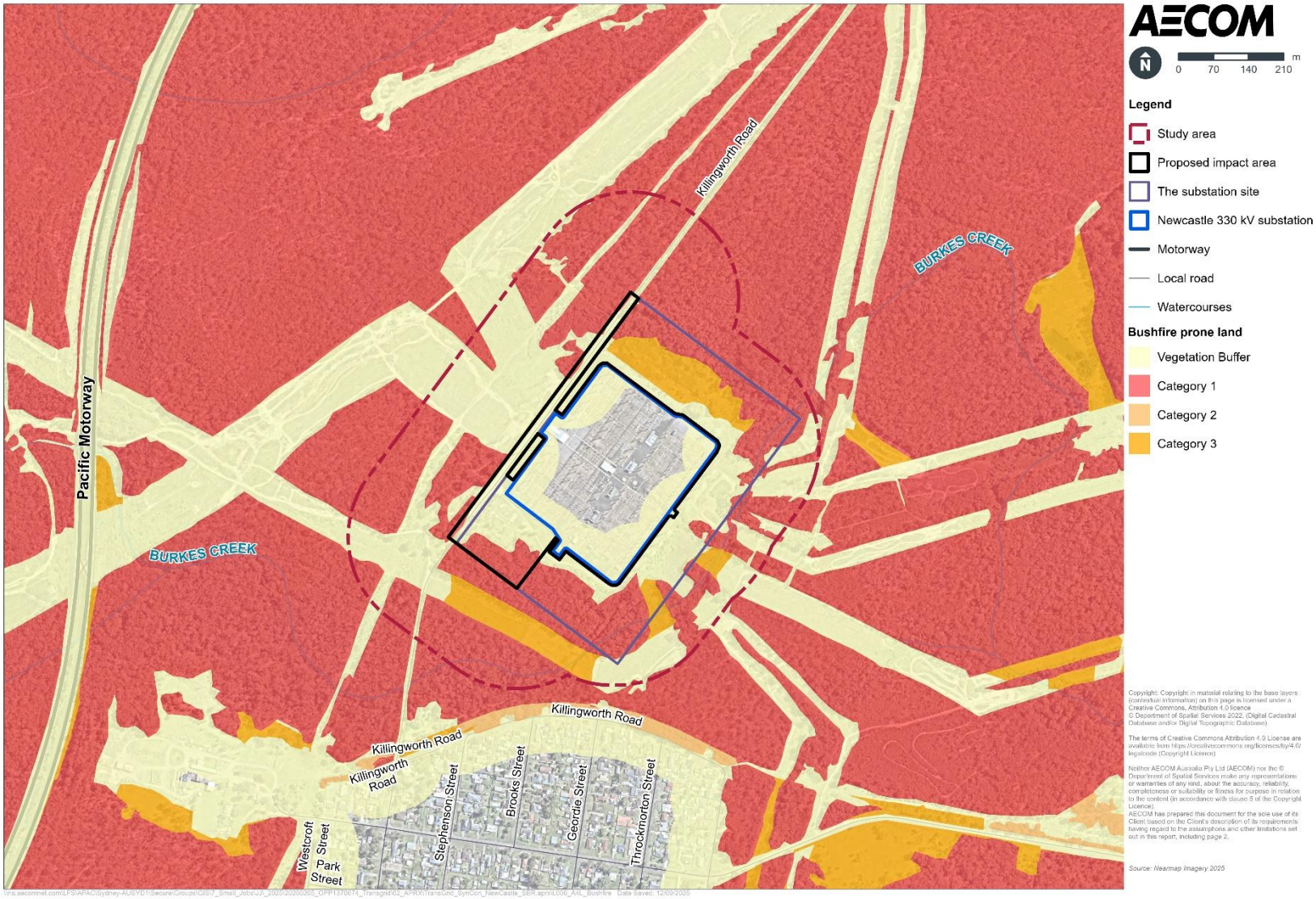


Figure 5-7 Bushfire prone land

Operation

Electric and Magnetic Fields

The proposed activity would only result in localised changes to EMF in the immediate vicinity of the new equipment. This level of EMF would be consistent with the existing substation, and it is not considered that the EMF levels would negatively impact the local community. All designs would be in accordance with the ICNIRP Guidelines for limiting exposure to EMF (ARPANSA, 2010).

Bushfire

Hot work and fire risk work associated with ongoing maintenance activities have the potential to cause fire ignition. These works would be managed under Transgrid's *Hot Works and Fire Risk Procedure*, with measures including suspension of activities on days of elevated fire danger.

An uncontrolled bushfire has the potential to impact the operation of the proposed activity. Bushfire has the potential to damage or destroy the proposed syncons and associated equipment. Appropriate space for asset protection zones (APZ) has been accommodated for in the proposed impact area. APZs provide a buffer zone between a bushfire hazard and an asset, reducing the risk of the asset being impacted by bushfire.

With the implementation of the mitigation measures in Appendix B, adverse construction and operational hazards and risks relevant to the proposed activity are not considered to be significant.

5.11. Visual amenity

5.11.1. Existing environment

The study area can be categorised into three separate sections within which the visual amenity varies, as follows:

- Substation infrastructure – This area includes the existing substation site. The visual amenity is characterised by electrical substation infrastructure and hardstand areas
- Transmission infrastructure – Areas include transmission lines and easements surrounding the substation site. The visual amenity is characterised by cleared transmission easements, with sparse vegetation, access tracks and transmission infrastructure (including overhead cables and transmission towers)
- Densely vegetated areas – This area includes densely vegetated areas surrounding the substation site. The visual amenity is characterised by dense mature vegetation, gullies, and watercourses.

The township of Killingworth is located around 400 m south of the proposed impact area, with the closest residential receiver located around 275 m away.

5.11.2. Impact assessment

Construction

During construction, there would be minor temporary visual impacts associated with the construction activities. This would include the presence of a construction work site, vehicles, plant and equipment. Dense vegetation between residences and the proposed impact area would provide visual screening. Construction works would be briefly visible for road users travelling along Killingworth Road.

Operation

The proposed activity would result in some cleared vegetation adjacent to the existing Newcastle 330 kV substation, a new access track and the installation of the syncons and associated infrastructure within the proposed impact area. The new infrastructure is not anticipated to impact the visual amenity of the study area since it is consistent with the current land use characteristics and views towards the substation.

While some vegetation clearing would be required, dense vegetation would remain between residences and the proposed impact area, acting as screening and reducing visual impacts to residential receivers. Additionally, the new infrastructure would only be briefly viewed by road users along Killingworth Road.

With the implementation of the mitigation measures in Appendix B, adverse construction and operational impacts to visual amenity as a result of the proposed activity are not considered to be significant.

5.12. Waste

5.12.1. Existing environment

Very little waste is generated from the current operation of the Newcastle 330 kV substation. Maintenance activities may generate waste associated with components of the substation that require replacement. Vegetation maintenance also generates green waste, in addition to domestic waste generated during inspections.

5.12.2. Impact assessment

Construction

Waste that is likely to be generated during construction works would include:

- General construction waste, such as packaging and excess construction material
- Surplus excavated materials that cannot be reused onsite
- Waste oils, greases and lubricants from the maintenance of plant and equipment
- Domestic and putrescible waste (including food scraps, bottles, cans and paper)
- Green waste from vegetation clearance activities.

All waste produced during construction would be reused where possible or recycled/disposed of at nearby authorised and appropriately licensed waste disposal facilities.

Operation

During operation, the volume and types of waste would remain largely unchanged from the existing Newcastle 330 kV substation.

With the implementation of the mitigation measures in Appendix B, adverse construction and operational waste impacts as a result of the proposed activity are not considered to be significant.

5.13. Social and economic considerations

5.13.1. Existing environment

The Newcastle 330 kV substation is an important part of the NSW power system.

2021 Census data for the geographical area defined by the Australian Bureau of Statistics (ABS), Statistical Area Level 2 (SA2), West Wallsend – Barnsley – Killingworth, was reviewed to understand the social and economic environment of the study area (ABS, 2022).

The median age is 38 years old. English is only spoken at home for 94.4% of the population. The four largest employment sectors for people in the Killingworth region are: other social assistance services (i.e. not medical services, pathology and diagnostic imaging services, nor allied health services), hospitals (except psychiatric hospitals), supermarket and grocery stores and aged care residential services.

The SA2 land is predominantly for environmental conservation with some industrial activity, such as mining and electricity transmission.

Key social infrastructure located within around 2 km of the proposed impact area includes:

- Educational facilities:
  - Holmesville Playhouse Pre-School
- Health, medical and emergency facilities:
  - Fire and Rescue NSW Holmesville Fire Station
- Sporting and recreational facilities:
  - Park Street Reserve Playground
  - Mount Sugarloaf Pony Club
  - Holmesville Skatepark
  - Kevin Evans Oval
  - Holmesville Playground
- Community groups and facilities:
  - Holmesville Community Garden
  - Sugar Valley Sustainable Neighbourhood.

Park Street Reserve Playground is located around 670 m south of the proposed impact area, and the remaining key social infrastructure items are located over 1.6 km from the proposed impact area.

5.13.2. Impact assessment

Construction

The proposed activity may temporarily affect the local community near the Newcastle 330 kV substation due to increases in noise, traffic, air quality emissions and visual amenity impacts. These impacts are considered to be minor and temporary and would be managed through the implementation of the mitigation measures proposed in Appendix B. No negative impacts to emergency services or the key employment sectors of the SA2 are expected.

The proposed activity would have a negligible impact on social infrastructure services and short-term housing in the region, as the proposed activity would only include a relatively small workforce. Negligible positive economic benefits would be derived from the workforce sourcing daily needs and potentially accommodation.

Operation

During operation, the proposed activity would not result in additional adverse social or economic impacts. In the long term, the proposed activity would support the reliability and security of the electricity supply, which is a positive impact.

With the implementation of the mitigation measures in Appendix B, adverse construction and operational social and economic impacts as a result of the proposed activity are not considered to be significant.

5.14. Cumulative impacts

5.14.1. Existing environment

The assessment of cumulative impacts focused on the proposed activity's interaction with other projects in the vicinity of the Newcastle 330kV substation, and where construction and/or operational timeframes are likely to be concurrent.

A review of the NSW Department of Planning, Housing and Infrastructure's major projects assessment website on 21 July 2025 did not identify approved or proposed major developments within 1 km of the proposed impact area.

Minor construction projects may occur in proximity to the study area. This may include the construction of dwellings, small renovation projects and demolition works approved by the local Council.

5.14.2. Impact assessment

The assessment of cumulative impacts focused on the proposed activity's interaction with other projects in the vicinity of the proposed activity, and where construction and/or operational timeframes are likely to be concurrent.

Construction

When considering potential minor approved construction projects occurring simultaneously with the proposed activity, there is potential for cumulative impacts from noise, traffic and dust to occur if the projects are located near the proposed activity. With the implementation of mitigation measures in Appendix B, cumulative impacts as a result of the construction of the proposed activity are not considered to be significant.

Operation

The proposed activity would not generate ongoing cumulative impacts during operation.

6. Consideration of statutory factors

6.1. Section 5.5 of the EP&A Act and 7.3 of the *Biodiversity Conservation Act 2016*

Under Section 5.5 of the EP&A Act, the determining authority (being Transgrid), has a duty to consider the effect of the proposed activity on the environment and the effects on any wilderness areas. Table 6-1 provides a summary of how each of the factors has been considered.

Table 6-1: Consideration of Section 5.5 of the EP&A Act. Duty to consider environmental impact

Factor	Comment
5.5(1). Examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.	All potential environmental impacts have been considered and assessed in Section 5. The proposed activity is not likely to result in significant environmental impacts.
5.5(3). Consider the effect of an activity on any wilderness area (within the meaning of the *Wilderness Act 1987)* in the locality in which the activity is intended to be carried on.	The proposed activity would not affect any wilderness areas.

Under Section 7.3 of the BC Act, the determining authority (being Transgrid) has a duty to take into account whether there is likely to be a significant effect on threatened species, ecological communities, or their habitats or whether the activity is to be carried out on a declared area of outstanding biodiversity value.

As detailed in Section 5.4, no threatened species, ecological communities, or their habitats would be significantly affected by the proposed activity, and the proposed activity would not be carried out on a declared area of outstanding biodiversity value.

It is unlikely that there would be any significant effect on threatened species, ecological communities, or their habitats.

6.2. Clause 171 of the EP&A Regulation

Clause 171(2) of the EP&A Regulation details those factors that must be taken into account when consideration is given to the likely impact of any activity on the environment, for the purposes of Part 5 of the EP&A Act. Table 6-2 provides a summary of how each of the Clause 171 factors has been considered.

Table 6-2: Consideration of Clause 171 factors

Factor	Potential impact
a. any environmental impact on a community.	As detailed in Section 5, the proposed activity would not result in significant adverse environmental impacts. Impacts from construction on the surrounding community are expected to be minor and temporary and would be appropriately managed with the implementation of the mitigation measures provided in this SER.

Factor	Potential impact
b. any transformation of a locality.	The proposed activity would not transform the locality it is in, as works would be carried out within the proposed impact area on Transgrid's existing Newcastle 330 KV substation and on the local road adjacent to the substation site.
c. any environmental impact on the ecosystems of the locality.	The proposed activity would not have a significant impact on the ecosystems of the locality (refer to Section 5.4).
d. any reduction of the aesthetic, recreational, scientific or other environmental quality.	The proposed activity would result in a minor change to the visual landscape through the introduction of the syncons and associated infrastructure and vegetation clearing (refer to Section 5.11).
e. any 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.	Based on known sites and available information, it is unlikely that the proposed activity would have an adverse 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.
f. any impact on the habitat of protected animals (within the meaning of the *Biodiversity Conservation Act 2016*).	The proposed activity may impact the habitat of protected animals, however, this impact is not expected to be significant and would be appropriately managed with the implementation of the mitigation measures provided in Appendix B of this SER (refer to Section 5.4.2).
g. any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.	The proposed activity would not endanger flora or fauna. Impacts to ecology are discussed further in Section 5.4.
h. any long-term effects on the environment.	The proposed activity would not have long-term effects on the environment.
i. any degradation of the quality of the environment.	The proposed activity would cause minor disturbance to some areas during construction, particularly due to vegetation clearing. However, this is not expected to be significant.
j. any risk to the safety of the environment.	Provided the mitigation measures identified in Appendix B are implemented, there is not expected to be any risk to the safety of the environment.
k. any reduction in the range of beneficial uses of the environment.	The proposed activity would be carried out within the proposed impact area, on Transgrid's existing Newcastle 330 kV substation and adjacent local road and would not result in a reduction of beneficial uses of the environment.

Factor	Potential impact
l. any pollution of the environment.	The proposed activity has the potential to result in pollution to the environment; however, the impacts would be appropriately managed through the mitigation measures provided in this SER.
m. any environmental problems associated with the disposal of waste.	Waste would be actively disposed of at appropriately licensed waste disposal facilities (refer to Section 5.12) and as such, would not result in environmental problems.
n. any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.	There would be no increase in demand on resources that are, or are likely to become, in short supply, as a result of the proposed activity.
o. any cumulative environmental effect with other existing or likely future activities.	The proposed activity would not contribute to significant cumulative impacts when considered in conjunction with current or likely future activities (refer to Section 5.14).
p. any impact on coastal processes and coastal hazards, including those under projected climate change conditions.	The proposed activity is not being carried out near coastal environments and would not affect any coastal processes or coastal hazards.
q. applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1.	The proposed activity is not expected to conflict with the goals of the applicable local, regional and district strategic plans.
r. other relevant environmental factors.	The proposed activity is not expected to have a significant impact on any other environmental factors not discussed in this SER.

6.3. Matters of National Environmental Significance under the EPBC Act

Under the EPBC Act, Transgrid is required to consider matters of national environmental significance (MNES), to assist in determining whether the proposed activity should be referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water. Table 6-3 provides a summary of how MNES have been considered.

Table 6-3: MNES under EPBC Act

MNES / Commonwealth land	Potential impact
Any impact on a World heritage property?	No, refer to Sections 5.5 and 5.6
Any impact on a National heritage place?	No, refer to Sections 5.5 and 5.6
Any impact on any wetlands of international importance?	No
Any impact on a Commonwealth listed threatened species or ecological communities?	No, refer to Section 5.4
Any impacts on a Commonwealth listed migratory species?	No, refer to Section 5.4

MNES / Commonwealth land	Potential impact
Any impact on a Commonwealth marine area?	No
Any impact on the Great Barrier Reef Marine Park?	No
Does the proposed activity involve a nuclear action (including uranium mines)?	No
Does the proposed activity involve a water resource, in relation to coal seam gas development and large coal mining development?	No
Is the proposed activity likely to have a significant impact on the environment on Commonwealth land?	No

6.4. Consideration of Ecologically Sustainable Development

Obligations under the EP&A Act require that Transgrid protects the environment by conducting its operations in compliance with the principles of ecologically sustainable development (ESD), namely:

- The precautionary principle
- Intergenerational equity
- Conservation of biological diversity and ecological integrity
- Improved valuation, pricing and incentive mechanisms.

The principles of ESD have been applied during the proposed activity design and assessment. Mitigation measures (Appendix B) would be applied to avoid or minimise impacts.

7. Environmental management

Transgrid is committed to conducting its activities and services, including the current proposed activity, in a manner that minimises pollution and environmental impacts, and complies with relevant legislation, industry standards and codes of practice. To achieve this, Transgrid maintains an Environmental Management System that is certified under the international standard ISO 14001. All works undertaken for the activity would be consistent with the Environmental Management System.

The proposed activity, as currently described in Section 2, is not likely to significantly affect the environment. As a result of the detailed environmental assessment undertaken in this SER, environmental management mitigation measures have been included in Appendix B.

Where the mitigation measures in technical reports differ from those listed in Appendix B, the mitigation measures contained in Appendix B take precedence.

A CEMP shall be prepared and submitted to an Environment Business Partner/ Delivery for review and endorsement four weeks prior to the commencement of works, including site establishment. The CEMP shall be prepared in accordance with Transgrid's Preparation of a Construction Environmental Management Plan Procedure.

In addition to the Contractor's Environmental Supervisor, Transgrid shall appoint an Environmental Inspector to regularly check that the proposed activity is being carried out in compliance with all environmental approval and legislative conditions.

The operation of the activity would be managed in accordance with Transgrid's certified Environmental Management System, which includes detailed maintenance procedures to minimise potential environmental impacts. Due diligence environmental checks, including environmental information generated from GIS where relevant, are undertaken before any maintenance works are carried out.

8. Summary and conclusion

The proposed activity has been assessed under Part 5 of the EP&A Act, and this SER has been prepared in accordance with relevant legislation, including but not limited to Section 5.5 of the EP&A Act, Clause 171 of the EP&A Regulation and the Commonwealth EPBC Act. An assessment of potential impacts is presented in Section 5. The key potential impacts associated with the proposed activity include:

- Removal of a small amount of native vegetation which may provide potential habitat for flora and fauna species.
- Minor erosion and sedimentation impacts from excavation activities during construction
- Minor noise impacts generated from construction plant, vehicles and the ongoing operation of the syncons
- Minor temporary impacts to traffic during the construction of the syncons and the road upgrade on Killingworth Road
- Minor temporary air quality impacts generated from excavation activities, construction plant and vehicles
- Permanent minor visual impacts from the clearing of vegetation and the installation of the syncons and associated infrastructure.

All other impacts were assessed as negligible.

Actions to mitigate (prevent, minimise, or offset) potential and likely impacts have been prescribed in Appendix B. These measures shall be implemented in undertaking the activity. Considering the assessment undertaken within this SER, it is considered that the environmental risk from potential impacts is low.

This SER provides a true and fair review of the activity in relation to its potential effects on the environment. It addresses, to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the activity.

Considering the assessment of the impacts detailed in this SER, it is concluded that the activity **is not likely to significantly affect the environment** and therefore an Environmental Impact Statement is not required.

In addition, it is concluded that the activity is not likely to significantly affect threatened species, ecological communities or their habitats and would not be carried out on a declared area of outstanding biodiversity value; therefore, a Species Impact Statement is not required. No formal biodiversity offsets are proposed for the proposed activity, though disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

This conclusion has been based on the assessment undertaken within this SER.

This SER is limited to the assessment of the activity described in Section 2. Supplementary assessment and determination in accordance with the EP&A Act would be required for:

- Works outside of the scope of work assessed in this environmental impact assessment, for which the environmental impact has not been considered; or
- Modifications to the activity scope, methodology or recommended mitigation measures, that alter the environmental impact assessed in this SER.

9. References

ABS. (2022). *2021 Census of Population and Housing, General Community Profile, New South Wales.* Commonwealth Government. Retrieved 2023, from Australian Bureau of Statistics.

AECOM. (2025). *Accelerated Syncon PTIP Planning Approval Summary Report.* Transgrid.

AECOM. (2025a). *Aboriginal Archaeological Due Diligence Assessment – Newcastle 330 kV Substation - new synchronous condenser.*

AECOM. (2025b). *Newcastle 330 kV Substation - new synchronous condenser - Flora and Fauna Assessment.*

AECOM. (2025c). *Newcastle 330 kV Substation - new synchronous condenser - Historic heritage assessment.*

AECOM. (2025d). *Noise and Vibration Impact Assessment - Newcastle 330 kV Substation - new synchronous condenser.*

AEMO. (2022). *2022 System Strength Report.*

ARPANSA. (2010). *Guidelines for Limiting Exposure to EMF.*

BOM. (2025). *Climate Data Online*. Retrieved from Bureau of Meteorology: http://www.bom.gov.au/climate/data/

Cth DCCEEW. (2025). *National Pollutant Inventory*.

DECC. (2008a). *Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services.* Department of Environment and Climate Change.

DECC. (2008b). *Soils and Construction Volume 2C Unsealed Roads.* Department of Environment and Climate Change.

DECC. (2009). *Interim Construction Noise Guideline.* Sydney: Department of Environment and Climate Change NSW.

DECCW. (2010). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010.*

Department of Planning and Environment . (2015). *NSW Code of Practice for Authorised Network Operators.*

Heritage NSW. (2008). *Elcom Newcastle Substation, State Heritage Inventory.*

International Commission on Non-Ionizing Radiation Protection. (2010). *Guidelines for limiting exposure to time-varying electric and magnetic fields (1Hz – 100kHz).*

Landcom. (2004). Managing Urban Stormwater: Soils and Construction Volume 1. *1*(4). Sydney, NSW, Australia.

NSW DCCEEW. (2024). *Estuary Report Card 2023-2024 - Lake Macquarie.*

NSW DCCEEW. (2025). *Basins and catchments - Macquarie Tuggerah*. Retrieved from https://water.dpie.nsw.gov.au/about-us/learn-about-water/basins-and-catchments/catchments/macquarie-tuggerah

NSW Department of Planning and Environment. (2023). *Guidelines for Preparing a Statement of Heritage Impact.*

NSW EPA. (2014). *Waste Classification Guidelines .*

NSW EPA. (2015). *Guidelines on the Duty to Report Contamination.*

NSW Heritage Office and Department of Urban Affairs and Planning. (1996). *NSW Heritage Manual.*

NSW Rural Fire Service. (2015). *Guide for bush fire prone land mapping.*

Transgrid. (2024). *Meeting system strength requirements in NSW.*

Umwelt. (2018). *Concrush Increase to Capacity Project.*

United States EPA. (2025). *Sulfur Hexafluoride (SF6) Basics*. Retrieved from https://www.epa.gov/eps-partnership/sulfur-hexafluoride-sf6-basics

WMA Water. (2019). *Upper Cockle Creek Flood Study.* Lake Macquarie City Council.

Appendix A Map series

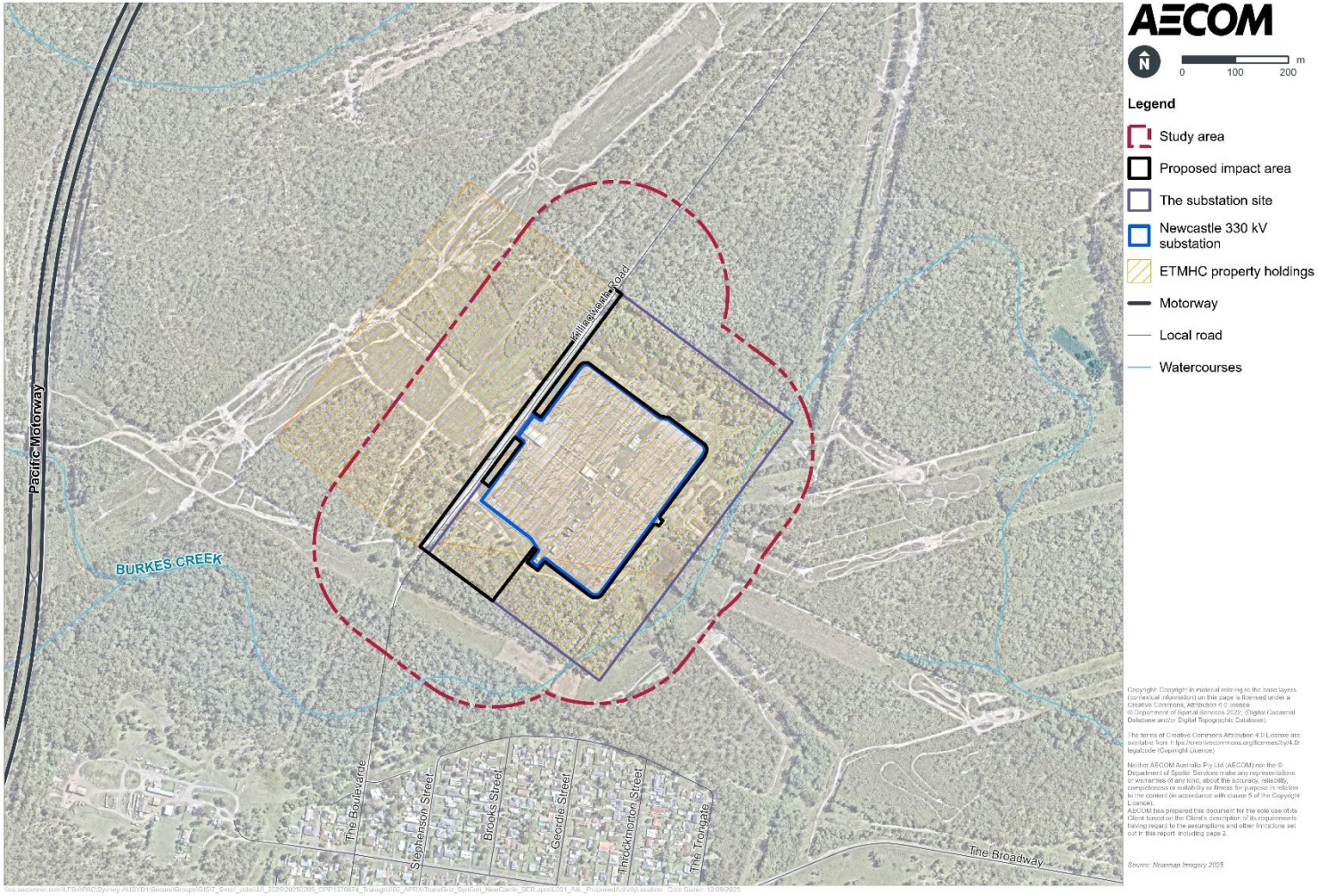


Figure A-1 Proposed activity location

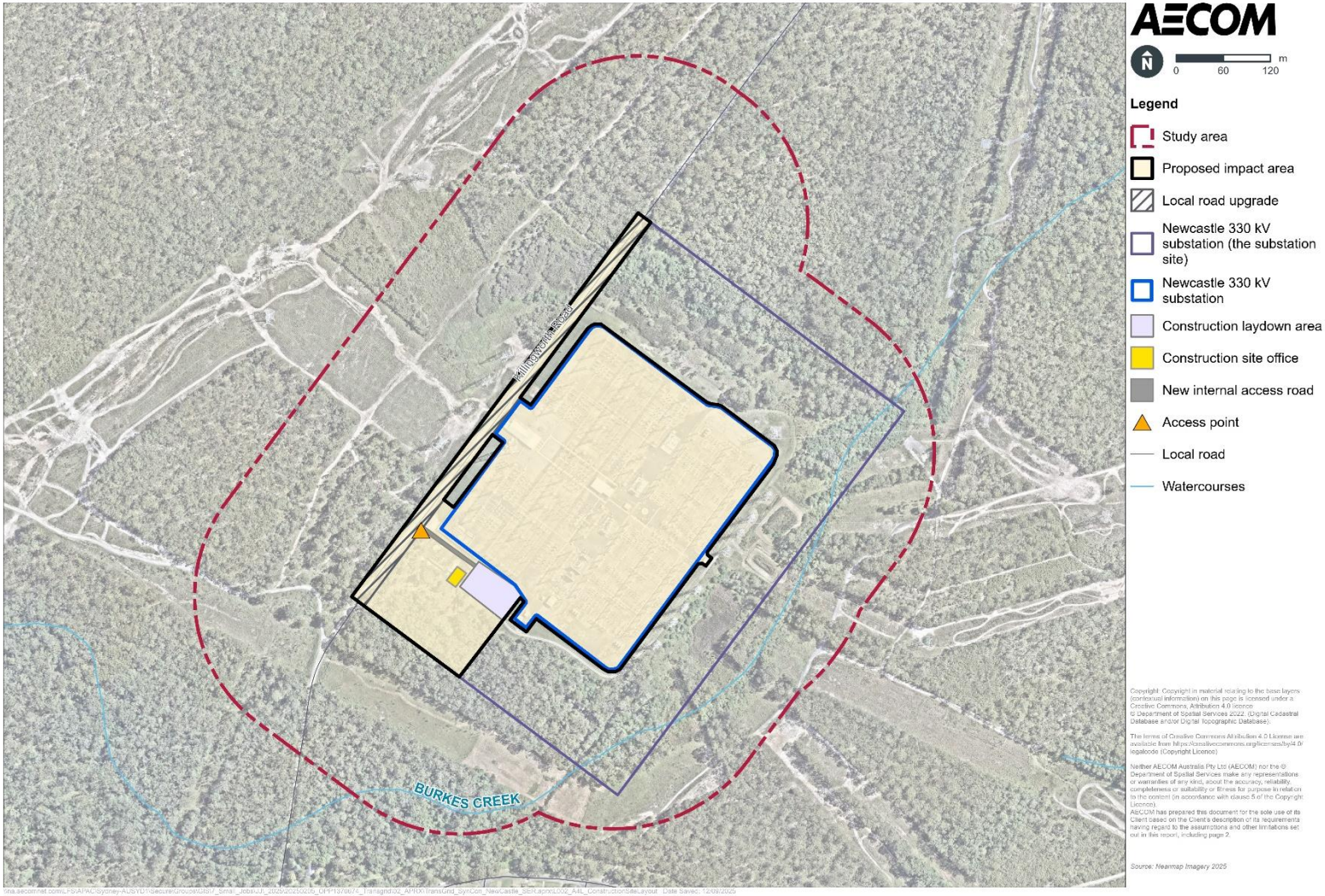


Figure A-2 Indicative construction site layout

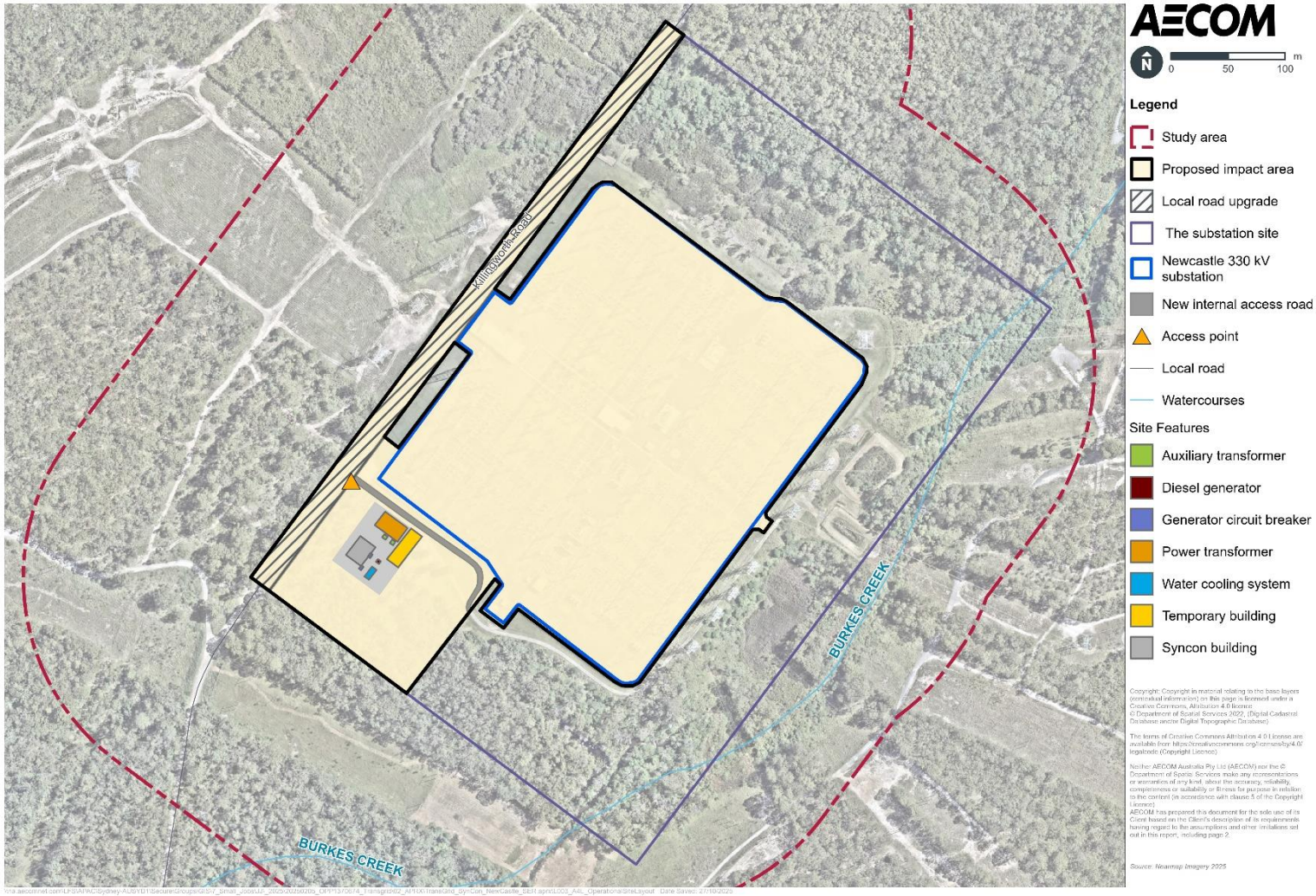


Figure A-3 Indicative operation site layout

Appendix B Mitigation measures

Mitigation measures	
Environmental management and incident response	
EM1	A Construction Environmental Management Plan (CEMP) would be prepared and submitted to Environment Business Partner/Delivery for review and endorsement four weeks prior to the commencement of works, including site establishment. The CEMP would be prepared in accordance with Transgrid's Preparation of a Construction Environmental Management Plan Procedure.
EM2	All workers would be inducted onto the CEMP, which would include relevant environmental mitigation measures and sensitive environmental area(s). Training would be given to site personal as appropriate. Records would be kept of this induction and training.
EM3	An Environmental Supervisor would be included as part of the construction staff to oversee implementation of the CEMP and to ensure that all mitigation measures are being effectively applied. In addition to the Contractor's Environmental Supervisor, Transgrid would appoint an Environmental Inspector to regularly audit and check that the work is being carried out in compliance with all environmental approval and legislative conditions.
EM4	Prior to commencement of works on Killingsworth Road, Transgrid shall make contact with Lake Macquarie City Council's Asset Management – Roads team to determine the standards required, and with Council's Quality and Surveillance team to determine any notification and inspection processes.
EM5	All environmental incidents and near misses must be reported to Transgrid. All pollution incidents that threatens or harms the environment must be reported immediately to relevant authorities, in accordance with the *Protection of the Environment Operations Act 1997* (POEO Act).
EM6	Environmental spill kits containing spill response materials suitable for the works being undertaken would be kept on site at all times and be used in the event of a spill. Any spills would be contained, cleaned up promptly and immediately reported to the Transgrid site representative.
EM7	All chemicals or other hazardous substances would be stored in a bunded area and away from any drainage lines/pits. The capacity of the bunded area would be at least 130% of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s would be shown on the Site Plans. All refuelling activities would be undertaken in designated refuelling zones that are bunded and impervious. The location of the refuelling zones would be shown on the Site Plans. Spill kits would be readily available for these zones.
EM8	Any environmentally sensitive areas would be clearly delineated and shown on Site Plans.

Mitigation measures	
Geology and soils	
GS1	An Erosion and Sediment Control Plan (ESCP) would be prepared by a suitably qualified professional. All erosion and sediment control measures would be designed, implemented and maintained in accordance with relevant sections of *Managing Urban Stormwater: Soil and Construction Volume 1* (Landcom, 2004) ('the Blue Book) (particularly Section 2.2) and *Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services* (DECC, 2008a). The ESCP would be included in the CEMP.
GS2	Vehicles and equipment would remain on existing roads and nominated site access. Vehicles and equipment would be free of mud, soil or vegetated matter prior to access onto public roads.
GS3	Any imported fill would be certified at source location (e.g. Quarrymaster or property owner) as pathogen and weed free Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM) in accordance with the POEO Act and the Waste Regulation.
GS4	Any excavated material suspected of showing evidence of contamination would be sampled and analysed by a NATA Registered laboratory and managed in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014), the Guidelines on the Duty to Report Contamination (NSW EPA, 2015) and the *Contaminated Land Management Act 1997*. The procedure would be included in the CEMP.
GS5	All oil handling would be undertaken in accordance with Transgrid's Oil Management Procedure.
Hydrology and water quality	
HW1	No refuelling or bulk herbicide preparation would occur within 40 metres of drainage lines/pits.
HW2	Water management for excavations and on-site would be included and adhered to, in accordance with the CEMP. Controls would include at a minimum: • Use of dish drains (or similar), coir logs, hay bales and/or sediment fence to reduce water flow into excavations and off-site • Separate clean and dirty water where possible • Record dewatering volumes if large amounts of ground water is encountered. (ensuring no water licence is required) • Identifying management methods for intercepted/collected water e.g. regular monitoring, treatment and discharge • Water quality testing will be required if suspected contamination is encountered (odour, sheen, visual contaminants) to inform disposal and/or discharge requirements. • Temporary dewatering structures are required to manage sediment laden water prior to drainage off-site • Reporting frequency and requirements.

Mitigation measures	
Ecology	
EC1	Where biosecurity issues are identified, mitigation and management strategies must be documented in the CEMP. This may include: • Wash down procedures to reduce the spread of weeds via vehicles and machinery. • Cleaning of vehicle tyres, undersides and radiator grills before leaving a property, cleaning of footwear and minimising soil movement between locations. • Establishing plant and vehicle washdown stations with appropriate signage and disposal for waste where appropriate. • Undertaking a vehicle hygiene inspection checklist or log • Imported material must be weed and pathogen free. • Working from clean areas towards weedy/pathogen affected areas to reduce the spread of weeds/soil pathogens. • All herbicide selection and use would be in accordance with Transgrid requirements.
EC2	The clearing of native vegetation would be minimised as far as possible, particularly within Zone 2. The limits of clearing would be agreed with the Transgrid environmental representative prior to works commencing, with areas not subject to clearing demarcated or fenced off to prevent movement of construction vehicles and workers into these areas.
EC3	All workers would be provided with an environmental induction prior to commencing work. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity. Key points would include: • Maintaining all construction activities within the designated and demarcated or fenced off boundaries • Identification of weeds and biosecurity threats (e.g. soilborne pathogens) on site and appropriate actions to prevent their spread (see detail below) • Identification of threatened plants and animals, and what to do in case of encountering these (see detail below).
EC4	If native fauna is encountered it would be allowed to move off site of its own accord, as far as it is safe to do so. If the animal does not move works are to stop in that area and a person qualified in wildlife handling must be called in to safely relocate the animal.
EC5	If any threatened flora is located within the clearing footprint works are to stop in that area and a Transgrid environmental representative contacted for further advice.
EC6	Lighting of the proposed activity would be designed in accordance with relevant standards and directed inwards, and away from adjacent vegetated areas as far as practicable.
EC7	Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible. This would include soil stabilisation and revegetation using a native seed mix approved by the Transgrid environmental representative.
EC8	Any external material (such as crushed sandstone or similar) brought in for the purposes of constructing and stabilising the biodiversity impact area would be fully removed upon completion of construction, unless required for the operation of the syncons or the existing Newcastle 330 kV substation.
EC9	Should the detailed design or onsite works determine the need to remove or trim any additional vegetation that has not been identified in this report, additional approval from Transgrid's environmental team would be required.

Mitigation measures	
Heritage	
HE1	In the event that a site or artefact (as defined by the *National Parks and Wildlife Act 1974* or *Heritage Act 1977*) is identified during construction works, works must cease at the location and no further harm to the object shall occur. The find must be immediately reported to Transgrid, and the regulator in accordance with legislation. No work must commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and NSW Police, DPE and Transgrid contacted.
HE2	Workers undertaking activity within the heritage curtilage of the 'Elcom Newcastle Substation' are to be made aware of its heritage significance and protection measures enacted to ensure there are no accidental physical impacts to its heritage significant elements during works (i.e., temporary demarcation of work areas through signage or boundary tape, toolbox presentation to ensure workers do not go beyond the bounds of defined work areas and reduce the risk of accidental impacts to the heritage item). See Section 1.4 (Item description) in Appendix E for the heritage item's significant elements. Details of these protection measures should be included within the project's CEMP.
Noise and vibration	
NV1	Noise generating works would be in accordance with the *Interim Construction Noise Guideline* (DECC, 2009): • 7:00am – 6:00pm Monday to Friday • 8:00am – 1:00pm Saturdays • No work on Sundays or Public Holidays. Work outside normal hours, on Sundays and public holidays would only comprise: • The delivery of materials outside normal hours requested by police or other authorities for safety reasons • Emergency work to avoid the loss of lives and/or property • Work timed to correlate with system planning outages • Vacuum and oil filling of equipment. Other noise generating works outside of the standard construction hours would require the prior formal written consent of the Environmental Business Partner/Delivery and require justification in accordance with the Guideline.
NV2	Noise affected neighbouring properties would be notified as to the timing and duration of the construction works at least seven days prior to commencing work.

Mitigation measures	
NV3	A Construction Noise and Vibration Management Plan (CNVMP) would be developed and implemented for the proposed activity. The CNVMP would include, as a minimum, the following: • Identification of nearby residences and other sensitive land uses • Description of approved hours of work • Description and identification of all construction activities, including work areas, equipment, and duration • Description of what work practices (generic and specific) would be applied to minimise noise and vibration • A complaints handling process with a dedicated contact included for 24 hours a day • Noise and vibration monitoring procedures • Overview of community consultation required for identified high impact work. Construction work should be planned and carried out during standard construction hours wherever possible. Table 7 1 in Appendix F presents a summary of the standard mitigation measures which should be considered as mitigation measures within the CNVMP where feasible and reasonable.
NV4	The following measures would be considered to manage potential operational noise impacts: • Housing the syncon units inside a building to provide attenuation. This may also provide screening for other noise sources such as existing transformers and capacitors. The building should provide a minimum insertion loss of 26 dB to the most affected receiver; this is inclusive of doors and any ventilation openings. Where feasible, ventilation openings should be directed away from noise sensitive receivers and acoustic louvres used to reduce noise emissions, if necessary. • Construction of a noise wall on three sides of the syncon cooling system (northwest, southwest and southeast, noting that the proposed sycon building may serve as the northwest wall), the height should extend around 1.0 m beyond the top of the cooling system. The wall must have no gaps and a minimum surface density of 5 kg/m^2. • Acoustic absorption is required on at least two adjacent surfaces of the noise wall facing the equipment. The acoustic absorption must have a minimum noise reduction coefficient (NRC) of 0.8. • Regular maintenance of mechanical equipment (e.g. fans, motors, air conditioning units and pumps) to minimise noise from wear, loose components, or deteriorated insulation. • During detailed design it is recommended that the final site layout, equipment selections and building construction details (dimensions, materials, openings and location) are reviewed to confirm compliance with the project noise trigger levels. • Noise monitoring shall be undertaken post construction to ensure operation noise has reduced to a level that does not result in adverse impacts to nearby sensitive receivers.
Traffic and access	
TA1	Transportation and equipment delivery movements on public roads would be in accordance with Transport for NSW and Council requirements.
TA2	Access track works would be constructed in accordance with the *Soils and Construction Volume 2C Unsealed Roads* (DECC, 2008b).

Mitigation measures	
TA3	Traffic, transportation and access mitigation and management strategies would be documented and implemented in accordance with Council and Transport for NSW requirements and documented within the CEMP and updated as required.
Air quality	
AQ1	If necessary, dust suppression techniques would be implemented, and incorporated into the CEMP, as per the techniques outlined in the Blue Book, such as water spraying of surfaces, covering stockpiles and covering surplus soils and materials during transportation.
AQ2	Air quality mitigation and management strategies would be documented and implemented in accordance with the CEMP.
Hazards and risk	
HR1	All designs would be in accordance with the *International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to EMF* (ARPANSA, 2010).
HR2	Transgrid's *Hot Works and Fire Risk Procedure* would be adhered to for planning and undertaking all hot and fire risk works. This process would be documented and implemented in accordance with the CEMP.
HR3	All SF_6 handling would be undertaken in accordance with Transgrid's *Management of SF_6 Gas – Work Instruction.*
Visual amenity	
VA1	All construction plant, equipment, waste and excess materials would be contained within the designated boundaries of the work site and shall be removed from the site following the completion of construction.
VA2	The syncon building and associated equipment would be designed generally in accordance with the visual amenity of the existing substation equipment.
Waste	
WA1	Waste mitigation and management strategies would be documented in the CEMP and be in accordance with Transgrid's Waste Management Procedures and associated Work Instructions. The CEMP shall include the following: • All waste streams and how they will be managed (e.g. segregation and storage on site and reuse/ recycling opportunities taking into account where waste will be generated and the location of recycling/reuse facilities) shall be identified prior to construction commencing and included in the CEMP or separate Waste Management Plan • All waste, including surplus soils, which cannot be reused would be classified in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014), removed from the site and disposed of at a facility that can lawfully accept the waste in accordance with the POEO Act and POEO Waste Regulation • All waste generated during construction would be maintained, tracked and recorded in a waste register in accordance with Transgrid's Waste Management Procedure and entered into Transgrid's Compliance, Audit, Risk and Safety Management System (CAMMS) • Any waste that requires tracking under State or Commonwealth legislation would be authorised in Transgrid's CAMMS waste management system, prior to waste being transported and leaving the site.

Mitigation measures	
WA2	Concrete trucks would be permitted to flick wet wipe their discharge chutes with the effluent discharged into prepared bored holes, prepared excavations/formwork or a watertight receptacle for recycling or disposal. No concrete washout or agitators is permitted.

Appendix C Flora and Fauna Assessment

Prepared for
Transgrid
ABN: 19 622 755 774

AECOM

Newcastle 330 kV Substation - new synchronous condenser

Flora and fauna assessment

14-Nov-2025

aecom.com

Delivering a better world

Newcastle 330 kV Substation - new synchronous condenser

Flora and fauna assessment

Client: Transgrid

ABN: 19 622 755 774

Prepared by

AECOM Australia Pty Ltd
Gadigal Country, Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

14-Nov-2025

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document Newcastle 330 kV Substation - new synchronous condenser

Ref 60585948

Date 14-Nov-2025

Originator Jamie McMahon, Elizabeth Rizzo

Revision History

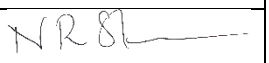
Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	20-May-2025	For client review	Jamie McMahon Technical Director	JM
1	29-Jul-2025	For client review	Jamie McMahon Technical Director	JM
2	28-Aug-2025	For client review	Neil Standen Associate Director	NS
3	08-Oct-2025	Final	Neil Standen Associate Director	NS
4	14-Nov-2025	Updated final	Neil Standen Associate Director	

Table of Contents

List of Tables

List of Figures

1.0 Introduction

Transgrid is proposing to install and operate two synchronous condensers (syncons) at the existing Newcastle 330 kV substation (the proposed activity). The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the New South Wales (NSW) power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their 2022 System Strength Report (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

AECOM Australia Pty Ltd (AECOM) has been engaged by Transgrid to prepare a Summary Environmental Report (SER) to assess potential impacts from the proposed activity at the existing Newcastle 330 kV substation. This flora and fauna assessment considers the impacts of the proposed activity on biodiversity values and will be used to support the SER. This report considers both the construction and operation of the proposed activity, and includes recommendations for avoidance, mitigation and offsetting of potential biodiversity impacts.

1.1 Proposed activity description

The scope of works for the proposed activity would include:

- Site establishment activities, including installation of construction offices and amenities, equipment storage and construction laydown areas and vegetation removal
- Construction of a new internal access road from Killingworth Road and upgrades to Killingworth Road to support the transport of equipment and vehicle movements to and from site
- Installation of a new bench (concrete slab, foundations and associated earthworks), with an indicative maximum footprint of around 130 by 150 metres, immediately south of the existing Newcastle 330 kV substation to house the syncons and associated infrastructure
- 330 kV busbar extension with a new switch bay, which comprises a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester
- Installation of the new syncons and associated equipment, including:
    - Power transformer with firewalls
    - Auxiliary transformers
    - Syncon building and gantry crane
    - Oil lubrication and water-cooling systems
    - Control room and battery room
    - Low voltage AC and DC systems
    - Protection and control systems
    - Backup diesel generator
    - Pony motor
- Installation of a new demountable secondary systems building
- Installation of new spill oil tank, secondary containment dam(s), and drainage systems to cater for the new transformers, diesel generator and the syncon oil lubrication system
- Extension of the substation's stormwater drainage system, to cater for the new bench area
- Installation of new lighting protection masts.
- Rehabilitation of the site including:
    - Removal of temporary construction facilities and equipment

- Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by Transgrid's environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction
- Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

Further details of the scope of works for the proposed activity are presented in Section 2 of the SER (AECOM, 2025).

1.2 Proposed impact area and biodiversity study area

The area where ground surface impacts are required as part of the proposed activity is referred to as the 'proposed impact area'. The proposed impact area is shown in Figure 1-1 and is an indicative maximum footprint in which the construction and operation of the syncons would be carried out. The proposed impact area also includes areas within the substation boundary that are required to facilitate connection to the proposed syncons, as well as a portion of Killingworth Road which requires upgrading.

This assessment has adopted a 'biodiversity study area' which includes the following:

- A 'biodiversity impact area'. This comprises a portion of the 'proposed impact area' located to the south of the existing substation, where the syncons would be situated, and where construction requiring vegetation removal would be carried out. Construction in other parts of the proposed impact area (e.g. within the existing substation footprint or upgrade works on Killingworth Road) are not expected to involve removal of sensitive vegetation
- A 20-metre buffer around the biodiversity impact area.

The biodiversity study area is shown in in Figure 1-2.

1.2.1 Site context

The Newcastle 330 kV substation is located on Killingworth Road, in the suburb of Killingworth and the City of Lake Macquarie Local Government Area (LGA), NSW.

The syncons are proposed to be located along the southern boundary of the existing substation (as shown in Figure 1-1), generally toward the southern extent of the proposed impact area. This area adjacent to the southern boundary of the substation is cleared and maintained as mowed grass. This general area would also be used for the site compound and laydown areas.

Access to the proposed impact area is along Killingworth Road, providing direct access to the substation. Killingworth Road is unsealed to the north of Killingworth and as it passes the substation.

The area around the proposed impact area is occupied by dense remnant bushland, intersected by transmission line easements in most directions. The terrain is generally flat, with a slight downward slope towards Burkes Creek to the south. The proposed impact area drains to the south and southeast into Burkes Creek, which flows into Cockle Creek at Barnsley.

As described in Section 1.2, the biodiversity study area comprises a buffer of 20 m. The 20 m buffer has been applied so that desktop searches provide a representative overview of species that have potential to be present within the biodiversity impact area.

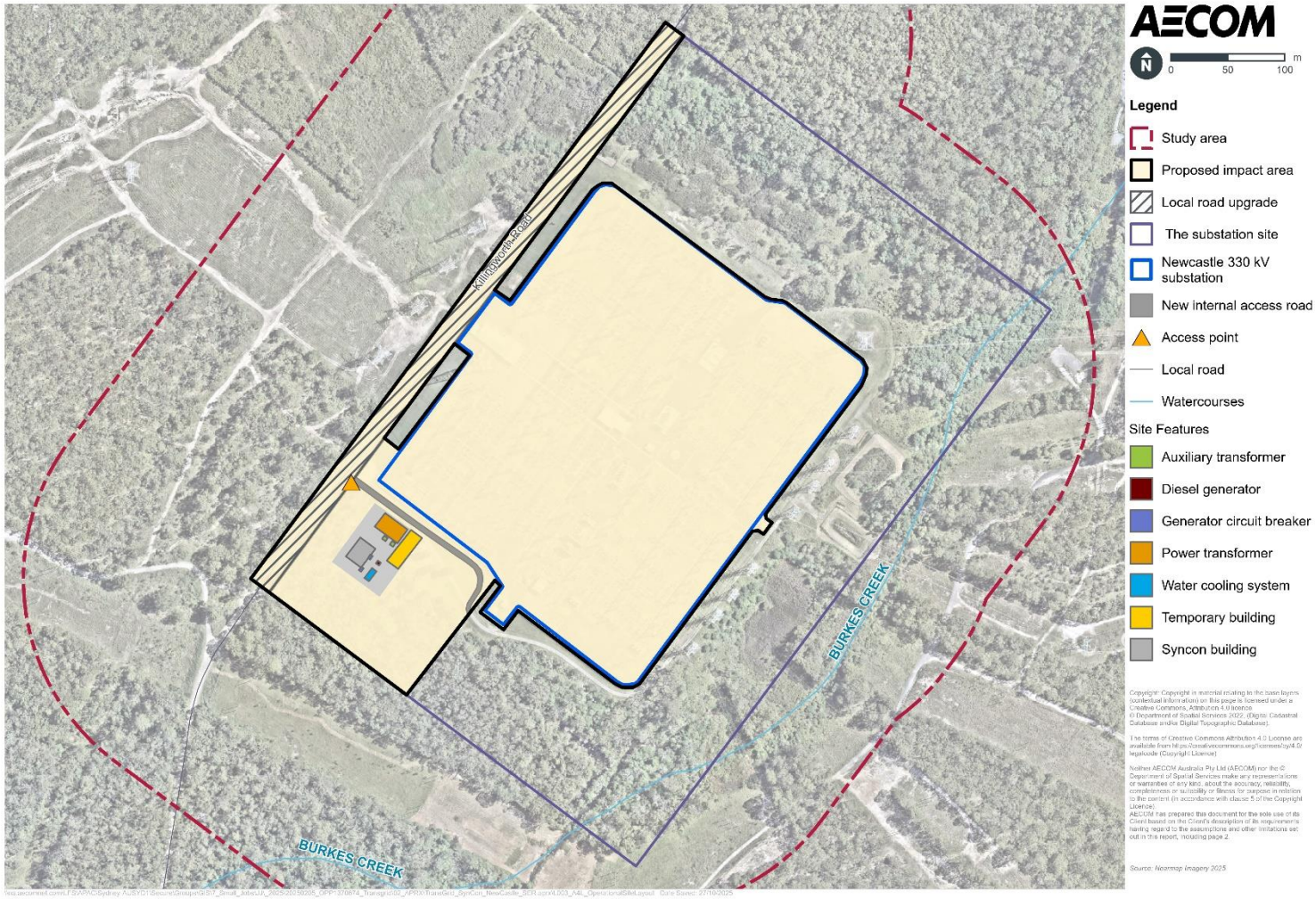


Figure 1-1 Proposed impact area and indicative operational site layout

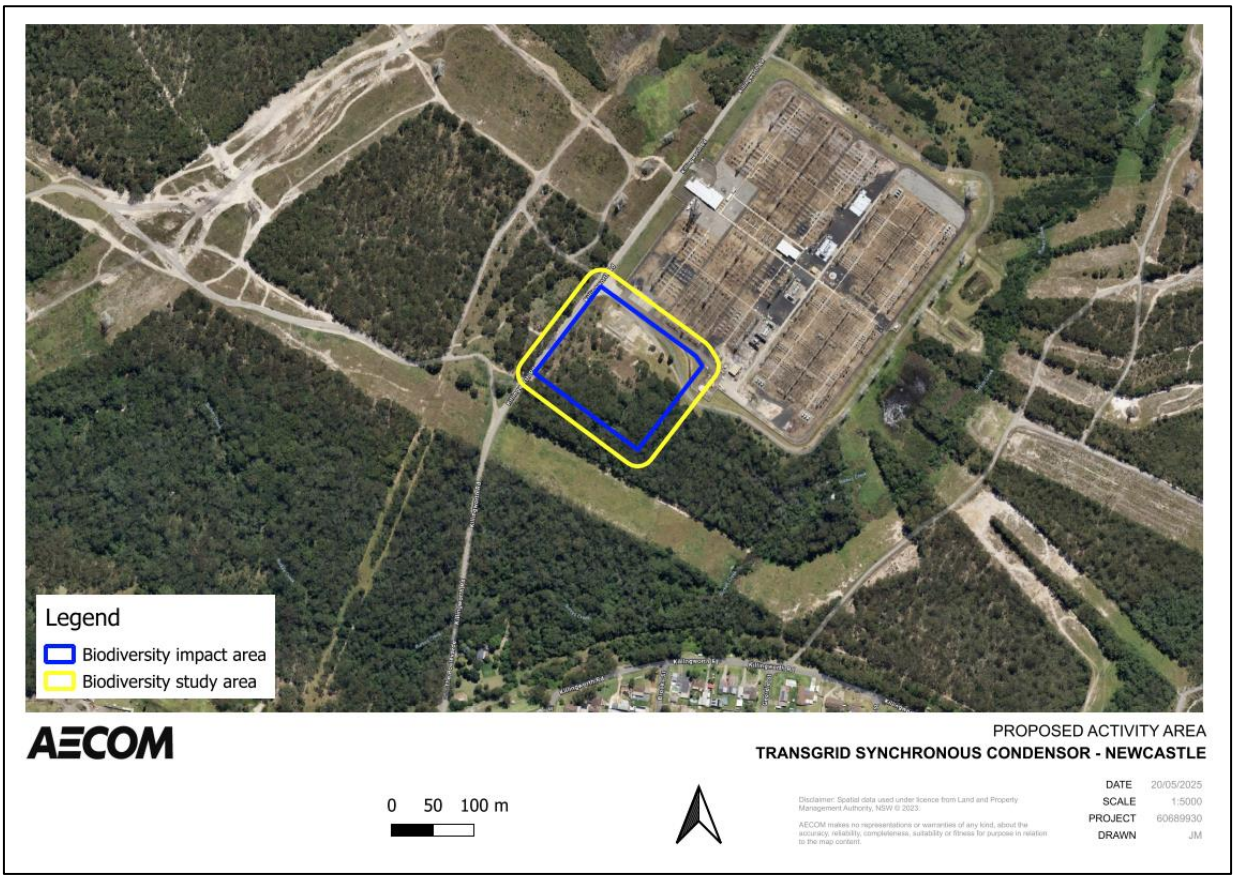


Figure 1-2 Biodiversity study area

1.3 Legislative context

As directed by *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP) the proposed activity would be permissible without development consent under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). As such development consent would not be required from Lake Macquarie Council, nor would local council vegetation protection measures such as tree protection orders apply. Further detail on the legislative context and permissibility of the proposed activity is included in Section 3 of the SER.

1.3.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that Commonwealth approval be obtained for certain actions, and establishes an assessment and approvals system for actions that have, or are likely to have, a significant impact on Matters of National Environmental Significance (MNES) Under the EPBC Act, impacts upon MNES are considered to assist in determining whether the proposed activity should be referred to the Australian Government Minister for the Environment and Water. The Minister may deem the action a ‘controlled action’ which may require more detailed assessment. Alternatively, if deemed ‘not a controlled action’ no more detailed assessment is required.

Potential impacts as a result of the proposed activity are discussed in Section 4.0. The proposed activity is not anticipated to result in a significant impact, and a referral under the EPBC Act is not required.

1.3.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) lists a number of threatened species, populations, ecological communities and declared areas of outstanding biodiversity value to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats.

Where any of these could be impacted by the proposed activity, an assessment of significance that addresses the requirements of Section 7.3 of the BC Act must be completed to determine the significance of the impact.

Potential impacts as a result of the proposed activity are discussed in Section 4.0. The proposed activity is not anticipated to result in a significant impact, and neither a species impact statement nor a biodiversity development assessment report is required.

1.3.3 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) provides a framework to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants and outlines the responsibilities of government, councils, private landholders and public authorities in the management of biosecurity matters.

Priority weeds are plants classified under the Biosecurity Act as presenting a biosecurity risk to the State or a particular region. If present, priority weeds need to be assessed and controlled to fulfil the General Biosecurity Duty and minimise biosecurity risks. Section 3.8 outlines the priority weeds of the Lake Macquarie LGA recorded during the field assessment.

1.3.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) protects threatened species, populations and ecological communities of fish and marine vegetation, and other living resources of NSW waters. Impacts to threatened species listed under this act are considered alongside those of the BC and EPBC Acts.

Section 199 of the FM Act requires a public authority provide the Minister for Primary Industries 21 days' notice dredging or reclamation works, though clause 227 of the Fisheries Management (General) Regulations 2019 provides an exemption from this requirement if the works are carried out in accordance with the Code of Practice for Minor Works in NSW Waterways. The proposed activity does not involve dredging or reclamation works, or works within Key Fish Habitat (KFH).

1.3.5 Coastal Management Act 2016 and *State Environmental Planning Policy (Resilience and Hazards) 2021*

The *Coastal Management Act 2016* (Coastal Management Act) and Chapter 2 of *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) provide a framework for considering impacts arising from development proposed within coastal areas of NSW. The Coastal Management Act and Resilience and Hazards SEPP define certain areas, including the coastal zone, coastal use area and the coastal environment area.

A key consideration for activities assessed under Part 5 of the EP&A Act is whether the proposed activity extends into areas mapped as Coastal Wetlands and Littoral Rainforests. In such cases, the proposed activity becomes development permitted with consent, as well as designated development. This planning pathway requires additional assessment and consultation, with the consent authority generally becoming the local council.

The proposed activity is not within an area mapped as coastal wetlands or littoral rainforests under these policies and therefore assessment under Part 5 of the EP&A Act can be undertaken.

Further clauses under Chapter 2 of the SEPP apply only to development with consent, and hence do not apply to this assessment.

2.0 Methodology

2.1 Overview

The assessment involved:

- A desktop review of relevant databases and resources (refer to Section 3.2), including:
  - NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) BioNet Wildlife Atlas
  - NSW State Vegetation Type Map via the NSW Government's central resource for Sharing and Enabling Environmental Data (SEED) portal
  - Commonwealth DCCEEW Protected Matters Database
  - NSW Department of Primary Industries WeedWise List
  - Bureau of Meteorology Atlas of groundwater dependent ecosystems
  - NSW Department of Primary Industries (DPI) key fish habitat
  - NSW DPI threatened aquatic species
- A field survey (refer to Section 2.3), comprising an assessment of vegetation present, and opportunistic fauna sightings
- Assessment of the potential biodiversity impacts of the proposed activity (refer to Section 4.0), including
  - The approximate amount and significance of vegetation and/or threatened species likely to be affected by the proposed activity
  - Impacts to fauna habitat connectivity
  - The potential for the proposed activity to introduce or spread weeds (including priority or environmental weeds), pests or other pathogens
  - The potential for the proposed activity to contribute to key threatening processes
- Identification of measures to avoid and/or minimise potential ecological impacts (refer to Section 5.0).

2.2 Assessment objectives

The overarching objectives of this flora and fauna assessment are:

- To identify the ecological values of the biodiversity impact area using a combination of desktop research and field inspection
- To provide Transgrid with information that would allow the proposed activity, where feasible, to avoid impacts to known and potential ecological values
- To provide appropriate management strategies to mitigate impacts to identified ecological values that cannot be avoided.

2.3 Field survey

An inspection of the biodiversity study area was undertaken in the morning of 26 February 2025. Conditions during the inspection were warm, approximately 24°C with scattered cloud and no wind. There had been 10 mm of rain throughout the week prior to the survey, according to the Lake Macquarie automatic weather station (Station ID 061412). Rainfall was also recorded on the day of survey (2.6 mm). No standing water was present within the biodiversity study area, though water was observed in Burkes Creek.

The full extent of the biodiversity study area was able to accessed, including the proposed site compound and laydown area.

The survey included assessment of vegetation present, as well as opportunistic fauna sightings. No detailed fauna survey was undertaken, though an assessment of fauna habitat present within the biodiversity study area was carried out.

2.4 Limitations

The survey focused on particular areas where ecological risks were deemed to be greater. This included areas of existing vegetation in which the syncon infrastructure is proposed to be placed, as well as locations within the biodiversity study area that were deemed to be more sensitive to potential off-site impacts.

While a fauna habitat assessment was undertaken, this technique is not an adequate substitute for full fauna surveys. Fauna are capable of inhabiting sub-optimal habitat, and fragmentation, isolation or species density can all influence the presence and distribution of a particular species. Species likelihood of occurrence was informed by considering habitat characteristics and opportunistic sightings, and is summarised in Appendix A.

No in-stream aquatic survey was undertaken though aquatic conditions were noted from the bank where relevant.

Detailed Biodiversity Assessment Method plot assessments were not undertaken, though relevant vegetation was inspected and recorded throughout the biodiversity study area.

3.0 Existing environment

3.1 Overview

Table 3-1 provides an overview of the site, including relevant environmental controls and sensitivities. Photographs of the site are included in Section 3.3.1.

Table 3-1 Environmental controls and sensitivities

Environmental considerations	In the biodiversity study area?
Does the biodiversity study area overlap a National Park?	No. The nearest National Park is 15 km southwest of the biodiversity study area
Does the biodiversity study area include any land reserved or dedicated for preservation of other environmental protection purposes?	No
Does the biodiversity study area overlap a World Heritage Area?	No
Does the biodiversity study area overlap an Environmental Protection Zone under an environmental planning instrument?	Yes. Land zoned C2 Environmental Conservation is located within the biodiversity study area. However, the biodiversity impact area is zoned SP2 Infrastructure.
Does the biodiversity study area include any land identified as a wilderness area?	No
Does the biodiversity study area overlap a wetland area dedicated under the Ramsar Wetlands Convention?	No
Does the biodiversity study area contain critical habitat?	No
Does the biodiversity study area contain Key Fish Habitat?	No. The nearest KFH (Burke Creek) is located approximately 250 m southeast of the biodiversity impact area.
Is the biodiversity study area mapped on the Biodiversity Values map?	No
Is the biodiversity study area mapped on the Native Vegetation regulatory map?	No (excluded)

3.2 Desktop searches

Desktop research was undertaken prior to the commencement of the field survey. This included database searches to determine if targeted surveys for specific species were required. Additionally, these searches helped to identify threatened biota known or likely to occur within the biodiversity study area.

A description of the databases and resources that were investigated is provided in Table 3-2.

Table 3-2 Desktop searches

Database / resource	Desktop search results
NSW DCCEEW BioNet Wildlife Atlas – Threatened Flora and Fauna Records and Exotic Species	The NSW DCCEEW BioNet Wildlife Atlas was searched on 16 May 2025 for threatened flora and fauna records. This search was undertaken using a 10 km x 10 km area centred on the biodiversity study area. This search returned 32 threatened ecological communities, 70 threatened fauna species and 26 threatened flora species listed under the BC Act and/or EPBC Act. Threatened flora and fauna in the biodiversity study area are discussed further in Section 3.5.
NSW State Vegetation Type Map	The State Vegetation Type Map was accessed via the SEED map to identify plant community types (PCT), vegetation class and vegetation formation within the biodiversity study area. Vegetation types and communities are discussed further in Section 3.4.
Commonwealth DCCEEW – Protected Matters Database	The Commonwealth DCCEEW Protected Matters Database was searched for MNES and other matters protected by the EPBC Act. This search utilised a 5 km radius search area of the biodiversity study area. MNES are discussed further in Section 3.3.
NSW Department of Primary Industries WeedWise List	Priority weeds are plants that pose a potentially serious threat to primary production or the natural environment. Under the *Biosecurity Act 2015* public authorities have a responsibility to prevent, manage, control or eradicated priority weeds in the region. Priority weeds are discussed further in Section 3.8.
Bureau of Meteorology Atlas of groundwater dependent ecosystems	The Bureau of Meteorology Atlas of groundwater dependent ecosystems (GDEs) was reviewed to understand if vegetation within or near the biodiversity study area potentially relies on groundwater, noting the potential that the proposed activity may alter groundwater flows to a minor extent. No GDEs were identified in the biodiversity study area.
NSW Department of Primary Industries key fish habitat	The DPI KFH mapping includes all marine and estuarine habitats up to highest astronomical tide level (that reached by 'king' tides) and most permanent and semi-permanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank (DPI 2011a). The biodiversity study area was reviewed for potential KFH. The nearest waterway, Burkes Creek, was identified as KFH, This waterway is located around 250 m from the biodiversity impact area.
NSW Department of Primary Industries threatened aquatic species	The DPI report *Fish communities and threatened species distributions of NSW* (DPI 2016) was reviewed for the purposes of establishing threatened fish species likely to be present and/or affected by the proposed activity. No listed threatened fish species were deemed likely to occur within the biodiversity study area.

3.3 Vegetation communities, threatened ecological communities and habitat

The NSW State Vegetation Type Map was accessed to identify PCTs in the vicinity of the biodiversity study area. PCTs and associated TECs identified within approximately 2 km the biodiversity study area are provided in include those identified in Table 3-3.

Table 3-3 Plant community types identified near the biodiversity study area

PCT	Associated TEC
3150 Hunter Coast Ranges Turpentine Wet Forest	None
3234 Hunter Coast Lowland Spotted Gum Moist Forest	**BC Act**, E: Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion
3244 Lower North Spotted Gum-Mahogany-Ironbark Sheltered Forest	None
3432 Hunter Coast Foothills Apple-Ironbark Grassy Forest	None
3433 Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest	**BC Act**, E: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions
3582 Hunter Coast Lowland Apple-Bloodwood Forest	None
3583 Hunter Coast Lowland Scribbly Gum Forest	None
3998 Lower North Creekflat Mahogany Swamp Forest	**BC Act**, E: Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
4020 Coastal Creekflat Layered Grass-Sedge Swamp Forest	None
4042 Lower North Riverflat Eucalypt-Paperbark Forest	None

Refer to Figure 3-2 for mapping of the above PCTs in and around the biodiversity study area. Note that none of the PCTs with equivalent TECs in this location (PCT 3234, PCT 3433 and PCT 3998) are present within the biodiversity impact area.

The biodiversity study area is characterised by three vegetation zones (refer to Figure 3-1) determined based on desktop and field assessment:

- **Zone 1: Regrowth native vegetation.** This zone has been previously cleared and is now in the process of regeneration. Review of historical aerial photos shows this area to be largely clear of vegetation in 1985, with the area being maintained as such until around 2015. With the exception of a small number of trees retained when the site was otherwise cleared, the remainder of the vegetation within this zone has regenerated within the last 10 years. The functional structure of this zone is variable, with area of more and less dense coverage in all strata. This zone has a generally low incidence of weeds, with the ground layer largely covered in leaf litter.
- **Zone 2: Remnant native vegetation**. This zone covers the riparian vegetation to the south of the biodiversity impact area. This vegetation has remained generally intact since at least 1985, with the exception of a small access road that appears to have been constructed around 2016. This vegetation is generally in good condition, with only minor weed invasion (mostly Lantana and small and large-leaved privet). The vegetation in this zone is mapped as *PCT 4042: Lower North Riverflat Eucalypt Paperbark Forest*. This PCT is not equivalent to any listed TEC under the BC Act or the EPBC Act in this location (though is part of the NSW Subtropical Coastal Floodplain Forest TEC where it occurs in the NSW North Coast bioregion, the southern boundary of which is

approximately 27 km north of the biodiversity impact area. This area retains a good functional structure, being largely dominated by the canopy and midstorey layers. Ground layer vegetation is generally sparse, and is typically restricted to grasses.

- **Zone 3: Cleared and maintained vegetation**. This vegetation zone is made up of cleared vegetation around the perimeter of the substation. This land is likely to have been cleared for asset protection zone purposes, and is maintained as such. The clear zone around the substation extends for a minimum of 10 m, extending to approximately 45 m along the southern boundary of the substation. Vegetation within this zone is primarily comprised of exotic grasses, though a small number of remnant *Eucalyptus tereticornis* remain to the east of the biodiversity impact area. This area retains little in the way of functional structure, being largely restricted to a ground layer only.

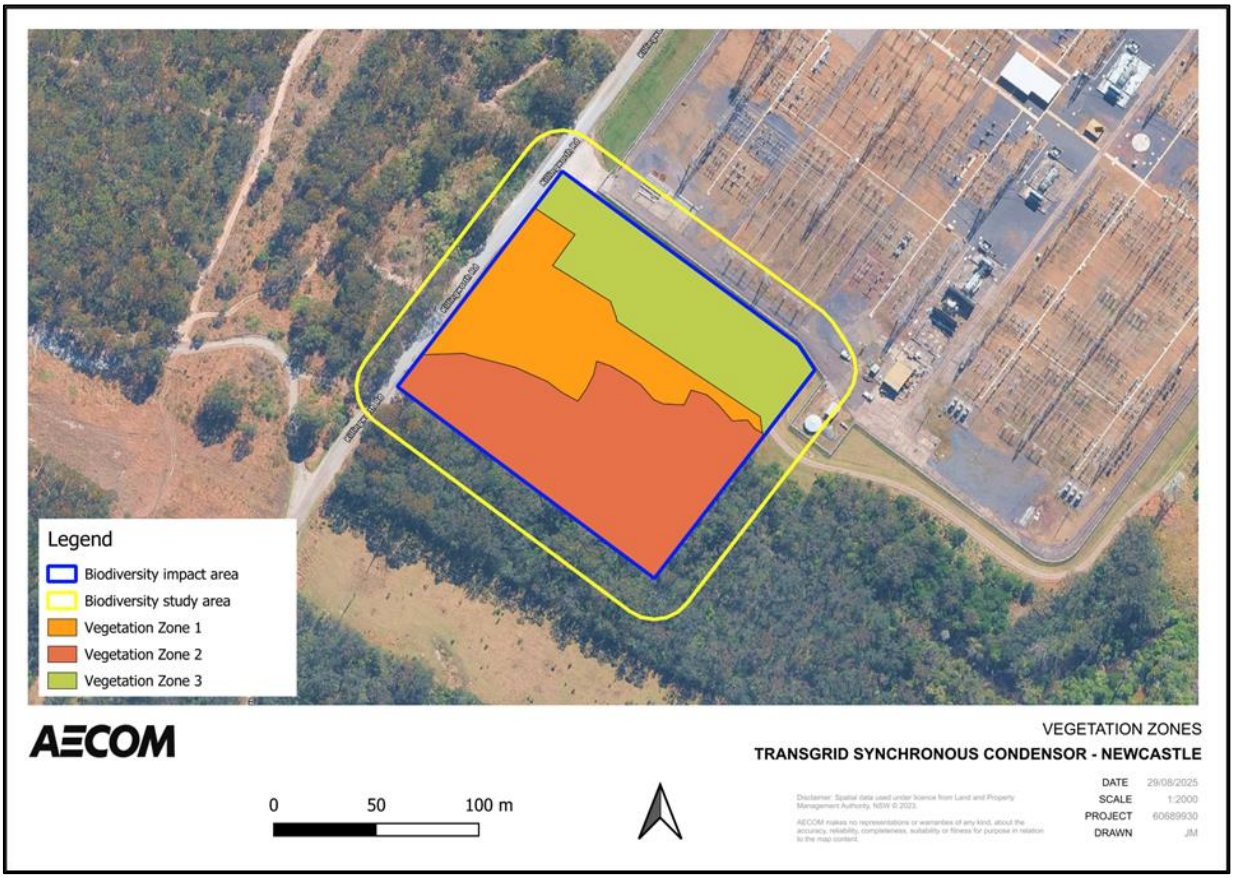


Figure 3-1 Vegetation zones

Species identified during the field survey as being present within the biodiversity study area included the following (exotic species marked with an asterisk):

- Bracken Fern *(Pteridium esculentum)*
- Spotted Gum *(Corymbia maculata)*
- Cheese Tree *(Glochidion ferdinandi)*
- Sweet Pittosporum *(Pittosporum undulatum)*
- Sweet Bursaria *(Bursaria spinosa)*
- Black Cypress Pine *(Callitris endlicheri)*
- Parramatta Wattle *(Acacia parramattensis)*
- Dagger Hakea *(Hakea teretifolia)*
- Common Silkpod *(Parsonsia straminea)*
- Prickly Beard-heath *(Leucopogon juniperinus)*
- *Hibbertia stricta*
- Kangaroo Grass *(Themeda australis)*
- Dodder Laurel *(Cassytha filiformis)*
- Flax-leaved Paperbark *(Melaleuca* linariifolia*)*

- Long-leaved Wattle *(Acacia longifolia)*
- Prickly Moses *(Acacia ulicifolia)*
- Sickle Wattle *(Acacia falcata)*
- Blue Flax-lily *(Dianella cerulea)*
- Jelly Bush *(Leptospermum polygalifolium)*
- Blady Grass *(Imperata cylindrical)*
- Tall Saw-sedge *(Gahnia clarkei)*
- Basket Grass *(Lomandra longifolia)*
- Forest Red Gum *(Eucalyptus tereticornis)*
- Smooth-barked Apple *(Angophora costata)*
- Large-leaf Hop-bush *(Dodonaea triquetra)*
- Asparagus fern *(Asparagoides sp.)* *
- Pink Bindweed *(Convolvulus erubescens)* *
- Small-leaved Privet *(Ligustrum sinense)* *
- Cassia *(Senna pendula)* *
- Mountain clover *(Trifolium montanum)* *
- Fleabane *(Erigeron bonariensis)* *
- Lantana *(Lantana camara)* *
- Purple top *(Verbena bonariensis)* *
- Crofton weed *(Ageratina adenophora)* *
- Paspalum *(Paspalum sp.)* *
- Rhodes grass *(Chloris gayana)*
- Pampas grass *(Cortaderia selloana)*

To the west of the biodiversity impact area, on the western side of Killingworth Road, is a patch of vegetation mapped as *PCT: 3433 Hunter Coast Foothills Spotted Gum Ironbark Grassy Forest* (refer to Figure 3-2). This community is equivalent to NSW Lower Hunter Spotted Gum Ironbark Forest TEC. This community is listed as endangered under the BC Act. This community is not listed under the EPBC Act.

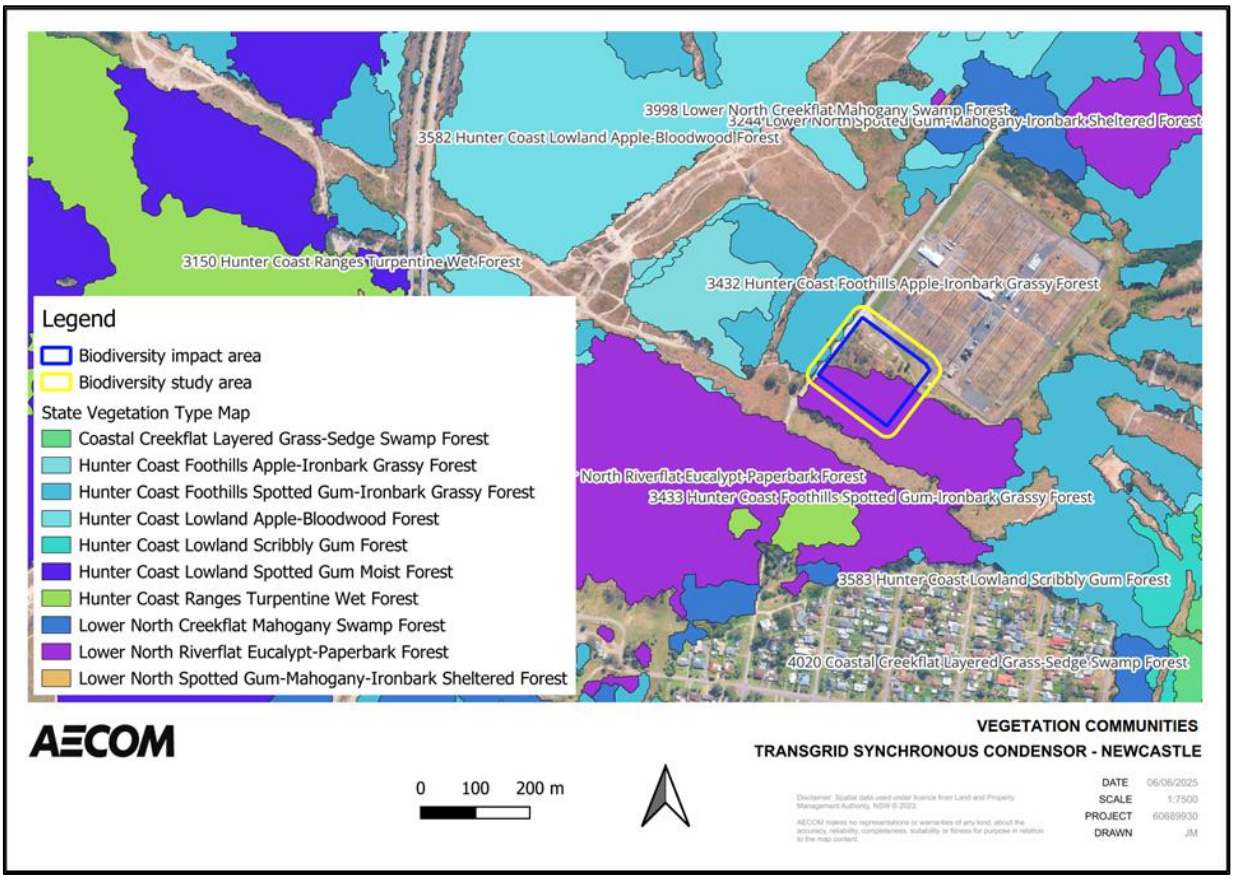


Figure 3-2 Vegetation communities

3.3.1 Site photographs

Figure 3-3 Open area of Zone 3

Figure 3-4 Vegetation within Zone 1

Figure 3-5 Vegetation within Zone 2

Figure 3-6 Flaking bark on isolated tree within Zone 3

Figure 3-7 Nest within isolated tree within Zone 3

Figure 3-8 Fallen log within Zone 1

Figure 3-9 Regrowth vegetation within Zone 1

3.4 Fauna habitat

Fauna observed within the biodiversity study area included:

- Bell Miner (*Manorina melanophrys*)
- Eastern Whipbird (*Psophodes olivaceus*)
- Willie Wagtail (*Rhipidura leucophrys*)
- Satin Bowerbird (*Ptilonorhynchus violaceus*)
- Kookaburra (*Dacelo novaeguineae*)
- Channel-billed Cuckoo (*Scythrops novaehollandiae*)
- Welcome Swallow (*Hirundo neoxena*)
- Magpie-lark (*Grallina cyanoleuca*)
- Rock Dove (*Columba livia*)
- Australian Magpie (*Gymnorhina tibicen*)
- Grey Butcherbird (*Cracticus torquatus*)
- Australian Raven (*Corvus coronoides*).

No evidence of other occupation in the form of scats or tracks was observed during the field survey, though the site would be reasonably expected to accommodate a range of native and exotic species given the degree of micro habitats available and the regular water sources available. As such, it is likely that mature canopy and midstorey vegetation would provide habitat and foraging resources for arboreal mammals such as microbats, megabats, gliders and possums. This vegetation is also likely to provide occasional roosting and foraging opportunities for a variety of additional birds not recorded during the field survey.

The biodiversity study area contained numerous fallen logs, coarse woody debris and bushrock. Flaking bark was present across most trees, with leaf litter present across most of Zone 1 and Zone 2.

The waterway of Burkes Creek is present to the south of the biodiversity study area, approximately 250 m from the limits of the biodiversity study area.

Aquatic habitat is generally absent, noting the forested and cleared nature of the biodiversity study area. Small depressions and drainage channels are present throughout the biodiversity study area, though these were dry at the time of the field survey.

The habitat value of Zone 1 is reduced compared to its pre-clearing state, though appears to be steadily improving over time. At present, this zone provides moderate habitat value, noting its substantial leaf litter and isolated bushrock. No tree hollows were observed within this zone, though there are a small number of mature trees that would provide roosting and foraging habitat in addition to the younger regrowth.

Habitat within Zone 2 is the most intact across the biodiversity study area, with several large mature trees and a well established midstorey. The ground layer contains less in the way of leaf litter, though the more enclosed nature of the vegetation in this zone encourages occupation by more cryptic species such as small insectivorous birds.

Zone 3 is largely devoid of any complex habitat, though is likely to provide a foraging area for certain species e.g. Australian Magpie, some reptiles. A nest was also observed within one of the remnant *Eucalyptus tereticornis* within this zone, indicating the area is still used as breeding habitat.

3.5 Threatened species

A desktop assessment was undertaken prior to the field survey to indicate the potential threatened species that may occur within the biodiversity study area. This included consideration of the threatened species returned by the Bionet and PMST searches undertaken on 16 May 2025. Of these species, an assessment of the likelihood of occurrence of each was undertaken. Species with a likelihood of

occurrence of moderate or above were targeted during the field survey. These species are listed in Table 3-4.

Table 3-4 Threatened species with moderate or higher likelihood of occurrence

Common name	Scientific name	Status	
		BC Act	EPBC Act
Fauna			
Little Lorikeet	*Glossopsitta pusilla*	V	-
Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	M
White-tailed Needletail	*Hirundapus caudacutus*	-	M
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-
Little Eagle	*Hieraaetus morphnoides*	V	-
Powerful Owl	*Ninox strenua*	V	-
Scarlet Robin	*Petroica boodang*	V	-
Pilotbird	*Pycnoptilus floccosus*	-	V
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-
Masked Owl	*Tyto novaehollandiae*	V	-
Sooty Owl	*Tyto tenebricosa*	V	-
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Eastern Freetail-bat	*Micronomus norfolkensis*	V	-
Little Bentwing-bat	*Miniopterus australis*	V	-
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-
Southern Myotis	*Myotis macropus*	V	-
Greater Glider	*Petauroides volans*	V	V
Yellow-bellied Glider	*Petaurus australis*	V	V
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V
Koala	*Phascolarctos cinereus*	E	E
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E
Flora			
Charmhaven Apple	*Angophora inopina*	V	V
Small Flower Grevillea	*Grevillea parviflora subsp. parviflora*	V	V
Black Eyed Susan	*Tetratheca juncea*	V	V
Nettle Bottle Brush	*Callistemon linearifolious*	V	-
Earp's Dirty Gum	*Eucalyptus parramattensis* subsp. *decadens*	V	V
Biconvex Paperbark	*Melaleuca biconvexa*	V	V
Magenta Lilly Pilly	*Syzygium paniculatum*	E	V

Targeted searches were undertaken for these species, though none were observed within the biodiversity impact area.

The nearest threatened fauna species records to the biodiversity study area are for Koala, Large-eared pied Bat and Grey-headed flying-fox. Habitat for these fauna species is present within the biodiversity study area, though is largely limited to Zone 2, with some habitat within Zone 1. The cleared land comprising Zone 3 (and the substation itself) is likely to present some degree of aerial foraging habitat for bats and other threatened birds.

The nearest threatened plant species to the biodiversity study area is a record for *Callistemon linearifolius* from 2007, located approximately 40 m to the south of the biodiversity study area. Targeted searches for this species failed to record it within the biodiversity study area. Other threatened flora species with higher potential to occur within the biodiversity study area included *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora*.

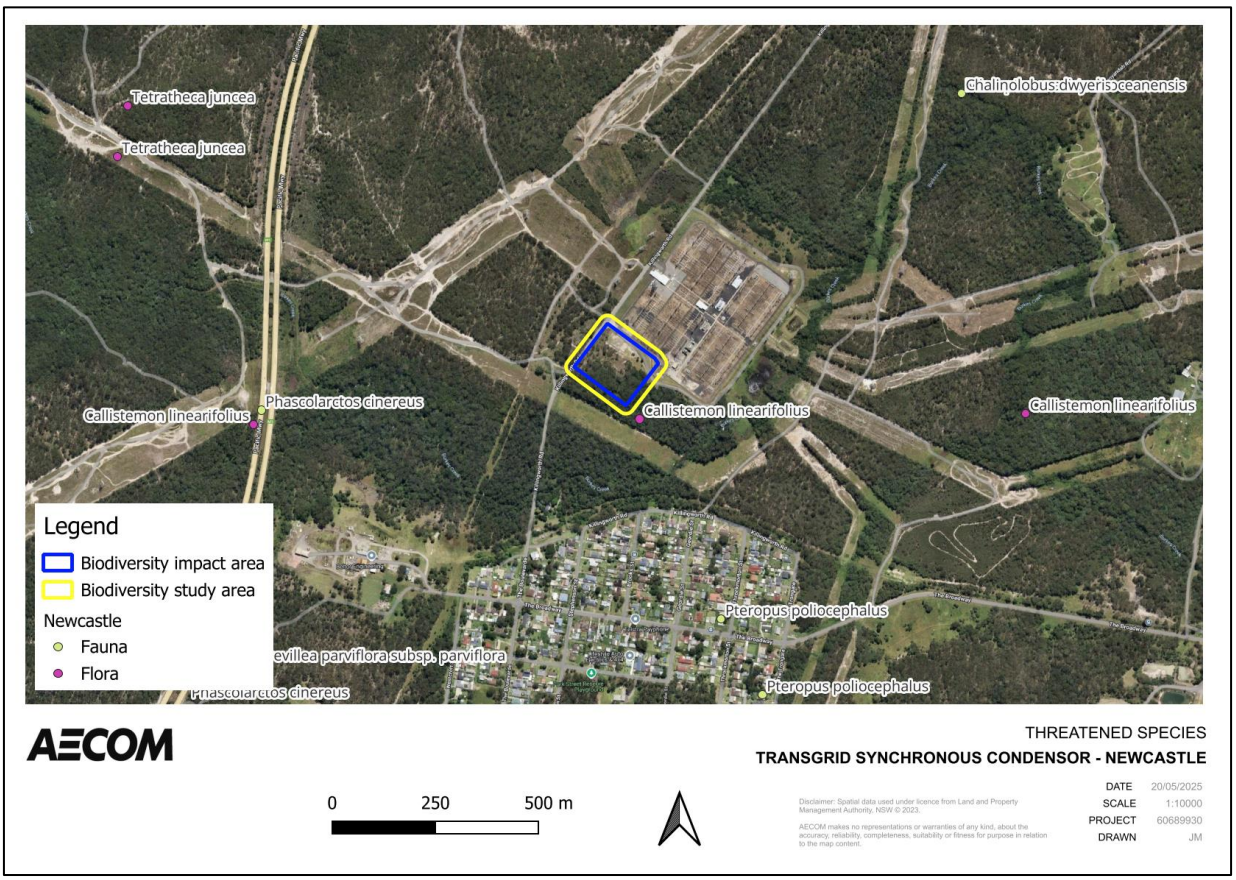


Figure 3-10 Threatened species records (Source: NSW BioNet Wildlife Atlas)

3.6 Areas of outstanding biodiversity value

None of the land in or around the biodiversity study area is listed as an area of outstanding biodiversity value.

3.7 Critical habitat

None of the land in or around the biodiversity study area is listed as critical habitat for any species.

3.8 Priority weeds

Priority weeds are plants classified under the *Biosecurity Act 2015* as presenting a biosecurity risk to the State or a particular region. Of those listed for the Lake Macquarie Council LGA the following species were recorded:

- Lantana (*Lantana camara*) - *Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale*
- Pampas grass (*Cortaderia selloana) - Land managers should eradicate the plant from the land and keep the land free of the plant. A person should not deal with the plant, where dealings include but are not limited to buying, selling, growing, moving, carrying or releasing the plant.*

With respect to other exotic species present within the biodiversity study area, these are subject to the ‘general biosecurity duty’ within NSW. This obligates landowners to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

4.0 Potential impacts

Potential biodiversity impacts associated with the proposed activity are detailed in the following sections and have been assessed on the basis of consideration of both direct and indirect effects, and the resulting change to the biophysical and ecological processes that establish and support the biodiversity values of the biodiversity impact area. For the proposed activity, these direct and indirect impacts are a result of changes to the biophysical environment that ultimately result in changes to biodiversity, i.e. vegetation, landform and soils.

The potential impacts identified in this section consider:

- Direct and indirect impacts to biodiversity
- The scale (local and regional), timing, frequency and duration of activities that may result in impacts during construction and operational phases of the proposed activity
- The significance of the impact, including any reasoning from assessments of significance
- Other anthropogenic activities that influence cumulative impacts to biodiversity in the area.

4.1 Vegetation

The construction of the syncons and their associated infrastructure would require result in direct impact to vegetation due to localised vegetation clearance. This report has assessed clearing would occur within all three vegetation zones, though the detailed design phase would seek to minimise clearing required in Zones 1 and 2, particularly any clearing outside of the operational footprint.

Figure 4-1 shows a conservative outline of the clearing required to facilitate construction and operation of the proposed activity.

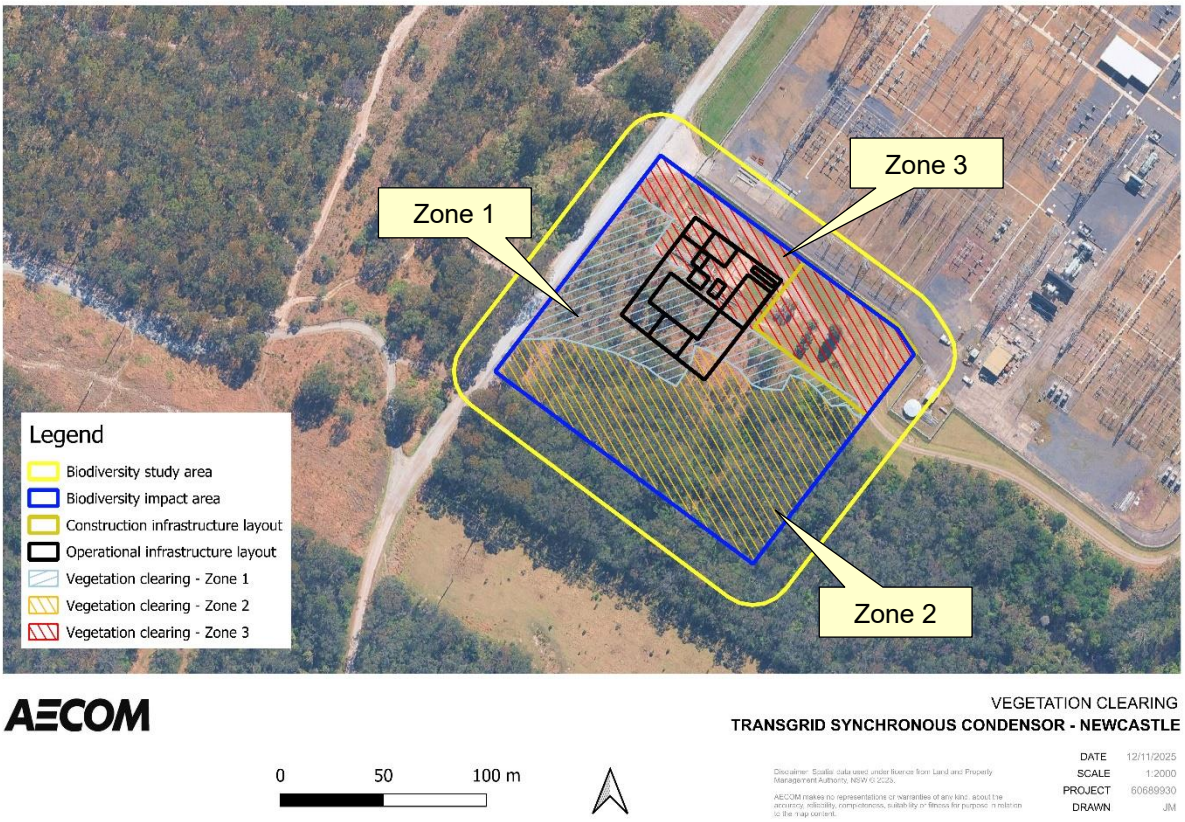


Figure 4-1 Conservative vegetation clearing

The conservative clearing of native vegetation within each zone would comprise:

- Zone 1: approximately 5,520 m^2
- Zone 2: approximately 9,352 m^2
- Zone 3: 0 m^2 (as this zone is not considered to comprise native vegetation, but rather approximately 5,875 m^2 of non-native and hardstand area.)

The areas indicated for clearing above include all construction and operational requirements. This includes construction compounds, laydown areas and construction access roads, as well as the operational footprint of the syncon. It is likely that the eventual clearing will be less than this, noting the likely construction and operational footprints outlined in Figure 4-1.

A conservative estimate of the overall area of native vegetation required to be removed is calculated to be 14,872 m^2 i.e. 1.49 ha. This area includes both Zones 1 and 2, and excludes Zone 3, which is not considered to comprise native vegetation.

Of all the zones, clearing within Zone 2 would result in the greatest degree of biodiversity impact, given the amount of remnant vegetation present. Clearing within this zone would be minimised as part of the detailed design, with the majority of construction and construction support areas preferentially located within Zone 1 and Zone 3.

The clearing of Zones 1 and 2 would occur within generally intact native vegetation. Based on the limited extent, and assuming the mitigation measures listed in Section 5.2 are implemented, the impact of vegetation removal in these locations would be minor and would therefore not constitute a significant impact.

The removal of native and non-native vegetation in the biodiversity impact area would not affect any threatened flora species or threatened ecological community.

Indirect off-site impacts to potential threatened flora such as edge effects related to weeds, light penetration, pests and sedimentation are not considered likely to be significant providing the proposed mitigation measures are implemented.

Two priority weeds listed under the Biosecurity Act for the Lake Macquarie Council LGA were recorded on site. These species and their required management actions are listed in Section 3.8.

The proposed activity has the potential to result in the infestation of the biodiversity impact area by new weeds, or the spread of existing weeds to locations outside the biodiversity impact area. Providing the mitigation measures (Section 5.2) and the management actions outlined for the priority weeds (Section 3.8) are implemented, this impact is not expected to be significant.

4.2 Fauna habitat

As outlined above, the biodiversity impact area and surrounds have been subject to extensive historic clearing for the purposes of the substation and associated activities, including establishment of transmission line easements. As such, the habitat value within the biodiversity study area is generally lower than the surrounding remnant bushland.

It is noted that several threatened microbat species have been previously recorded in the vicinity of the biodiversity study area. Two of these species, *Miniopterus australis*, and *Micronomus norfolkensis*, are forest-dwelling bats, while *Myotis macropus*, *Miniopterus orianae oceanensis* and *Chalinolobus dwyeri* are cave-dwelling. The forest-dwelling bats would be subject to loss of foraging and potentially roosting habitat in this location, particularly due to clearing in Zone 2. Within that zone, the most sensitive habitat feature for these species (and many others) is the large mature Eucalyptus trees. Clearing of these should be avoided as far as possible.

The proposed activity would not alter or remove any existing caves, crevices or other masonry elements that may constitute habitat for cave-dwelling bats, including any parts of the substation itself. As such the impact to roosting habitat for cave dwelling bats would be negligible, though foraging habitat would still be affected.

Noting local records of Koala, the clearing of native vegetation, particularly within Zone 2, would result in an adverse impact to this species. The vegetation in this area includes known feed trees for this

species, and Koalas are also known to move throughout the landscape along waterways. The removal of vegetation for the proposed activity would not prevent such movement, though would contribute to an ongoing loss of habitat in the region and more broadly. The impact of the proposed activity is highly restricted and localised and would not be significant, though it is recommended that the clearing footprint be minimised as far as possible in future design stages, with an emphasis on protecting vegetation within Zone 2, particularly large mature trees. Any areas disturbed for construction and not part of the operational footprint would be rehabilitated to as close to pre-construction conditions as possible.

Construction of the syncons would disturb soils and may lead to localised erosion and sedimentation in nearby waterways if not managed appropriately. This impact may be managed through the application of appropriate sediment controls and is not expected to be significant, noting the relatively flat topography of the biodiversity impact area.

The operation of machinery including chainsaws during construction has the potential to directly disturb native fauna through noise impacts. While these impacts are inevitable and largely unable to be mitigated, they would be temporary and are therefore not considered to be significant.

The operation of the proposed activity is not expected to generate substantial noise or air emissions. The proposed activity would include night time lighting for security purposes. Providing suitable mitigation measures are implemented, the potential for these factors to directly disturb fauna would be minor.

The proposed activity would include new hardstand areas, which may lead to increased runoff, though with suitable mitigation (erosion and sediment controls) the impact of this on biodiversity values is expected to be negligible.

Overall, the construction and operation of the proposed activity is not expected to result in any significant impacts upon local fauna or their habitat

4.3 Wildlife connectivity and fragmentation

The removal of vegetation for the construction of the proposed activity would require clearing of areas of native and exotic vegetation across all three zones.

The clearing of vegetation associated with the proposed activity would lead to an inevitable increase in fragmentation in the local area, particularly for clearing within Zone 2. This fragmentation would be in addition to that already incurred by the construction and operation of the substation and the associated transmission lines, which is substantial. Existing clearing of transmission line easements in all directions from the substation currently results in disruptions in connectivity both north-south and east-west across the broader locality. Additional fragmentation has also occurred for the construction of the Pacific Highway to the west of the biodiversity study area, as well as local roads such as Killingworth Road and Wakefield Road.

Due to this historic disturbance, the connectivity of habitat for ground-dwelling fauna in both the north-south and east-west direction has been substantially disrupted. Connectivity for mobile aerial species such as birds and arboreal mammals however is still maintained, though may be reduced for more cryptic species.

The primary impact of the proposed activity in terms of connectivity would be the removal of vegetation to enable construction work to be carried out. Vegetation clearing would primarily affect remnant native vegetation in good condition within Zone 2. Based on the indicative operational site layout, it is anticipated that much of the clearing in Zone 2 would be required for construction support only and would not be required for the operation of the syncons (approximately 9,352 m^2). These areas would be rehabilitated upon completion to as close to pre-construction conditions as possible.

Noting the presence of substantial amounts of equivalent contiguous habitat in most directions from the biodiversity impact area (ignoring the above-mentioned fragmentation for transmission line easements), and the commitment to rehabilitate portions of the biodiversity impact area, this loss of connectivity would be a minor impact within this area. On a regional scale the impact would be negligible, though it would contribute cumulatively to the ongoing fragmentation of native vegetation and habitat within the lower Hunter/Central Coast region.

This impact is not considered to be significant given the mobile nature of native fauna likely to be present in the area, the relatively small scale of the clearing and the moderate duration of the impact (expected to be around 6-10 years until regrowth reconnects habitat, providing active regeneration of this habitat is implemented).

4.4 Spread of weeds, pests and pathogens

The movement of vehicles and personnel into and throughout the biodiversity impact area has the potential to facilitate the spread of weeds. However, with the implementation of the mitigation measures outlined in Section 5.2 the overall impact of weeds associated with the construction phase of the proposed activity would be low.

The operation of the proposed activity would not present any additional or ongoing risk in terms of the spread of weeds.

The biodiversity impact area is likely to be utilised by a range of vertebrate pest species. Impacts from pest species are likely to include ongoing grazing and predation on small to medium native fauna. The proposed activity is unlikely to alter the occurrence of pest species in and around the biodiversity impact area, either positively or negatively, due to the localised nature of the works. As such the overall impact in this regard is considered to be neutral with respect to the baseline scenario.

The proposed activity also has the potential to spread pathogens into the proposed activity area. This may include plant diseases such as myrtle rust and phytophthora fungus, or animal disease such as chytrid fungus, which affects amphibians.

The scope of the field survey was not broad enough to be able to identify the presence of any plant pathogens in the biodiversity study area, though no immediate signs of poor plant health of dieback were observed. Similarly, no fauna survey was undertaken so the presence of chytrid could not be confirmed. Assuming that these pathogens are not currently present, and providing suitable hygiene measures are implemented as per the measures outlined in Section 5.2, the risk of the introduction of such pathogens is expected to be low.

4.5 Key threatening processes

BC Act

The following key threatening processes listed under the BC Act are considered relevant to the proposed activity:

- *Clearing of native vegetation*

The proposed activity would result in the clearing of a small amount of native vegetation within Zone 1 and 2 to facilitate the construction of the syncon. The vegetation in these zones is generally in good condition, with vegetation in Zone 1 being modified from its original state and currently regenerating. As such minor weed invasion is present in this location. Management measures aimed at reducing the amount of vegetation clearing are provided in Section 5.2.

- *Invasion of native plant communities by exotic perennial grasses*

Exotic perennial grasses and other environmental weeds exist within the biodiversity study area and can benefit from disturbance to natural vegetation. Weed management at the site would help prevent these species from spreading within or between sites.

- *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*

Chytridiomycosis is a fatal disease of amphibians and is caused by the chytrid *Batrachochytrium dendrobatids*. Management measures are recommended to address contributing to this key threatening process.

EPBC Act

Relevant key threatening processes listed under the EPBC Act are:

- Land clearance
- Novel biota and their impact on biodiversity
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.

The impact of clearing of vegetation is outlined within this document. The scale of the proposed clearing is considered minor relative to the surrounding habitat and the preferential avoidance of areas of higher vegetation quality. It is expected that further opportunities would be investigated during subsequent stages of development to reduce the degree of vegetation clearing required.

The other two key threatening processes are considered minor based on the limited physical scale of the proposed activity and would be managed during construction and operation through the application of relevant mitigation measures.

4.6 Cumulative impacts

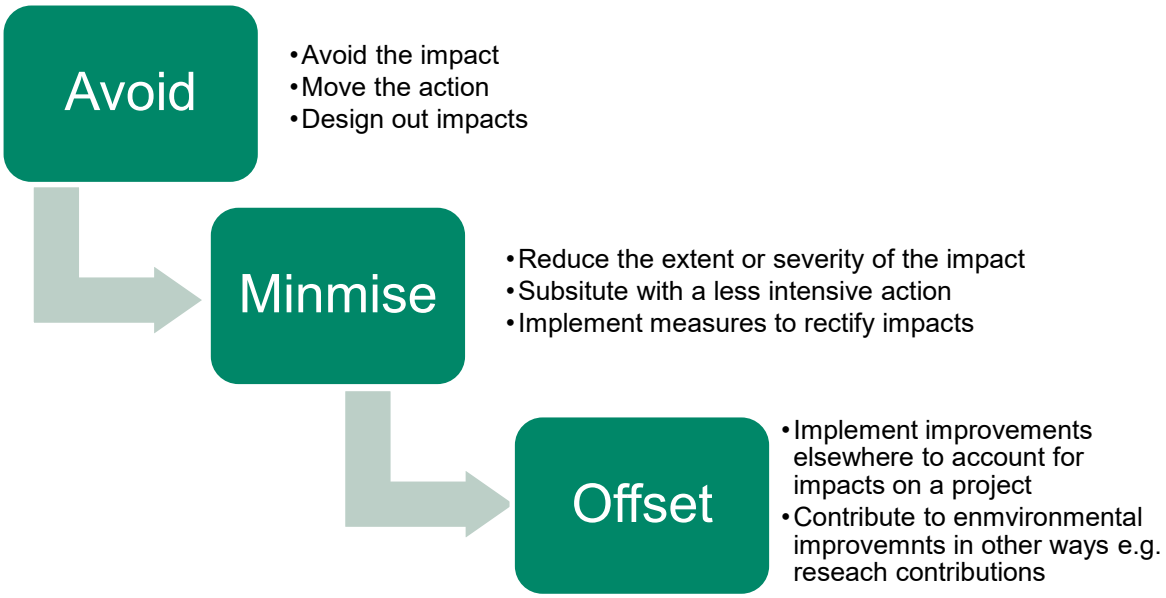
No other similar infrastructure of large scale development projects are known to be planned for this area. As such the potential for cumulative impacts arising from the proposed activity in combination with other projects nearby would be low.

The removal of vegetation, and subsequent habitat, associated with the proposed activity would contribute to the overall and ongoing reduction in available habitat and resources available for native species generally. This is of particular note at this site where the clearing of native vegetation for the various transmission easements has resulted in significant fragmentation of the local landscape and habitat. The proposed activity would not increase this fragmentation directly, though it would increase the size of the area already cleared around the substation and contribute to the ongoing loss of native habitat within the Lower Hunter and Central Coast regions. Despite this, the impact of the proposed activity is not considered to be significant in a cumulative sense, noting that areas used for construction only are recommended to rehabilitated to as close to pre-construction conditions as possible upon completion.

5.0 Management measures

5.1 Avoidance and minimisation

Management of environmental impacts associated with the proposed activity would be implemented in accordance with the following management hierarchy:



The following section outlines how these principles have been implemented as part of the proposed activity to date.

1. **Avoid:**
   - The proposed activity has been designed to avoid impacts to native vegetation where possible and feasible. This includes preference for a design that is largely based within the historically cleared area adjacent to the existing substation, with small sections located in remnant or regenerating areas of native vegetation
   - The selected design solution is relatively modest, being at the lower end of potential engineering designs to address the issue. The indicative design represents an appropriate balancing of several factors including environmental and amenity impact, cost, constructability and disruption to service. These factors would continue to be considered as part of detailed design development.
2. **Minimise:**
   - The design has sought to minimise the amount of vegetation removal while still safely constructing the proposed activity
   - The proposed activity has been designed to minimise the construction duration to minimise fauna impacts, as well as to minimise the amenity impacts to local residents and businesses.
3. **Offset:**
   - No formal offsets are proposed for the proposed activity, though rehabilitation of non-operational disturbed land would take place.

5.2 Mitigation measures

The following mitigation measures are recommended for the proposed activity:

- The clearing of native vegetation would be minimised as far as possible, with the minimisation of impacts in Zone 2 (refer to Figure 3-1) being a priority. The limits of clearing would be agreed with the Transgrid environmental representative prior to works commencing, with areas not subject to clearing demarcated or fenced off to prevent movement of construction vehicles and workers into these areas
- All workers would be provided with an environmental induction prior to commencing work. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity. Key points would include:
    - Maintaining all construction activities within the designated and demarcated or fenced off boundaries
    - Identification of weeds and biosecurity threats on site and appropriate actions to prevent their spread (see detail below)
    - Identification of threatened plants and animals, and what to do in case of encountering these (see detail below)
- All machinery entering and leaving the site would be inspected for weeds and/or weed seed. If detected these would be removed prior to entering or leaving the site and suitably contained and disposed of to prevent new infestations and/or further spread
- Weed control measures would be developed and implemented as part of the CEMP to manage the potential dispersal and establishment of weeds during the construction phase of the proposed activity. This would include the management and disposal of weeds (and particularly priority weeds) in accordance with the Biosecurity Act
- During construction and rehabilitation priority weeds would be managed according to their specific biosecurity obligations under the Biosecurity Act
- Lighting of the proposed activity would be designed in accordance with relevant standards and directed inwards, and away from adjacent vegetated areas as far as practicable
- Sediment controls would be installed at the downstream side of all areas of soil subject to disturbance to prevent impacts to local waterways and other aquatic habitats. These must be monitored and maintained on a regular basis throughout construction and reinstated as necessary to ensure their ongoing effectiveness
- Soils within the biodiversity impact area would be stabilised upon completion of construction to minimise the potential for ongoing sedimentation of nearby waterways. This would include the use of stabilising materials such as coir rolls or similar steeper areas
- Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to pre-construction conditions. This would include soil stabilisation and revegetation using a native seed mix approved by the Transgrid environmental representative.
- Any external material (such as crushed sandstone or similar) brought in for the purposes of constructing and stabilising the biodiversity impact area would be fully removed upon completion of construction, unless required for the operation of the syncons or the existing Newcastle 330 kV substation
- If native fauna is encountered it would be allowed to move off site of its own accord, as far as it is safe to do so. If the animal does not move works are to stop in that area and a person qualified in wildlife handling must be called in to safely relocate the animal
- If any threatened flora is located within the clearing footprint works are to stop in that area and a Transgrid environmental representative contacted for further advice.

- All construction material, fluids, fuel etc would be stored in appropriately bunded and/or contained areas to reduce the potential for spills entering local waterways if spilled. All refuelling should be undertaken within designated laydown areas only
- Should the detailed design or onsite works determine the need to remove or trim any additional vegetation that has not been identified in this report, additional approval from Transgrid's environmental team would be required.

6.0 Conclusion

The proposed activity has the potential to result in localised impacts upon existing native and non-native vegetation, as well as minor impacts to fauna habitat. The vegetation, habitat and species that would be affected are generally comprised of common native and exotic species located within land partially subject to historic disturbance.

The main impacts of the proposed activity upon flora would be through the direct clearing of vegetation for the installation of the syncons and construction support areas. Vegetation impacts associated with these actions were assessed as not being significant due to the relatively small footprint and abundance of residual connectivity and contiguous vegetation in the area. The total area subject to vegetation clearance is based on the indicative maximum footprint in which the construction and operation of the syncons would be carried out and therefore is a conservative estimate. Based on the indicative construction and operational layout of the proposed activity, it is likely that the total area of vegetation clearance would be less than this.

No threatened species or ecological communities were identified within or near the biodiversity impact area. The proposed activity is not anticipated to result in a significant impact to MNES, and a referral under the EPBC Act is not required.

Habitat impacts associated with the works would be localised and generally temporary, though it is noted that vegetation cover within the construction support area may take several years to fully recover. Despite this, the overall impact on habitat for known threatened fauna species is not considered to be significant.

On the basis of the above, and providing the mitigation measures provided are properly implemented, the proposed activity is not considered likely to result in a significant impact upon biodiversity values, including threatened species or ecological communities.

7.0 References

Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (GDE): http://www.bom.gov.au/water/groundwater/gde/map.shtml. (BoM 2024)

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2025, Protected Matters Search Tool

NSW Department of Primary Industries - Fisheries, 2013, Policy and guidelines for fish habitat conservation and management.

NSW Department of Primary Industries - Fisheries, 2016, Fish communities and threatened species distributions of NSW

NSW Department of Primary Industries (DPI) - Fisheries, 2025a. Profiles for species, populations and ecological communities

NSW Department of Primary Industries WeedWise Priority Weeds List (DPI 2025b)

NSW Department of Primary Industries database for threatened species and aquatic TECs: https://www.dpi.nsw.gov.au/fishing/species-protection/what-current (DPI 2025c)

NSW Department of Environment and Conservation (DEC) *Threatened Species Survey and Assessment: Guidelines for developments and activities* (working draft) (2004)

NSW Environment, Energy and Science Group (EES), 2025a, BioNet database

NSW Environment, Energy and Science Group, 2025b, Vegetation Types Database and Threatened Species Profile Database

Sydney Trains Biodiversity System Procedure (EMS-09-PR-0003)

Sydney Trains Biodiversity Offsets Calculator (EMS-09-WI-0177)

Appendix A

Likelihood of Occurrence

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Heleioporus australiacus	Giant Burrowing Frog		V	V	Distributed through the Sydney Basin sandstone country in woodland, open woodland and heath vegetation, breeding habitat is generally soaks or pools within first or second order streams, but also 'hanging swamp' seepage lines and where small pools form from the collected water. Spend the majority of time in non-breeding habitat up to 300 m away and burrows in soil surface or leaf litter.	Low
Litoria aurea	Green and Golden Bell Frog		E	V	Large populations in NSW are located around coastal and near coastal areas of the metropolitan areas of Sydney, Shoalhaven and mid north coast. It Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.)	Low
Mixophyes balbus	Stuttering Frog		E	V	Inhabits rainforest and wet, tall open forest. Breeds in streams after summer rains and deposits eggs on rock shelves or in shallow riffles. Non-breeding habitat includes thick understorey vegetation and deep leaf litter on forest floors.	Low
Mixophyes iteratus	Giant Barred Frog		E	E	Occurs in damp rainforest, and both moist and dry eucalypt forest below 1000m. Inhabit deep leaf litter and breed in shallow, flowing rocky streams. Are capable of dispersing hundreds of metres from streams.	Low
Parvipsitta pusilla	Little Lorikeet		V		Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance approx. 3 cm) of Eucalyptus spp. between 2 - 15 m above the ground.	Moderate
Anthochaera phrygia	Regent Honeyeater		CE	CE	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. Birds are also found in drier coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Nectar and fruit from the mistletoes are also eaten during the breeding season.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Ardenna grisea	Sooty Shearwater			M	Forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters. The species migrates and forages in the North Pacific and Atlantic Oceans during the non-breeding season. Sooty Shearwaters may forage inshore occasionally, especially during rough weather.	Low
Artamus cyanopterus cyanopterus	Dusky Woodswallow		V		The Dusky Woodswallow is found in open forests and woodlands, and may be seen along roadsides and on golf courses	Moderate
Botaurus poiciloptilus	Australasian Bittern		E	E	Inhabits temperate freshwater wetlands and occasionally estuarine reedbeds, with a preference for permanent waterbodies with tall dense vegetation. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds. Freshwater is generally preferred, although dense saltmarsh vegetation in estuaries and flooded grasslands are also used by the species.	Low
Calidris acuminata	Sharp-tailed Sandpiper			M	Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Low
Calidris canutus	Red Knot			E, M	Tidal mudflats, sandflats, beaches, saltmarsh, ploughed fields, flooded pasture	Low
Calidris ferruginea	Curlew Sandpiper		E	CE, M	Coastal migratory species with a NSW distribution from Hastings Point to Shoalhavn Heads. Found in open, sandy beaches with exposed sand bars and rocky outcrops. Rare use of near-coastal wetlands.	Low
Callocephalon fimbriatum	Gang-gang Cockatoo		V	E	Occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in winter and open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas in summer.	Low
Calyptorhynchus lathami lathami	Glossy Black-Cockatoo		V	V	Occupy coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where Casuarina and Allocasuarina species are present. This species is dependent on large hollow-bearing eucalypts for nesting.	Moderate
Charadrius leschenaultii	Greater Sand-plover		V	V, M	Occurs in coastal areas and inhabits littoral and estuarine habitats. Prefer sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks.	Low
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)		V		Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
					with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	
Cuculus optatus	Oriental Cuckoo			M	Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest.	Low
Daphoenositta chrysoptera	Varied Sittella		V		Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low
Erythrotriorchis radiatus	Red Goshawk		CE	V	Occurs in coastal and sub-coastal areas in woodland and forests, including riverine forests. Favours intermediate density forests to aid hunting of birds. Nest in tall trees, often beside permanent water sources.	Low
Falco hypoleucos	Grey Falcon		E		Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Low
Gallinago hardwickii	Latham's Snipe			M	Soft wet ground, shallow water with tussocks, inundated parts of paddocks, seepage below dams, saltmarsh and mangrove fringes	Low
Grantiella picta	Painted Honeyeater		V	V	Occurs in Eucalyptus woodland and forests, with a preference for mistletoe (Amyema spp.). Can also occur along watercourses and in farmland. Nests from spring to autumn in outer canopy of eucalypts, she-oak, paperbark and mistletoe branches.	Low
Haliaeetus leucogaster	White-bellied Sea-Eagle		V	M	Coastlines, estuaries, large rivers and lakes; occasionally over adjacent habitats; builds a large stick nest in a tall tree, rarely on artificial structures	Moderate
Hieraaetus morphnoides	Little Eagle		V		Occupies habitats rich in prey (birds, reptiles and mammals) within open eucalypt forest, woodland or open woodland. Requires tall living trees for building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.	Moderate
Hirundapus caudacutus	White-throated Needletail			M	Aerial space over a variety of habitat types, but prefers to forage over treed habitats as these would provide a greater abundance of insect prey; often forage on the edge of low pressure systems and may follow these systems ; breeds in Asia.	Moderate

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Hydroprogne caspia	Caspian Tern			M	Coastal waters, beaches, mudflats, large rivers, dams and lakes	Low
Irediparra gallinacea	Comb-crested Jacana		V		Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	Low
Ixobrychus flavicollis	Black Bittern		V		Occurs below 200 m above sea level and inhabit both terrestrial and estuarine wetlands, with a preference for permanent water bodies and dense vegetation. Roosts in trees or amongst dense reeds.	Low
Lathamus discolor	Swift Parrot		E	CE	In NSW mostly occurs on the coast and south west slopes, occurring in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (Eucalyptus robusta), Spotted Gum (Corymbia maculata), Red Bloodwood (C. gummifera), Mugga Ironbark (E. sideroxylon), and White Box (E. albens).	Low
Limosa lapponica	Bar-tailed Godwit			M	Tidal mudflats, estuaries, shallow river margins, flooded pastures	Low
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)		V		Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Low
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)		V		Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Neophema chrysostoma	Blue-winged Parrot		V	V	Blue-winged parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zone. The species can also be seen in altered environments such as airfields, golf-courses and paddocks. Pairs or small parties of blue-winged parrots forage mainly near or on the ground for seeds of a wide range of native and introduced grasses, herbs and shrubs	Low
Ninox connivens	Barking Owl		V		Occurs throughout NSW, where it inhabits dry open sclerophyll forests and woodlands, favouring dense riparian stands of eucalypts or casuarinas along watercourses or around wetlands, where there are many large trees suitable for roosting or breeding.	Low
Ninox strenua	Powerful Owl		V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. They require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	Moderate
Numenius madagascariensis	Eastern Curlew			CE, M	Estuaries, tidal mudflats, sandspits, saltmarsh, mangroves	Low
Pachyptila turtur subantarctica	Fairy Prion			V	A marine bird, found mostly in temperate and subantarctic seas.The Fairy Prion sometimes forages over continental shelves and the continental slope, but it can come close inshore in rough weather.	Low
Pandion cristatus	Eastern Osprey		V	M	Requires clear estuarine and inshore marine waters and coastal rivers for foraging, and nests in tall (usually dead or dead-topped) trees in coastal habitats from open woodland to open forest, within 1-2 km of water.	Low
Petroica boodang	Scarlet Robin		V		In NSW it occupies open forests and woodlands from the coast to the inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat.	Moderate

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Pycnoptilus floccosus	Pilotbird			V	Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth	Moderate
Pyrrholaemus sagittatus	Speckled Warbler		V		Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Moderate
Rostratula australis	Painted Snipe (Australian subspecies)		E	E, M	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. Nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	Low
Stagonopleura guttata	Diamond Firetail		V		Found in grassy eucalypt woodlands, open forest, mallee, grassland and riparian areas.	Low
Sternula nereis nereis	Australian Fairy Tern			V	It breeds on sheltered mainland coastlines and close islands, usually on sandy beaches above the high tide line but below where vegetation occurs. It feeds almost entirely on fish mainly by following shoals of feeding predatory fish, and is rarely found out of sight of land.	Low
Tringa nebularia	Common Greenshank			M	Mudflats, estuaries, saltmarsh, margins of wetlands	Low
Tyto novaehollandiae	Masked Owl		V		Occurs throughout NSW, roosting and nesting in heavy forest. Hunts over open woodland and farmland, with a home range of 500 - 1000 ha. The main requirements are tall trees with suitable large hollows for nesting and roosting and adjacent areas for foraging. Feeds on small mammals.	Moderate
Tyto tenebricosa	Sooty Owl		V		Inhabits subtropical and warm temperate rainforest, and moist or dry eucalypt forest with a well-developed mid-storey of trees or shrubs. Roost and nest sites for the species occur in gullies. Utilise large hollows for nesting and prey on other hollow dependent species. Roost in hollows or dense vegetation.	Moderate
Cercartetus nanus	Eastern Pygmy-possum		V		In New South Wales the species is found in coastal areas and at higher elevation. Inhabit shrubby vegetation in a wide variety of habitats, from open heathland or shrubland to sclerophyll or rain forest. Require flowering plants and shrubs for foraging and access to hollows/nesting vegetation.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Chalinolobus dwyeri	Large-eared Pied Bat		V	V	Roosts in disused mine shafts, caves, overhangs and disused Fairy Martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Pied Bat is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat).	Moderate
Dasyurus maculatus	Spotted-tailed Quoll		V	E	Utilises a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V		This species occupies tall, mature, wet forest and the species have been recorded roosting in stem holes in Eucalyptus and in buildings. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Low
Micronomus norfolkensis	Eastern Freetail-bat		V		Habitats preference includes dry eucalypt forest and coastal woodlands but also include riparian zones in rainforest and wet sclerophyll forest. Forages above forest canopy or forest edge and requires roosts including tree hollows.	Moderate
Miniopterus australis	Little Bentwing-bat		V		This species occurs in moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bent-wing Bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat		V		Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Moderate
Myotis macropus	Southern Myotis		V		This species generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Moderate

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Notamacropus parma	Parma Wallaby		V	V	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Low
Petauroides volans	Greater Glider			V	The greater glider is an arboreal marsupial, largely restricted to eucalypt forests and woodlands. It is found in highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. During the day it shelters in tree hollows, with a particular selection for large hollows in large, old trees.	Moderate
Petaurus australis	Yellow-bellied Glider		V	V	Typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. Preference for resource rich forests where mature trees provide nesting hollows and tree species composition with adequate food resources, including winter-flowering Eucalypts and sap-rich trees.	Low
Petaurus australis australis	Yellow-bellied Glider		V	V	Typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. Preference for resource rich forests where mature trees provide nesting hollows and tree species composition with adequate food resources, including winter-flowering Eucalypts and sap-rich trees.	Moderate
Petaurus norfolcensis	Squirrel Glider		V		The Squirrel Glider inhabits dry sclerophyll forest and woodland. In NSW, potential habitat includes Box-Ironbark forests and woodlands in the west, the River Red Gum forests of the Murray Valley and the eucalypt forests of the northeast. Individuals have also been recorded in a diverse range of vegetation communities, including Blackbutt, Forest Red Gum and Red Bloodwood forests, Coastal Banksia heathland and Grey Gum/Spotted Gum/Grey Ironbark dry hardwood forests of the Central NSW Coast. The Squirrel Glider is nocturnal and shelters in tree hollows. This species is capable of gliding up to 50m.	Low
Petrogale penicillata	Brush-tailed Rock-wallaby		E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, isolated rock stacks and tree limbs. Preference for north-facing slopes and cliff lines. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Phascolarctos cinereus	Koala		V	V	Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily Eucalyptus tereticornis and E. viminalis) and presence of mature trees very important. Preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape.	Moderate
Potorous tridactylus tridactylus	Long-nosed Potoroo		V	V	Inhabits coastal heaths and dry and wet sclerophyll forests, with sandy loam soils. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. Require dense vegetation for shelter and access to fungi. It is mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours.	Low
Pseudomys novaehollandiae	New Holland Mouse			V	Inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. Nest in burrows and have a preference for deeper top soils and softer substrates to aid digging. Spends considerable time foraging above-ground for food in areas of high floristic diversity.	Low
Pteropus poliocephalus	Grey-headed Flying-fox		V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 km to forage, on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V		Inhabits eucalypt rainforest, sclerophyll forest and open woodland vegetation. Availability of tree hollows is important for access to roosting sites.	Low
Scoteanax rueppellii	Greater Broad-nosed Bat		V		Occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland. Large hollow bearing trees required for roosting.	Low
Vespadelus troughtoni	Eastern Cave Bat		V		A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Hoplocephalus bungaroides	Broad-headed Snake		E	V	Confined to the Sydney basin within a radius of approximately 200 km of Sydney. Preferred habitat of sandstone outcrops with woodland, open woodland and/or heath vegetation. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges and tree hollows.	Low
Hoplocephalus stephensii	Stephens' Banded Snake		V		Rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day.	Low
Acacia bynoeana	Bynoe's Wattle		E	V	Occurs mainly in heath and dry sclerophyll forest, open woodland with dense to sparse heath understorey; open woodlands with a sparse shrub cover and a grass/sedge ground cover; and heathlands with sparse overstorey. With sand or sandy clay substrate, often with ironstone gravel and usually well drained, infertile soil.	Low
Angophora inopina	Charmhaven Apple		V	V	This species is a member of the A. bakeri complex, which also includes A. crassifolia, A. paludosa and A. exul. It is most similar to A. crassifolia from which it is distinguished by the broader leaves with shorter petioles. None of these related species are known from the same area as A. inopina, although A. bakeridoes occur sporadically in the ranges to the west, and near Kurri Kurri. Occurs most frequently in four main vegetation communities: (i) Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina woodland/forest; (ii) Hakea teretifolia–Banksia oblongifolia wet heath; (iii) Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina sedge woodland; (iv) Eucalyptus capitellata–Corymbia gummifera–Angophora inopinawoodland/forest. Ecological knowledge about this species is limited. Is lignotuberous, allowing vegetative growth to occur following disturbance. However, such vegetative reproduction may suppress the production of fruits/seeds, necessary for the recruitment of new individuals to a population, and the time between such disturbance and the onset of sexual reproduction is not known. Flowering appears to take place principally between mid-December and mid-January, but is generally poor and sporadic. Preliminary experiments indicate that neither pollination or seed viability are limiting factors in the life cycle.	Moderate
Caladenia tessellata	Thick Lip Spider Orchid		E	V	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low Brittle Gum (Eucalyptus mannifera), Inland Scribbly Gum (E. rossii) and Allocasuarina spp. woodland with a sparse understorey and stony soil.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Callistemon linearifolius	Netted Bottle Brush		V		Inhabits dry sclerophyll forest on the coast and adjacent ranges.	Moderate
Cryptostylis hunteriana	Leafless Tongue Orchid		V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (E. sieberi), Red Bloodwood (Corymbia gummifera) and Black Sheoak (Allocasuarina littoralis); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (C. subulata) and the Tartan Tongue Orchid (C. erecta).	Low
Cynanchum elegans	White-flowered Wax Plant		E	E	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree Leptospermum laevigatum – Coastal Banksia Banksia integrifolia subsp. integrifolia coastal scrub; Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland; Spotted Gum Corymbia maculata aligned open forest and woodland; and Bracelet Honeymyrtle Melaleuca armillaris scrub to open scrub.	Low
Eucalyptus glaucina	Slaty Red Gum		V	V	Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	Low
Eucalyptus nicholii	Narrow-leaved Black Peppermint		V	V	Occurs in grassy sclerophyll woodland in association with other eucalyptus species.	Low
Eucalyptus parramattensis subsp. decadens			V	V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, E. parramattensis subsp. decadens is a characteristic species of â€˜Kurri Sand Swamp Woodland in the Sydney Basin Bioregionâ€™, an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the â€˜Tomago Swamp Woodlandâ€™ as defined by NSW NPWS (2000). Very little is known about the biology or ecology of this species. Flowers from November to January. Propagation mechanisms are currently poorly known. Seed dispersal is likely to be effected by wind and animals. Likely to be sensitive to over-frequent fire, however there is evidence (i.e. coppicing, epicormic	Moderate

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
					shoots) that the species may be tolerant of low intensity fires. The species has a canopy stored seed bank for dispersal after fire events.	
Eucalyptus scoparia	Wallangarra White Gum		E	V	Low altitude populations (below 1300 m) mainly occur in podsolic soils in damp habitat.	Low
Euphrasia arguta			CE	CE	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. The number of plants at a given site may vary over time depending on the season and disturbance history. Near Nundle, local populations had apparently declined at sites that had been disturbed twice within three years, in contrast with sites that were disturbed only once. Euphrasia arguta has an annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April. As with other species of Euphrasia, this species is semi-parasitic and attaches to the roots of other associated plants.	Low
Grevillea parviflora subsp. parviflora	Small-flower Grevillea		V	V	Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Hunter occurrences are usually 30-70m ASL, while the southern Sydney occurrences are typically at 200-300m ASL. Often occurs in open, slightly disturbed sites such as along tracks.	High
Macadamia tetraphylla	Rough-shelled Bush Nut		V	V	Occurs in subtropical rainforest and complex notophyll vineforest, at the margins of these forests and in mixed sclerophyll forest. Grows on moderate to steep hillslopes on alluvial soils at well-drained sites	Low
Melaleuca biconvexa	Biconvex Paperbark		V	V	The species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other Melaleuca species or as an understorey species in wet forest.	Moderate
Persicaria elatior	Tall Knotweed		V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low
Pomaderris brunnea	Brown Pomaderris		E	V	Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Low

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Prasophyllum sp. Wybong				CE	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Most populations are small, although the Wybong population contains by far the largest number of individuals. Known to occur in open eucalypt woodland and grassland	Low
Pterostylis gibbosa	Illawarra Greenhood		E	E	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum Eucalyptus tereticornis, Woollybutt E. longifolia and White Feather Honey-myrtle Melaleuca decora. Near Nowra, the species grows in an open forest of Spotted Gum Corymbia maculata, Forest Red Gum and Grey Ironbark E. paniculata. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark E. crebra, Forest Red Gum and Black Cypress Pine Callitris endlicheri.	Low
Rhizanthella slateri	Eastern Australian Underground Orchid		V	E	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Flowers September to November.	Low
Rhodamnia rubescens	Scrub Turpentine		CE		Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts	Low
Rhodomyrtus psidioides	Native Guava					Low
Rutidosis heterogama	Heath Wrinklewort		V	V	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	Low
Syzygium paniculatum	Magenta Lilly Pilly		E	V	Grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	Moderate
Tetratheca juncea	Black-eyed Susan		V	V	Confined to the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. Usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest.	Moderate

Scientific name	Common name	FM Act	BC Act	EPBC Act	Habitat	Likelihood of occurrence
Thelymitra adorata			CE	CE	Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs.	Low
Thesium australe	Austral Toadflax		V	V	Suitable habitat for this species includes grassland and grassy woodland, often in damp sites.	Low

Appendix D Aboriginal Archaeological Due Diligence Assessment

AECOM Australia Pty Ltd
Gadigal Country
Level 21, 420 George Street
Sydney NSW 2000
PO Box Q410
QVB Post Office NSW 1230
Australia
www.aecom.com

+61 2 8008 1700 tel

ABN 20 093 846 925

14 November 2025

Jake Ingle
Environmental Planner
Transgrid
180 Thomas Street,
Sydney,
NSW, 2000

Dear Jake,

Re: Aboriginal Archaeological Due Diligence Assessment – Newcastle synchronous condenser

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been engaged by Transgrid to undertake an Aboriginal archaeological due diligence assessment for the proposed installation and operation of two synchronous condensers (syncons) at Transgrid's existing Newcastle 330 kV substation (hereafter the 'proposed activity') (refer to Figure 1). The Newcastle 330 kV substation is located off Killingworth Road, in the suburb of Killingworth and the City of Lake Macquarie Local Government Area (LGA), New South Wales (NSW).

The purpose of this assessment is to identify potential impacts to Aboriginal heritage values as a result of the proposed activity and to provide Transgrid with appropriate management advice. This assessment will be used to support the Summary Environmental Report (SER) being prepared for the proposed activity. The contents of this letter report have been compiled with reference to Heritage NSW's *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010* (DECCW, 2010a).

1.1 Proposed activity

The proposed activity involves the installation and operation of two syncons and associated infrastructure at the existing Newcastle 330 kV substation. The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the NSW power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their *2022 System Strength Report* (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

The scope of works for the proposed activity would include:

- Site establishment activities, including installation of construction offices and amenities, equipment storage and construction laydown areas and vegetation removal
- Construction of a new internal access road from Killingworth Road and upgrades to Killingworth Road to support the transport of equipment and vehicle movements to and from site
- Installation of a new bench (concrete slab, foundations and associated earthworks), with an indicative maximum footprint of around 130 by 150 metres (m), immediately the south of the existing Newcastle 330 kV substation to house the syncons and associated infrastructure
- 330 kV busbar extension with a new switch bay, which comprises a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester

- Installation of the new syncons and associated equipment, including:
  - Power transformer with firewalls
  - Auxiliary transformers
  - Syncon building and gantry crane
  - Oil lubrication and water-cooling systems
  - Control room and battery room
  - Low voltage AC and DC systems
  - Protection and control systems
  - Backup diesel generator
  - Pony motor
- Installation of a new demountable secondary systems building
- Installation of new spill oil tank, secondary containment dam(s) and drainage systems to cater for the new transformers, diesel generator and the syncon oil lubrication system
- Extension of the substation's stormwater drainage system, to cater for the new bench area
- Installation of new lighting protection masts.
- Rehabilitation of the site including:
  - Removal of temporary construction facilities and equipment
  - Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by Transgrid's environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction
  - Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

The area where ground surface impacts are required as part of the proposed activity are referred to as the 'proposed impact area' (refer to Figure 1) with this area forming the focus of this Aboriginal archaeological due diligence assessment.

The proposed impact area is an indicative maximum footprint in which the construction and operation of the syncons would be carried out. The impact area also includes areas required to facilitate connection to the proposed syncons, as well as a portion of Killingworth Road which requires upgrading.

Further details of the scope of works for the proposed activity are presented in Section 2 of the SER (AECOM, 2025).

2.0 Methodology

2.1 Assessment objectives

The overarching objectives of this Aboriginal archaeological due diligence assessment are to:

- Identify the Aboriginal cultural heritage values of the proposed impact area using a combination of desktop research and site inspection
- Provide Transgrid with information that would allow the proposed activity, where possible, to avoid impacts to known and potential Aboriginal cultural values
- Provide appropriate management strategies for the identified Aboriginal heritage values of the proposed impact area that cannot be avoided, as appropriate.

2.2 Methodology overview

This Aboriginal archaeological due diligence assessment was completed with reference to Heritage NSW's *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010* (DECCW, 2010a).

Accordingly, the following key steps were undertaken for the assessment:

- Completion of a desktop-based landscape review of the proposed impact area, assessing landscape variables (e.g. landform, stream order, slope and disturbance) to determine archaeological sensitivity
- Review of existing Aboriginal Heritage Information Management System (AHIMS) data for land within and surrounding the proposed impact area, obtained from Heritage NSW on 18 February 2025
- Review of the findings of past Aboriginal heritage investigations relevant to the Newcastle 330 kV substation
- Completion of visual inspections of the proposed impact area
- Provision of appropriate management advice to Transgrid in the form of this letter report.

2.3 Assessment limitations

This Aboriginal archaeological due diligence assessment has the following limitations:

- Previously recorded Aboriginal sites within the region of the proposed impact area have been identified and reviewed in this assessment. AECOM has relied on the reports from second parties to complete reviews and has not sought to independently verify the results and interpretations in these reports
- Predictions have been made about the probability of subsurface archaeological materials occurring within the proposed impact area, based on surface indications and environmental contexts. However, it is possible that materials may occur in any landscape context

3.0 Relevant legislation and policy

3.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act), administered by Heritage NSW, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Secretary of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the NPW Act as follows:

- An *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to the Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains)
- An *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010* (NPW Regulation), and the demonstration of due diligence.

An Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened.

Applications for an AHIP must be accompanied by assessment reports compiled in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b). Applications must also provide evidence of consultation with Registered Aboriginal Parties (RAPs). Consultation is required under Part 8A of the NPW Regulation and is to be conducted in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010c). AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons.

Section 89A of the NPW Act requires notification of the location of Aboriginal sites within a reasonable time, with penalties for non-notification. Section 89A is binding in all instances. An AHIP is only required if impacts will occur to Aboriginal objects and/or place.

3.2 Native Title

A search of the National Native Title Tribunal's online mapping tool 'Native Title Vision', the National Native Title Register and Register of Native Title Claims relevant to the proposed activity was undertaken on 25 March 2025. These searches returned no registered native title claims, determinations or relevant Indigenous Land Use Agreements with the proposed impact area.

Figure 1 Proposed impact area and AHIMS

[This figure has been redacted]

4.0 Landscape context

Consideration of the landscape context of the proposed impact area is predicated on the well-established proposition that the nature and distribution of Aboriginal archaeological materials are closely connected to the environments in which they occur. Environmental variables such as topography, geology, hydrology and the composition of local floral and faunal communities will have played an important role in influencing how Aboriginal people moved within and utilised their respective Country. Amongst other things, these variables will have affected the availability of suitable campsites, drinking water, economic[1] plant and animal resources, and raw materials for the production of stone and organic implements. At the same time, an assessment of historical and contemporary land use activities, as well as geomorphic processes such as soil erosion and aggradation, is critical to understanding the formation and integrity of archaeological deposits, as well as any assessments of subsurface archaeological potential.

The proposed impact area's landscape context information is provided in Table 1.

Table 1 Review of landscape context of the proposed impact area

Environmental variable	Key observations
Topography	Topographically, the proposed impact area falls within Matthei's (1995) Awaba Hills physiographic region. This region consists of low, rolling hills and ridgelines that are primarily composed of Hawkesbury Sandstone and Narrabeen Group sedimentary rocks. The region is characterized by steep slopes, narrow crests, and incised valleys, often covered with dry sclerophyll forests and patches of rainforest in sheltered areas. Specifically, the proposed impact area consists of a lower slope and flat associated with a broad ridgeline located to the north of the proposed impact area. Elevations within the proposed impact area range from 20 m Australian High Datum (AHD) in the north, near Killingworth Road, to 26 m AHD in the west, associated with the ridgeline's lower slope providing a total relief of 6 m across the proposed impact area. Slope/gradient varies from level (0-1%), very gently inclined (1-3%) to gently inclined (3-10%).
Hydrology	The proposed impact area is located within the Lake Macquarie catchment. No watercourses are located directly within the proposed impact area, with the closest watercourse, Burkes Creek, located approximately 180 m to the south. Burkes Creek rises to the northwest of the proposed impact area in Sugarloaf State Conservation Area as a 1st order watercourse and flows roughly to the southeast becoming a 3rd order watercourse near the proposed impact area before feeding into Cockle Creek approximately 3.5 km to the east. Existing archaeological survey data for eastern Australia indicate a strong trend for the presence of open artefact sites along watercourses, specifically, on creek banks and 'flats' (i.e., flood/drainage plains), terraces and bordering lower slopes (Kohen 1986). Although this distribution pattern can be attributed in part to geomorphic dynamics and archaeological sampling bias, with extensive fluvial erosion activity along watercourses resulting in higher levels of surface visibility and, by extension, concentrated survey effort, an occupational emphasis on watercourses is supported by the results of numerous subsurface investigations (e.g., AECOM 2013b, 2015; AMBS 2000; Craib et al. 1999; GML 2012; Jo McDonald CHM 2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b). Collectively, these investigations have demonstrated that assemblage size and complexity tend to vary significantly in relation to stream order and landform, with larger, more complex assemblages concentrated on elevated, low gradient landform elements adjacent to higher order watercourses (≥3rd order). Outside of these contexts, surface and subsurface artefact distributions have typically been found to be sparse and discontinuous and are often referred to as 'background scatter'.

Environmental variable	Key observations
Geology	Reference to the 1:100,000 Newcastle Geological Map Sheet (9232) indicates that the near surface geology within the proposed impact area consists of Quaternary alluvium comprising gravel and sand focussed around Burkes Creek, as well as Maitland Group geological formation. The Maitland Group is a geological unit within the Sydney Basin, primarily found in the Hunter Valley. It consists of Permian-aged sedimentary rocks including sandstone, siltstone, shoal, coal and conglomerate, primarily deposited in a fluvial-deltaic to shallow marine environment.
Soils	Soils within the proposed impact area have been mapped by Matthei's (1995) as belonging to the alluvial Cockle Creek (cc) and erosional Killingworth (ki) Soil Landscapes. Soils of the Killingworth soil landscape are formed on Maitland Group geologies with dominant soil materials comprising brownish black sandy to silty loams A horizons. B horizons comprise yellowish brown clays with strong structure and smooth-face rough ped fabric. A horizon pH levels range from moderately acid (pH4.5) to slightly acid (pH 6.0). Soils of the Cockle Creek (cc) soil landscape are formed on Maitland Group geologies with dominant soil materials comprising brownish black sandy to silty clay loam A horizons. B horizons comprise yellowish brown silty to medium clays with moderate to strong structure and smooth-face ped fabric. A horizon pH levels range from moderately acid (pH5.5) to slightly acid (pH 6.0).
Flora	Native vegetation within the proposed impact area has been extensively modified as a result of historical land use activities, in particular construction of the substation. With the exception of the southern corner of the proposed impact area, all vegetation was cleared from the site between 1966 and 1975 and now comprises regrowth and a mixture of native and non-native grasses and exotic weeds. In the southern corner, vegetation consists of Eucalypt and paperbark woodland.
Land disturbance	Known past land use disturbances within the proposed impact area have included native vegetation clearance, levelling for constructing the substation, access track and road construction, erosion, and localised earthworks. Section 5.0 provides detail on historical land disturbances within the proposed impact area.

5.0 Historical land use

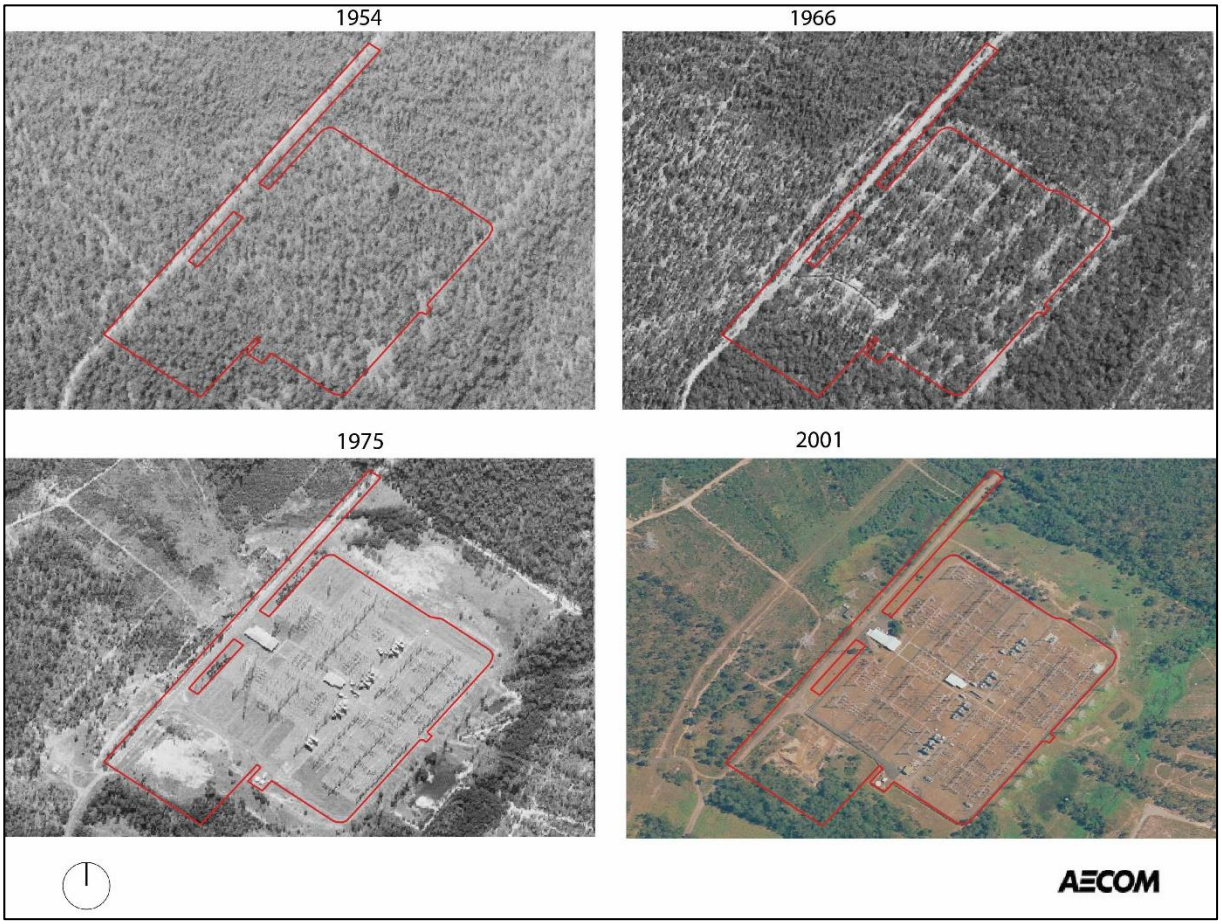
A review of historic aerials for the proposed impact area dated to 1954, 1966, 1975, and 2001 (Figure 2) indicate a range of activities and associated ground surface impacts within and surrounding the proposed impact area. These include:

- Ground disturbances associated with the construction of Killingworth Road prior to 1954
- Partial clearing of the site around 1966
- Near complete vegetation clearance within the proposed impact area around 1975, with only a cluster of trees remaining in the southern corner
- Ground disturbances associated with the construction of the Newcastle 330 kV substation around 1975
- Additional construction in the southern area around 2001.

To varying degrees, all of the above-cited land use activities and associated ground surface impacts are relevant to the survival, integrity and identification of Aboriginal archaeological evidence within the proposed impact area. Overall, all land within the proposed impact area is considered to be moderately disturbed. Vegetation clearance and impacts associated with construction of the substation have actively disturbed land across the area.

Key implications for the current assessment include the disturbance of pre-existing archaeological deposits (if present), both surface and subsurface, through direct (e.g., earthworks) and indirect means, resulting in a loss of archaeological integrity and a significantly reduced likelihood for the presence of culturally scarred trees.

Figure 2 Historical aerial photographs of the proposed impact area in red (Source: NSW Spatial Collaboration Portal 2025)



6.0 AHIMS Database

The AHIMS database, administered by Heritage NSW, contains records of all Aboriginal objects reported to the Director General of the Department of Premier and Cabinet in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

A search of the AHIMS database for a 5 x 5 km area surrounding the proposed impact area (i.e., the 'search area') was undertaken on 18 February 2025. A total of 45 Aboriginal archaeological sites were identified within the search area comprising 29 open artefact sites (i.e., isolated artefacts and artefact scatters), eight grinding grooves, six modified trees, and two areas of Potential Archaeological Deposit (PAD) (Table 2). Consideration of the location of previously recorded sites indicates that no sites are located within the proposed impact area with the closest site, [redacted] (Figure 1). The site was recorded as a [redacted].

Table 2 AHIMS search results

Site type	Site count	%
Artefact (open artefact site)	29	64.4
Grinding grooves	8	17.8
Modified tree	6	13.3
PAD	2	4.4
TOTAL	**45**	***100**

***Total rounded**

7.0 Previous Aboriginal heritage investigations

The Aboriginal archaeology of the Lake Macquarie LGA is well researched, having been the subject of numerous Aboriginal archaeological investigations since the 1980s (for overviews see Haglund, 1986; Umwelt Australia Pty Ltd, 2003). Notable investigations to date have included surveys by Brayshaw McDonald Pty Ltd (1989), Brayshaw (1986), Dallas (1983,1993), Insite Heritage Pty Ltd (2003), Insite Heritage Pty Ltd (2010), AECOM Australia Pty Ltd (2011), Mills Archaeological & Heritage Services Pty Ltd, (2011), Biosis Research Pty Ltd (2021), subsurface testing programs by Dallas, (1986), HLA-Envirosciences Pty Ltd (1995), McCardle Cultural Heritage Pty Ltd (2005), major salvage excavations by Dyall & Bentley (1975;1980) and a burial excavation by Donlon (1991).

Key observations drawn from a review of the local and regional archaeological context of the proposed impact area are as follows:

- Artefact scatters and isolated finds – collectively referred to as open artefact sites – are the most common site types within the region. Recorded stone artefact assemblages consist principally of flake and non-flake debitage (i.e., flakes [complete and broken], flake shatter fragments and flaked pieces), with cores, retouched tools and groundstone implements comparatively poorly represented
- Grinding groves, often located on sandstone platforms, are the second most common site type in the local area
- Shell middens/scatters with and without associated flaked stone artefacts and other cultural materials/features also feature on a local and regional scale, and are likely to occur in foreshore zones of lakes, creeks and coastal areas
- Aboriginal burials sites, particularly associated with shell middens, are known to occur in sandy soil contexts in the local and regional area e.g. Swansea, Pinny Beach, Ettalong, and Wamberal
- Other, comparatively rare site types include: scarred trees, quarries (stone and ochre), stone arrangements and waterholes
- Stone artefacts can occur within any landform element, both in surface and subsurface contexts, with larger and more complex deposits occurring in association with higher order creeklines and estuarine environments such as Lake Macquarie
- No Aboriginal archaeological sites have been previously identified within or directly adjacent to the proposed impact area.

8.0 Results

In accordance with the methodology presented in Section 2.0, a desktop assessment was initially undertaken by AECOM to identify areas of archaeological sensitivity and previously identified Aboriginal sites within the proposed impact area. On the basis of available desktop data, AECOM recommended that a site inspection be undertaken due to the presence of a landscape feature of Aboriginal archaeologically sensitivity – Burkes Creek – within 200 m of the proposed impact area.

A visual inspection of the proposed impact area was completed on 26 February 2025 by AECOM principal heritage specialist Geordie Oakes. The purpose of this inspection was to help establish whether the proposed works will, or are likely to, harm any Aboriginal objects/sites. During the visual inspection notes were taken regarding Ground Surface Visibility (GSV), Ground Integrity (GI, i.e., land condition), archaeological sensitivity and impact risk. Impact risk was determined based on archaeological sensitivity, as well as the nature of proposed activity-related impacts. Results of the inspection included the following:

1. No Aboriginal objects, sites or places were identified within the proposed impact area during the inspection
2. GSV across the proposed impact area was, in general, poor due to the presence of vegetation (grass) cover. Areas of enhanced visibility were associated with clearing, disturbance, access tracks and erosion

- Consistent with examined aerials, the visual inspection indicated that land within the proposed impact area has been variously disturbed by historic land uses. On this basis land within the proposed impact area was assessed as having low GI
- No areas of Aboriginal archaeological sensitivity were identified within the proposed impact area.

9.0 Key findings

The key findings of this Aboriginal archaeological due diligence assessment are as follows:

- There are no AHIMS sites located within the proposed impact area
- No new Aboriginal objects/sites were identified during the site inspection
- The archaeological sensitivity of the proposed impact area was assessed as low based on landform variables and past disturbances
- The likelihood that the proposed activity would harm any Aboriginal objects/sites is considered low.

10.0 Recommendations

3. On the basis of the above, no further heritage works or reporting are required
4. In the event that an Aboriginal site or object (artefact) (as defined by the NPW Act or *Heritage Act 1977*) is identified during the proposed activity, the works must cease at the location and no further harm to the object/site shall occur. The find must be immediately reported to Transgrid, and the regulator in accordance with legislation. No work must commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access, and NSW Police, Heritage NSW and Transgrid contacted.

Yours faithfully,

Geordie Oakes
Principal Heritage Specialist
geordie.oakes@aecom.com

Direct Dial: +64 2 89340610
Direct Fax: +64 2 89340001

11.0 References cited

AECOM Australia Pty Ltd. (2011). *Chain Valley Colliery Heritage Impact Assessment, Chain Valley, Lake Macquarie, NSW*.

AECOM Australia Pty Ltd. (2013). *Lots 21 & 22, DP584915, Richmond Road, Marsden Park: Aboriginal Cultural Heritage Assessment Report*. Unpublished report for Winten (No. 26) Pty Ltd.

AECOM Australia Pty Ltd. (2015). *Archaeological Salvage of Open Artefact Site MPIP5 (45-5-3726)* (Vol. 5, Issue 26). Unpublished report for Winten (No. 26) Pty Ltd.

Aplin, K., Ford, F., & Hiscock, P. (2010). Early Holocene Human Occupation and Environment of the Southeast Australian Alps: New evidence from the Yarrangobilly Plateau, New South Wales. In S. Haberle, J. Stevenson, & M. Prebble (Eds.), *Altered Ecologies: Fire, Climate and Human Influence on Terrestrial Landscapes* (Terra Aust, pp. 187–212). ANU E Press.

Australian Museum Business Services. (2000). *Mungerie Park Town Centre: Archaeological Salvage Excavations near Kellyville, Cumberland Plain, NSW*.

Biosis Research Pty Ltd. (2021). *Old Main Road Fennel Bay Aboriginal Archaeological Report*. Unpublished report for Landcom.

Boot, P., & Cooke, H. (1990). *Conservation and Management Plan for London Bridge Karst Area - Googong Foreshores Reserve*. Unpublished report prepared for the A.C.T Heritage Unit.

Brayshaw, H. (1986). *Archaelogical Survey - Proposed National Highway Wakefield to Minmi Road, West of Newcastle, NSW*.

Brayshaw McDonald Pty Ltd. (1989). *Archaeological Survey of Proposed Tourist Resort at Summerland Point, Lake Macquarie*. Unpublished report for Bexford Pty Ltd.

Craib, J. ., Bonhomme, T., Mangold, G. R., & Williams, S. S. (1999). *Archaeological Salvage Excavations at Site RS1 (45-5-982), Regentville, Western Sydney: Final Report*. Unpublished report for TransGrid.

Dallas, M. (1983). *An Archaeological Survey of Green Point Estate Belmont NSW*.

Dallas, M. (1993). *Archaeological Investigation of a Proposed Retirement Village and NSW NPWS Site #45-3A-11 Within the Green Point Estate Belmont, NSW.* Unpublished report for McCloy Developments Pty Ltd.

Donlon, D. (1991). *Skeletal Remains from the Swansea Channel Burial Ground, NSW. Description and Analysis* (Issue December). Unpublished report for the Australian Institute for Aboriginal and Torres Strait Islander Studies.

Dyall, L., & Bentley, F. (1980). *Excavations at Swansea - Annual Report*. Unpublished report for the National Parks and Wildlife Service.

Dyall, L. K., & Bentley, F. (1975). *Archaeological excavations at Swansea Annual Report*.

Flood, J. (1973). *The Moth-Hunters - Investigations Towards a Prehistory of the South-Eastern Highlands of Australia*. Australian National University, Canberra.

Flood, J. (1976). Man and Ecology in the Highlands of Southeastern Australia: A Case Study. In N. Peterson (Ed.), *Tribes and Boundaries in Australia* (pp. 30–49). AIAS.

Flood, J. (1980). *The Moth Hunters: Aboriginal Prehistory of the Australian Alps*. Australian Institute of Aboriginal Studies.

Flood, J. (1984). Recent Research on Traditional Aboriginal Society of the Canberra Area. *Canberra and District Historical Society Journal*, *13*, 17–25.

Flood, J. (1996). *Moth Hunters of the Australian Capital Territory: Aboriginal life in the Canberra Region*. Self published.

Flood, J., David, B., Magee, J., & English, B. (1987). Birrigai: A Pleistocene Site in the Southeastern Highlands. *Archaeology in Oceania*, *22*(1), 9–26.

Gillespie, L. L. (1984). *Aborigines of the Canberra Region*. Canberra Publishing and Printing Co.

GML Heritage Pty Ltd. (2012). *East Leppington Aboriginal Archaeological Technical Report* (Issue November). Unpublished report for Stockland Development.

Haglund, L. (1986). *Lake Macquarie Heritage Study*. Report prepared for Lake Macquarie City Council.

HLA-Envirosciences Pty Ltd. (1995). *Report of Sub Surface Testing at Nords Wharf and Cams Wharf Lake Macquarie, NSW*. Prepared for Electrical and Mechanical Engineering Hunter Water.

Huys, S., & O'Sullivan, R. (2013). *Yass Valley Aboriginal Heritage Study*. Unpublished report for Yass Valley Council.

Insite Heritage Pty Ltd. (2003). *Archaeological Report for Proposed Residential Development Lots 59, 79 and 114 Cameron Park*. Unpublished report for Yarraman Developments Pty Ltd.

Insite Heritage Pty Ltd. (2010). *Heritage and Archaeological Assessment Proposed Upgrade of Lake Macquarie Yacht Club*.

Jo McDonald Cultural Heritage Management Pty Ltd. (2001). *Salvage Excavations of Six Sites along Caddies, Second Ponds, Smalls and Cattai Creeks in the Rouse Hill Development Area, NSW*. Unpublished report for Rouse Hill Infrastructure Consortium.

Jo McDonald Cultural Heritage Management Pty Ltd. (2003). *Archaeological Salvage Excavations at the proposed Xavier College: Site ADI 47+48 (NPWS #45-5-1048), Ninth Avenue, Llandilo, NSW*. Unpublished report for PMDL on behalf of the Catholic Education Office, Diocese of Parramatta, NSW.

Jo McDonald Cultural Heritage Management Pty Ltd. (2005). *Archaeological Salvage Excavation of Eight Archaeological Landscapes in the Second Ponds Creek Valley, Rouse Hill Development Area, NSW*. Unpublished report for Rouse Hill Infrastructure Pty Ltd and Landcom.

Jo McDonald Cultural Heritage Management Pty Ltd. (2006a). *Archaeological Salvage Excavation at the St Marys Project Eastern Precinct: Site ADI:EPI (NPWS #45-5-2994)*. Unpublished report for Lend Lease.

Jo McDonald Cultural Heritage Management Pty Ltd. (2006b). *Archaeological Salvage Excavation of the Colebee Release Area, Schofields, NSW: Volume 1*. Unpublished report for Medallist Gold Holdings Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2007). *Salvage Excavation of Four Archaeological Sites in the Caddies Creek Precinct, Rouse Hill Regional Centre, NSW*. Unpublished report for Lend Lease GPT (Rouse Hill) Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2009a). *Archaeological Subsurface Investigations at the Cadden's Release*. Unpublished report for Landcom.

Jo McDonald Cultural Heritage Management Pty Ltd. (2009b). *Archaeological Subsurface Investigations at WP3 and WP4 - Western Precinct St Mary's Development Site,*. Unpublished report for Marylands Development Company.

Kohen, J. (1986). *Prehistoric Settlement in the Western Cumberland Plain: Resources, Environment and Technology*. Macquarie University.

Lance, A., & Koettig, M. (1986). *An Aboriginal Resources Planning Study for the City of Goulburn, New South Wales*. Unpublished report for Goulburn City Council.

Mary Dallas Consulting Archaeologists. (1986). *Pipeline route between Gwandalan and Mannering Park sewage treatment works*. A Report for the Public Works Department of NSW.

Matthei, L. E. (1995). *Soil Landscapes of the Newcastle 1: 100,000 sheet*. Department of Land and Water Conservation.

McCardle Cultural Heritage Pty Ltd. (2005). *Sugar Valley Golf Course Test Excavations*. Unpublished report for Buildev Developments.

Mills Archaeological & Heritage Services Pty Ltd. (2011). *An Indigenous and Non-indigenous Heritage Assessment of a Proposed Residential Development at Lot 103 and Lot 105 George Booth Drive Esterville near Newcastle*. Unpublished report for Hammersmith Management.

Navin Officer Heritage Consultants Pty Ltd. (2003). *Late Pleistocene Occupation at "Wombeyan One", Wombeyan Caves Reserve, NSW: An Archaeological Subsurface Testing Program in a Proposed Sewage Treatment Area*. Unpublished report for NSW Department of Commerce.

Packard, P. (1984). *With a Pinch of Salt - The Archaeology of Saline-Seepage Erosion Sites in the Yass River Basin*. Australian National University, Canberra.

Packard, P. (1986). *Archaeological Sites in Sand Deposits on the Southern Tablelands*. Unpublished report for NSW National Parks and Wildlife Service.

Theden-Ringl, F. (2016). Aboriginal Presence in the High Country: New Dates from the Namadgi Ranges in the Australian Capital Territory. *Australian Archaeology*, *81*(1), 25–42.

Theden-Ringl, F. (2017). A Reassessment of Technological Change Models for the Australian High Country. *Archaeology in Oceania*, *52*, 81–97.

Theden-Ringl, F. (2018). At the Margins of the High Country: A Terminal Pleistocene to Late Holocene Occupation Record from Wee Jasper, Southeastern Australia. *Australian Archaeology*, *84*(2), 145–163.

Umwelt (Australia) Pty Ltd. (2003). *Lake Macquarie Aboriginal Heritage Study*. Unpublished report for Lake Macquarie City Council.

AECOM

Appendix A – AHIMS Search Results (Redacted)

Appendix E Historic Heritage Assessment

Prepared for
Transgrid
ABN: 19 622 755 774

Newcastle 330 kV Substation - new synchronous condenser

Historic Heritage Assessment

14-Nov-2025

Newcastle 330 kV Substation - new synchronous condenser

Historic Heritage Assessment

Client: Transgrid

ABN: 19 622 755 774

Prepared by

AECOM Australia Pty Ltd
Gadigal Country, Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

14-Nov-2025

Job No.: 60731082

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Newcastle 330 kV Substation - new synchronous condenser – Statement of Heritage Impact
Ref	60731082
Date	14-Nov-2025
Originator	Rebecca Hibberd
Checker/s	Alice Thurgood
Verifier/s	Dr Darran Jordan

Revision History

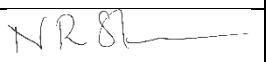
Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	13-May-2025	Draft for Transgrid Review	Dr Darran Jordan ANZ Heritage Technical Group Leader	
1	29-Jul-2025	Final draft for Transgrid review	Dr Darran Jordan ANZ Heritage Technical Group Leader	DJ
2	28-Aug-2025	Final	Neil Standen Associate Director	NS
3	08-Oct-2025	Final	Neil Standen Associate Director	NS
4	14-Nov-2025	Final	Neil Standen Associate Director	

Table of Contents

Figures

Tables

Executive Summary

AECOM Australia Pty Ltd (AECOM) has been engaged to prepare a historic heritage assessment to assess potential impacts from the proposed installation of two new synchronous condensers (syncons) at the existing Newcastle 330 kilovolt (kV) substation. This historic heritage assessment has been prepared to assess potential impacts on heritage values and provide relevant management recommendations. This historic heritage assessment has considered potential impacts to the *Lake Macquarie Local Environmental Plan 2014* (Lake Macquarie LEP) heritage register listed item 'Elcom Newcastle Substation' (LEP #108).

For the purpose of this assessment, the proposed impact area is defined as an indicative maximum footprint in which the construction and operation of the syncons would be carried out. The study area is defined as a 200 metre buffered area surrounding the proposed impact area. The proposed activity involves the installation and operation of two syncons and associated infrastructure at the existing Newcastle 330 kV substation, including the upgrade of Killingworth Road and temporary construction site facilities.

The installation of two new syncons and its associated infrastructure would comprise a permanent physical impact to a cleared portion of land within the 'Elcom Newcastle Substation' curtilage, however there would be a less than minor impact to any 'significant elements' of the heritage item. No subsurface deposits associated with past operations of the site are expected to occur in the area. The installation of sympathetic electrical infrastructure, on a portion of the site historically used for stockpiling, has been considered to have a positive visual impact on the heritage item.

The proposed activity is considered to be mitigation works to enable the ongoing capability of the 'Elcom Newcastle Substation' with a less than minor impact to the heritage item's significant elements. The proposed activity would have a negligible impact on the overall significance of the 'Elcom Newcastle Substation'.

Due to these findings, the following recommendations have been made:

Recommendation 1

The proposed activity would have a less than minor impact to the heritage item's significant elements and a negligible impact on the overall significance of the 'Elcom Newcastle Substation'. No further heritage investigation, assessment or reporting is required.

Recommendation 2

Workers undertaking activity within the curtilage of the 'Elcom Newcastle Substation' are to be made aware of its heritage significance and protection measures enacted to ensure there are no accidental physical impacts to its heritage significant elements during works (i.e., temporary demarcation of work areas through signage or boundary tape, toolbox presentation to ensure workers do not go beyond the bounds of defined work areas and reduce the risk of accidental impacts to the heritage item). See Section 1.4 (Item description) for the heritage item's significant elements. Details of these protection measures should be included within the project's Construction Environmental Management Plan (CEMP). The temporary impacts to the 'Elcom Newcastle Substation' would not be permanent and the location would be returned to the same condition following the completion of works.

Recommendation 3

In the event that an unexpected heritage item (as defined by the *Heritage Act 1977*) is identified during the proposed activity, the works must cease at the location and no further harm to the item shall occur. The find must be immediately reported to Transgrid, and the regulator in accordance with legislation. No work must recommence in the vicinity of the unexpected find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the proposed activity, works must stop immediately and the area be secured to prevent unauthorised access, with NSW Police, Heritage NSW and Transgrid to be contacted to determine next steps.

1.0 Introduction

1.1 Background

Transgrid is proposing to install and operate a synchronous condenser (syncon) at the existing Newcastle 330 kilovolt (kV) substation (the proposed activity). The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the New South Wales (NSW) power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their *2022 System Strength Report* (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

AECOM Australia Pty Ltd (AECOM) has been engaged to prepare a historic heritage assessment to assess potential impacts from the proposed activity at the existing Newcastle 330 kV substation. Work would occur within the heritage curtilages of the *Lake Macquarie Local Environmental Plan 2014* (Lake Macquarie LEP) heritage register listed item 'Elcom Newcastle Substation' (LEP #108). The proposed impact area is shown on Figure 1-1.

Accordingly, this historic heritage assessment has been prepared to assess potential impact to the item.

This assessment will be used to support the Summary Environmental Report (SER) for the proposed activity.

1.2 Proposed impact area and study area

The Newcastle 330 kV substation is located off Killingworth Road, in the suburb of Killingworth and the City of Lake Macquarie Local Government Area (LGA), NSW. The substation is located within Lots 1 and 2 of DP619513, which is owned by the Electricity Transmission Ministerial Holding Corporation (ETMHC) and leased and managed by Transgrid (the substation site). The substation site is located in a vegetated rural area surrounded by cleared transmission line easements, with Burkes Creek traversing the southern corner of the substation site. Residential development is located 100 metres south of the substation site.

The area where ground surface impacts are required as part of the proposed activity are referred to as the 'proposed impact area' (refer to Figure 1-1 and Figure 1-2).The proposed impact area is an indicative maximum footprint in which the construction and operation of the syncons would be carried out. The impact area also includes areas within the substation boundary that are required to facilitate connection to the proposed syncons, as well as a portion of Killingworth Road which requires upgrading.

The study area for this assessment is defined as a 200 metre buffered area surrounding the proposed impact area and is shown in Figure 1-1 and Figure 1-2.

1.3 Proposed activity

The scope of works for the proposed activity would include:

- Site establishment activities, including installation of construction offices and amenities, equipment storage and construction laydown areas and vegetation removal
- Construction of a new internal access road from Killingworth Road and upgrades to Killingworth Road to support the transport of equipment and vehicle movements to and from site
- Installation of a new bench (concrete slab, foundations and associated earthworks), with an indicative maximum footprint of around 130 by 150 m, immediately south of the existing Newcastle 330 kV substation to house the syncons and associated infrastructure
- 330 kV busbar extension with a new switch bay, which comprises a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester

- Installation of the new syncons and associated equipment, including:
  - Power transformer with firewalls
  - Auxiliary transformers
  - Syncon building and gantry crane
  - Oil lubrication and water-cooling systems
  - Control room and battery room
  - Low voltage AC and DC systems
  - Protection and control systems
  - Backup diesel generator
  - Pony motor
- Installation of a new demountable secondary systems building
- Installation of new spill oil tank, secondary containment dam(s) and drainage systems to cater for the new transformers, diesel generator and the syncon oil lubrication system
- Extension of the substation's stormwater drainage system, to cater for the new bench area
- Installation of new lighting protection masts.
- Rehabilitation of the site including:
  - Removal of temporary construction facilities and equipment
  - Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by Transgrid's environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction
  - Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditions as possible.

The location of the work and indicative syncon site layout are shown in Figure 1-1. Figure 1-2 shows the indicative construction site layout.

Further details of the scope of works for the proposed activity are presented in Section 2 of the Summary Environmental Report (SER) (AECOM, 2025).

1.4 Item description

The 'Elcom Newcastle Substation' is registered on Schedule 5 of the Lake Macquarie LEP. The heritage curtilage of the item is shown in Figure 2-1.

The following description is quoted from the State Heritage Inventory (SHI) listing of the LEP site:

> *PHYSICAL CHARACTERISTICS - 1993:*
>
> *Large outdoor high-voltage switching and transformer sub-station, forming the focal point for 330,000 and 132,000 volt main transmission lines in the region.*
>
> *The fenced yard is filled with high-voltage transformers and switchgear, and many overhead high-voltage lines on steel towers, all exposed to weather and public view, but not to public access.*
>
> *The Newcastle Substation interconnects each of the region's power stations to one or other of the various load centres, such as Newcastle or Sydney, and continually adjusts the allocations (switchings) to get the optimum balance between power station output and the varying loads.*
>
> *It is operated by remote control, from the Elcom's State System Control Centre at Carlingford.*
>
> *The substation has been modified over the years since it was established, to keep up with necessary changes in switchgear, and to adapt to the changing sources and levels of electric power.*

(Heritage NSW, 2008)

1.5 Objectives

The overarching objective of this assessment is to prepare a historic heritage assessment in order to assess the impact of the proposed activity on the heritage significance of the 'Elcom Newcastle Substation' (LEP #108). The purpose of this assessment is to evaluate and explain how the proposed development, rehabilitation or land use change would affect the value of the heritage item and/or place and address how the heritage value of the item/place can be conserved, maintained, or enhanced.

Key tasks included:

- Developing of an understanding of the historical context of 'Elcom Newcastle Substation' (LEP #108) through desktop-based research of available historical documentation, including parish maps and historic aerials, as well as a review of previous studies and heritage database searches
- Documenting the heritage values of the listing, including the identification of any areas of archaeological potential within the proposed impact area
- Assessing the proposed activity against the relevant elements of the listing, including the potential for direct and indirect impacts to the listing's heritage values
- Identifying measures to reduce, avoid or mitigate impacts to the listing's known or potential heritage values.

This impact assessment has been prepared in accordance with the NSW Heritage Office & NSW Department of Urban Affairs and Planning (1996) *NSW Heritage Manual* and the Department of Planning and Environment's (2023) *Guidelines for Preparing a Statement of Heritage Impact*.

1.6 Authorship

This assessment was prepared by AECOM Archaeologist and Heritage Consultant Rebecca Hibberd. A technical and quality review was undertaken by AECOM Principal Heritage Specialist Dr Darran Jordan.

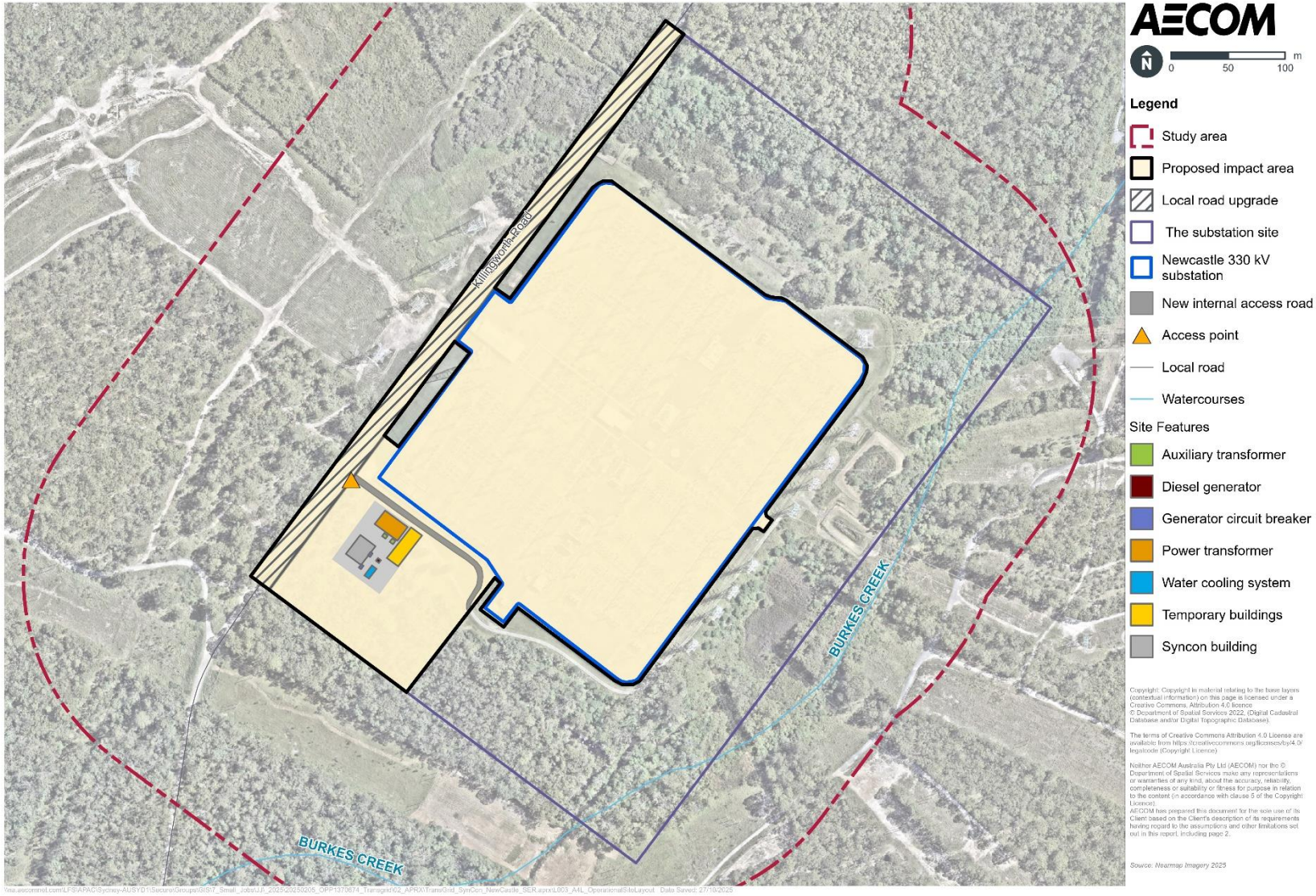


Figure 1-1 Location of proposed activity and indicative site layout

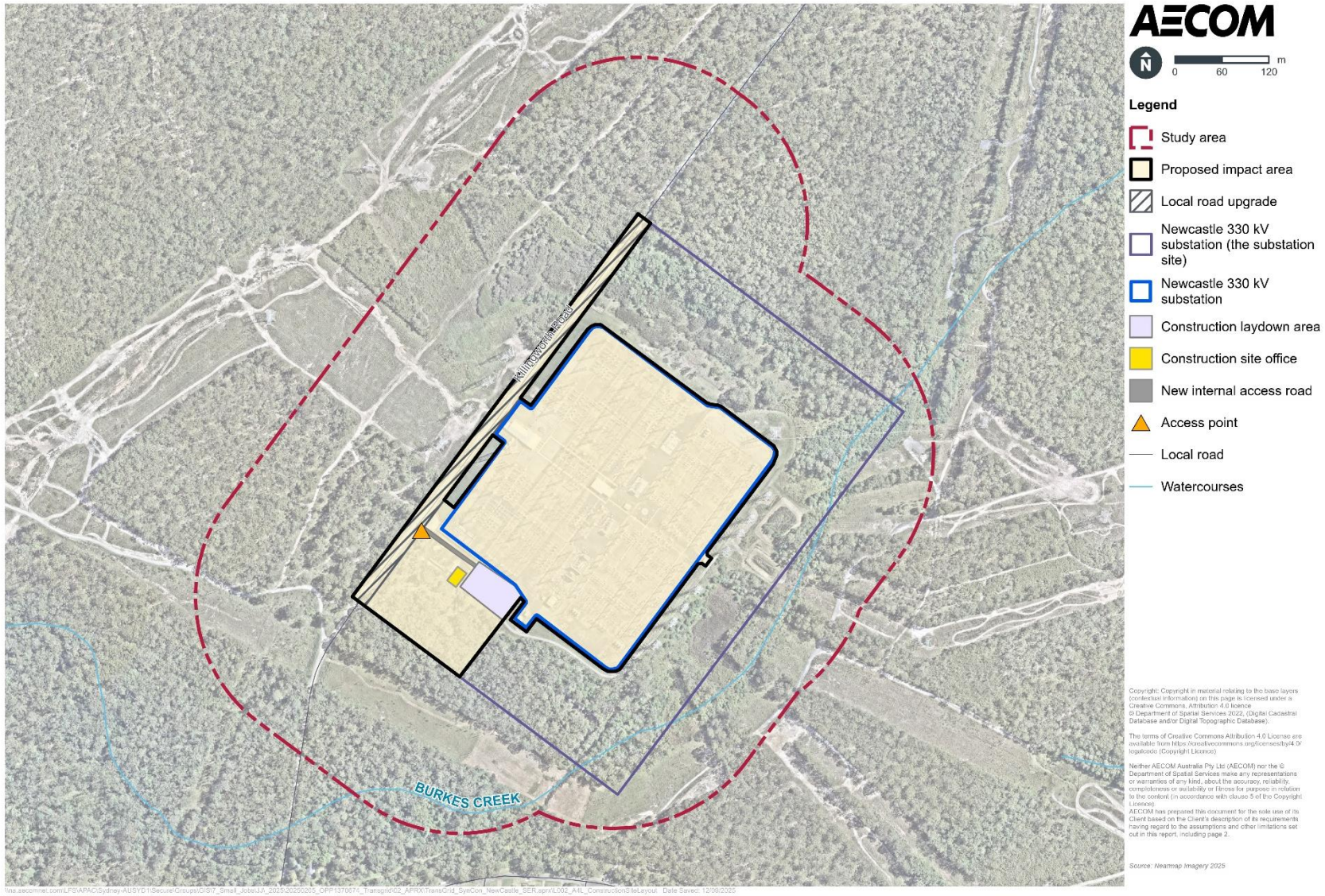


Figure 1-2 Indicative construction site layout

2.0 Legislative context

2.1 Commonwealth legislation

2.1.1 Environment Protection & Biodiversity Conservation Act 1999

The *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) defines 'environment' as both natural and cultural environments and therefore includes Aboriginal and non-Aboriginal historical cultural heritage items. Under the EPBC Act, protected heritage items are listed on the National Heritage List (NHL) (items of significance to the nation) or the Commonwealth Heritage List (CHL) (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE). The RNE has been suspended and is no longer a statutory list; however, it remains as an archive.

Under Part 9 of the EPBC Act, any action that is likely to have a significant impact on a matter of National Environmental Significance (known as a controlled action under the Act), may only progress with approval of the Commonwealth Minister for the Department of Climate Change, Energy, the Environment and Water. An action is defined as a project, development, undertaking, activity (or series of activities), or alteration. An action will also require approval if:

- It is undertaken on Commonwealth land and will have or is likely to have a significant impact on the environment on Commonwealth land; and
- It is undertaken by the Commonwealth and will have or is likely to have a significant impact.

There are no relevant listings on the CHL, RNE, or NHL within or immediately adjacent to the proposed activity.

2.2 NSW legislation

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the system of environmental planning and assessment in NSW. As the proposed activity is for electricity transmission facilities and is to be carried out by Transgrid, it can be assessed under Division 5.1 of the EP&A Act. Division 5.1 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by prescribed determining authorities, such as Transgrid, which do not require development consent under Part 4 of the EP&A Act.

2.2.2 State Environmental Planning Policy (Transport and Infrastructure)

Section 2.44 of State Environmental Planning Policy (Transport and Infrastructure) (SEPP (Transport and Infrastructure)) permits development on any land 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 consent.

Under section 2.11 of SEPP (Transport and Infrastructure), consultation with the local council is required if the proposed activity is likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (which is not also a State heritage item) in a way that is more than minor or inconsequential. If impact is considered to be more than minor or inconsequential, an assessment of the impact must accompany the written notice to council.

The proposed activity is located within the Lake Macquarie LGA. The SEPP (Transport and Infrastructure) prevails over all other environmental planning instruments (such as LEPs) and as such development consent from council is not required where impacts on a heritage item are determined to be less than minor.

Although the proposed activity is expected to have less than a minor impact to the heritage item's significant elements and a negligible impact on the overall significance of the 'Elcom Newcastle Substation', Transgrid has notified Lake Macquarie City Council of the proposed activity. Any response received from the council will be addressed in the SER.

During the preparation of this historic heritage assessment, the heritage conservation provisions of the Lake Macquarie LEP were considered for completeness as discussed in Section 2.3.

2.2.3 *Heritage Act 1977*

The *Heritage Act 1977* was enacted to conserve the environmental heritage of NSW. Under Section 32, places, buildings, work, relics, moveable objects, or precincts of heritage significance are protected. Proposals to alter, damage, move or destroy places, buildings, work, relics, moveable objects, or precincts protected by an IHO or listed on the SHR require an approval under Section 60. There are standard exemptions to the requirement for a Section 60 permit under Section 57 (2) of the *Heritage Act 1977* (see below).

There are no relevant listings on the NSW SHR within or immediately adjacent to the proposed activity.

Under Section 170 (S170) of the *Heritage Act 1977*, NSW Government agencies are required to maintain a register of heritage assets. The S170 Register places obligations on the agencies, but not on non-government proponents, beyond their responsibility to assess the impact on surrounding heritage items.

There is no relevant listing within or immediately adjacent to the proposed activity.

2.3 Local legislation and policy

Lake Macquarie Local Environmental Plan 2014

Part 5, Section 5.10 of the Lake Macquarie LEP addresses heritage conservation. All heritage items listed on the LEP are included in Schedule 5 of the document.

As noted above, the SEPP (Transport and Infrastructure) prevails over all other environmental planning instruments (such as LEPs) and as such development consent from council is not required where impacts on a heritage item are determined to be less than minor.

There is one relevant listing in Schedule 5 of the Lake Macquarie LEP within the study area – ‘Elcom Newcastle Substation’ (LEP #108).

2.4 Lake Macquarie Development Control Plan 2014

The primary purpose of a Development Control Plan (DCP) is to guide development according to the aims of the corresponding LEP. The Lake Macquarie DCP 2014 applies to the LGA of Lake Macquarie City Council. Part 5 of the DCP supports the LEP by providing additional objectives and development standards for development in productivity support, industrial and infrastructure zones. Part 5 applies to the ‘Elcom Newcastle Substation’ as it is land zoned as Infrastructure SP2 under the Lake Macquarie LEP.

Section 2.14 of Part 5 augments the provisions of the Lake Macquarie LEP in respect to European heritage and to provide residents, landowners, purchasers and developers with a document which sets out in detail the Lake Macquarie City Council’s policy on change relating to European heritage items.

Lake Macquarie DCP 2014 was considered when preparing this historic heritage assessment.

2.5 Statutory database searches

Searches of the following statutory databases were undertaken on 3 April 2025:

- Australian Heritage Database (World, National, Commonwealth heritage lists)
- NSW SHR
- Schedule 5 of Lake Macquarie LEP.

Table 2-1 provides a summary of the database search results.

Table 2-1 Historic heritage register/list searches

Heritage Register	Results	Location
NSW SHR[1]	None	N/A
Lake Macquarie LEP[1]	'Elcom Newcastle Substation' (LEP #108)	Within proposed impact area
WHL[1]	None	N/A
NHL[1]	None	N/A
CHL[1]	None	N/A
RNE[2]	None	N/A

1 – Statutory Heritage Registers
2 – Non-Statutory Heritage Registers

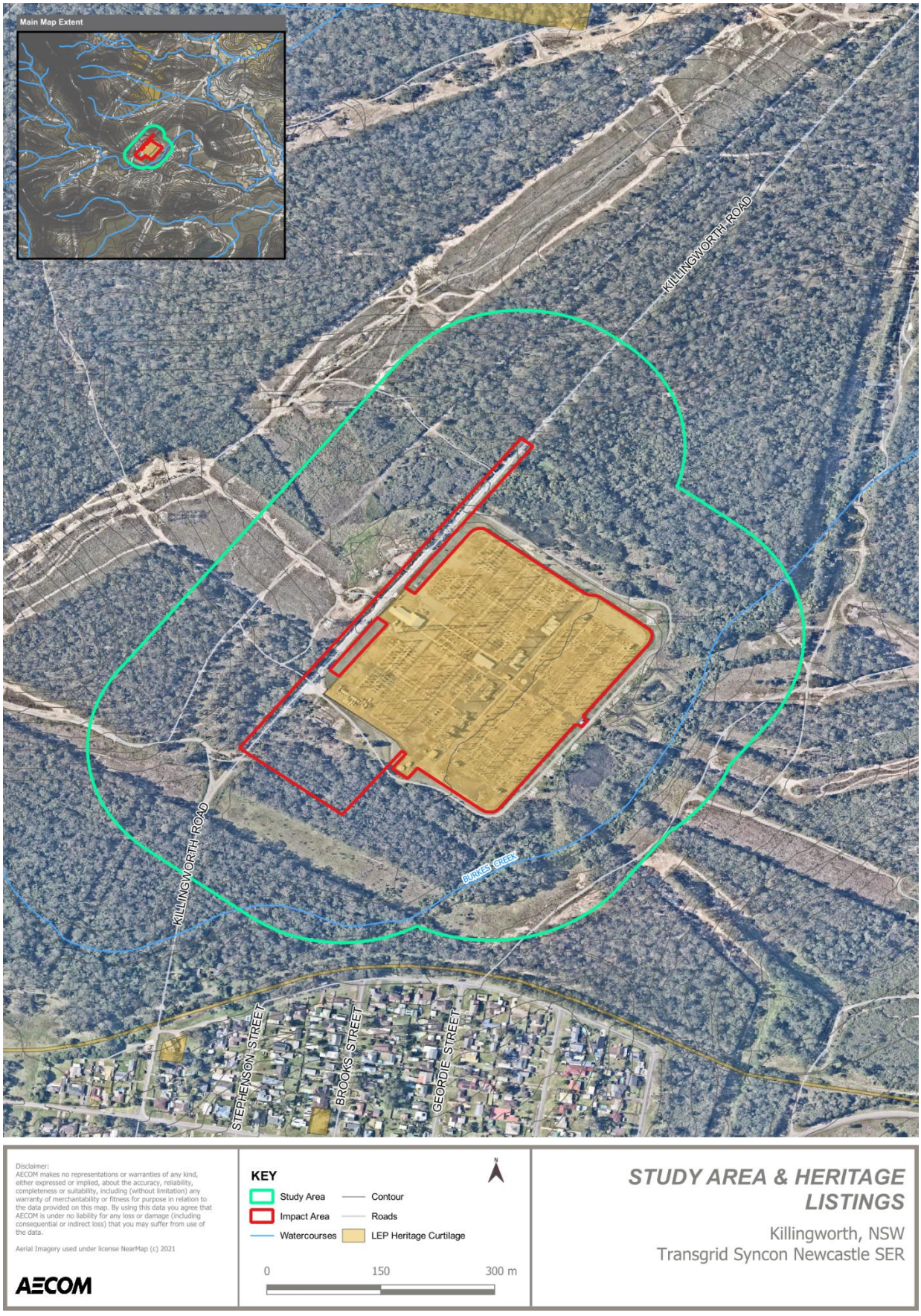


Figure 2-1 Location of proposed impact area, showing Lake Macquarie LEP heritage curtilage

3.0 Historical background

To understand the potential and existing heritage and archaeological values of an area, it is necessary to understand its historical context. The following historical summary features quotes from the relevant sections of the NSW SHI listings.

3.1 Aboriginal history

The proposed impact area falls within the traditional lands of the Awabakal people, who's missionary and Congregational minister Lancelot Threlkeld described as occupying "*[t]he land bounded (to the South) by Reid's Mistake the entrance to Lake Macquarie, (to the North) by Newcastle & Hunter's River, (to the West) by five islands on the head of Lake Macquarie 10 miles west of our station. This boundary, about 14 miles N and S by 13 E and W, is considered as their own land*" (Threlkeld 1828 in Ford (2010:339).

3.2 European settlement

Located on the eastern coast of NSW, south of Newcastle, the Lake Macquarie region remained largely undeveloped during the first century of the east coast's European occupation. In 1800 Captain William Reid 'accidentally discovered' the coast entrance to the lake (Heritas Architecture, 2010).

Lake Macquarie remained largely untouched by larger historical movements including pastoralism, convictism and the gold rushes that reached other regions of NSW. The exploitation of two major resources, timber and coal, dominated the early history of the Lake Macquarie region, initiating the establishment of villages and towns including Killingworth, West Wallsend, Cardill and Dudley. Killingworth was established on the original 2,560 acre granted to William Bucknell in 1888. The property was known as 'Deega' (see Figure 3-1).

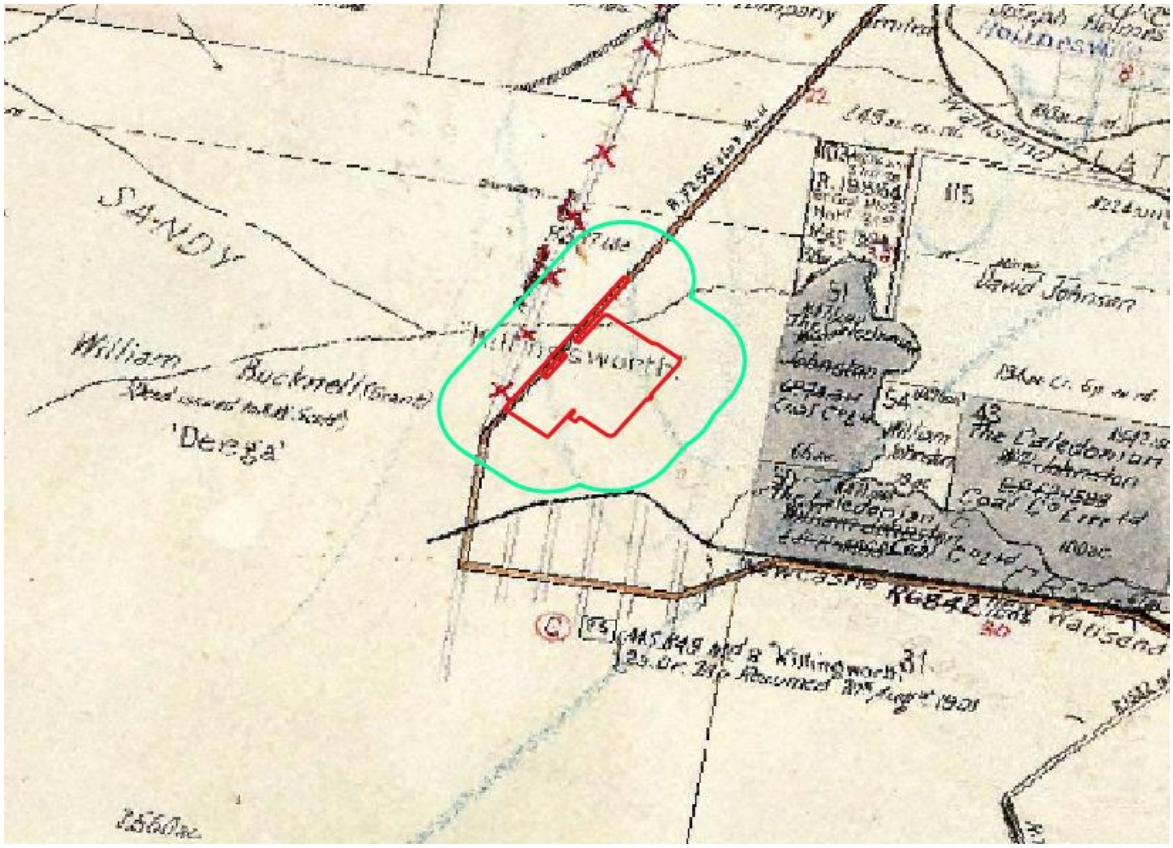


Figure 3-1 Parish Map of Teralba Parish, showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Land Registry Services, 8 May 2025)

Rail transportation stimulated the expansion of the coal and timber industries in the 1880s. Killingworth township benefited from this expansion with the opening of Killingworth Colliery, also known as West Wallsend Extended Colliery, in 1892. Workers of the colliery relocated to Killingworth, with the first post office opening in August 1900 and the first public school opening in July 1891.

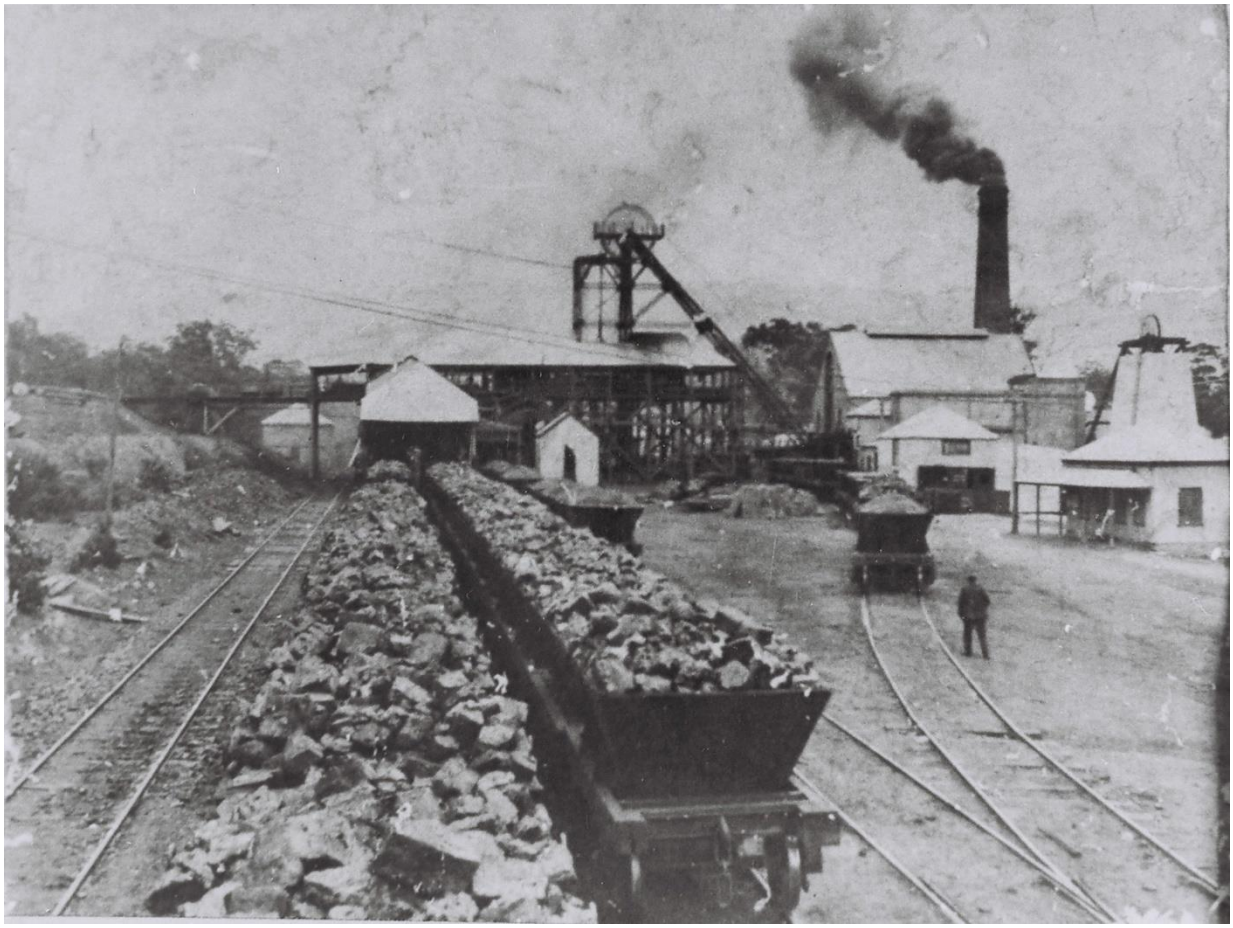


Figure 3-2 Killingworth Colliery, New Wallsend, also known as Wallsend Extended Colliery (Source: Lake Macquarie City Council, 12 May 2025)

The development of four power stations across Lake Macquarie throughout the second half of the twentieth century not only boosted the population but also brought amenities to nearby towns and encouraged the expansion of services and public utilities (Heritas Architecture, 2010).

The following history of 'Elcom Newcastle Substation' comes from the NSW SHI listing:

> *HISTORICAL NOTES - 1993: Elcom started construction in January 1967.*
>
> *The substation was a major element in the new 330,000 volt transmission line network, linking the new coalfields-based power stations to the various load centres.*
>
> *Work was completed at the end of 1968.*
>
> *The substation provided power to a series of 132,000 volt bulk supply substations serving councils from Gosford to Taree.*
>
> (Heritage NSW, 2008)

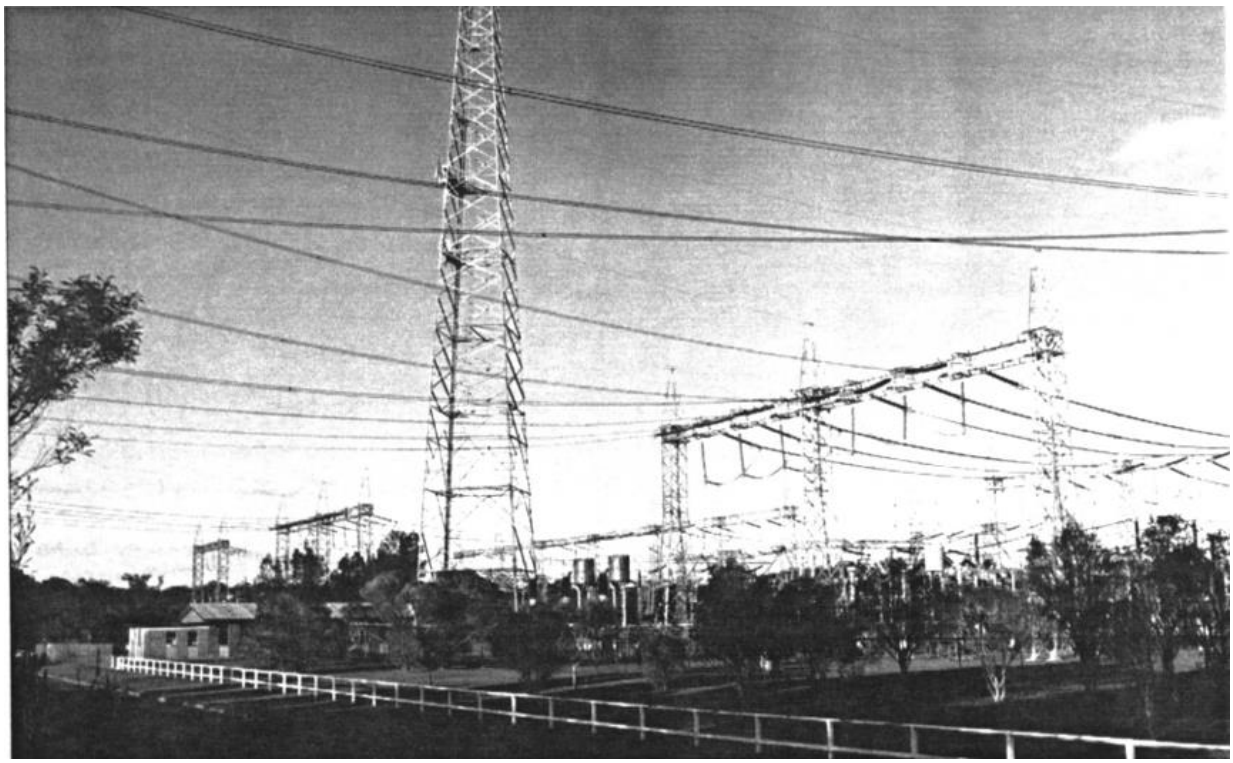


Figure 3-3 Elcom Newcastle Substation, Killingworth 1993 (Source: Suters Architects Snell (1993))

3.3 Historical aerials

Historical aerial mapping from the years 1954 to 2025 were assessed for historical land use relating to the 'Elcom Newcastle Substation'. There have been several major developments across the impact area over the past 79 years, with the most relevant to the proposed activity relating to land use, land regeneration and the construction/use of the 'Elcom Newcastle Substation'.

3.3.1 'Elcom Newcastle Substation'

Historical aerials from 1954 indicate that very little development occurred across the study area prior to this imagery, with disturbance limited to the construction of Killingworth Road, located immediately adjacent (west) to the study area (see Figure 3-4). Between 1954 and 1966, little to no development appears to occur within the study area, however disturbance on the future substation site is evident with native vegetation clearance occurring in a grid pattern (see Figure 3-5).

By 1975, the Newcastle substation was constructed and in operation (see Figure 3-6). The construction of the substation included the large scale clearance of native vegetation within and surrounding the site, as well as along numerous transmission easements for powerline connection to the substation. In 1975 the study area is largely cleared of vegetation and stands empty next to the substation. The portion of the impact area that extends into the substation site is empty of infrastructure at this time.

Very little change occurred across the impact area between 1975 and 1984, limited to minimal vegetation regrowth. Infrastructure within the substation site expanded during this time, abutting the portion of the study area that extends into the site boundary (see Figure 3-7).

Over the next 30 years a large portion of the study area remained largely undeveloped and utilised for stockpiling or carparking (see Figure 3-8 to Figure 3-13). The southern portion of the study area was left to the regrowth of standing vegetation and grasses. Between 2014 and present day the study area was used for stockpiling and access to the site from Killingworth Road (see Figure 3-10 to Figure 3-13).

Figure 3-4 Historical aerial image from 1954 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

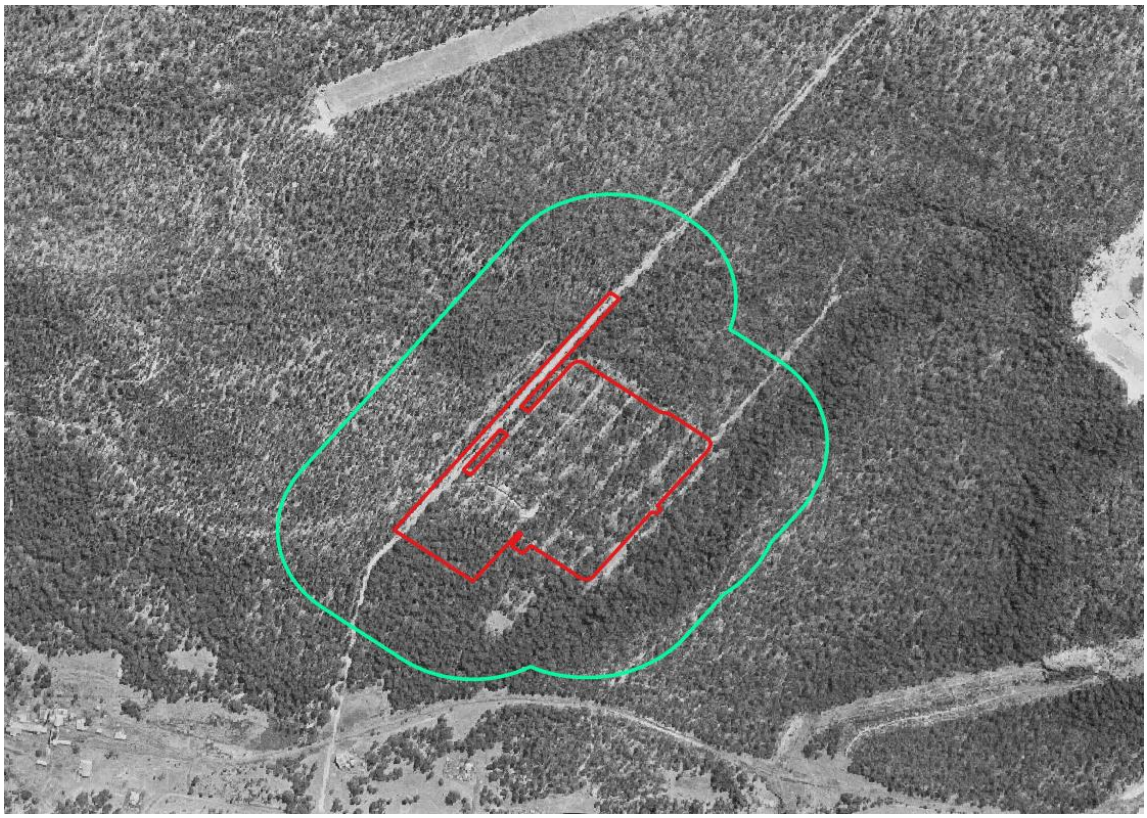


Figure 3-5 Historical aerial image from 1966 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

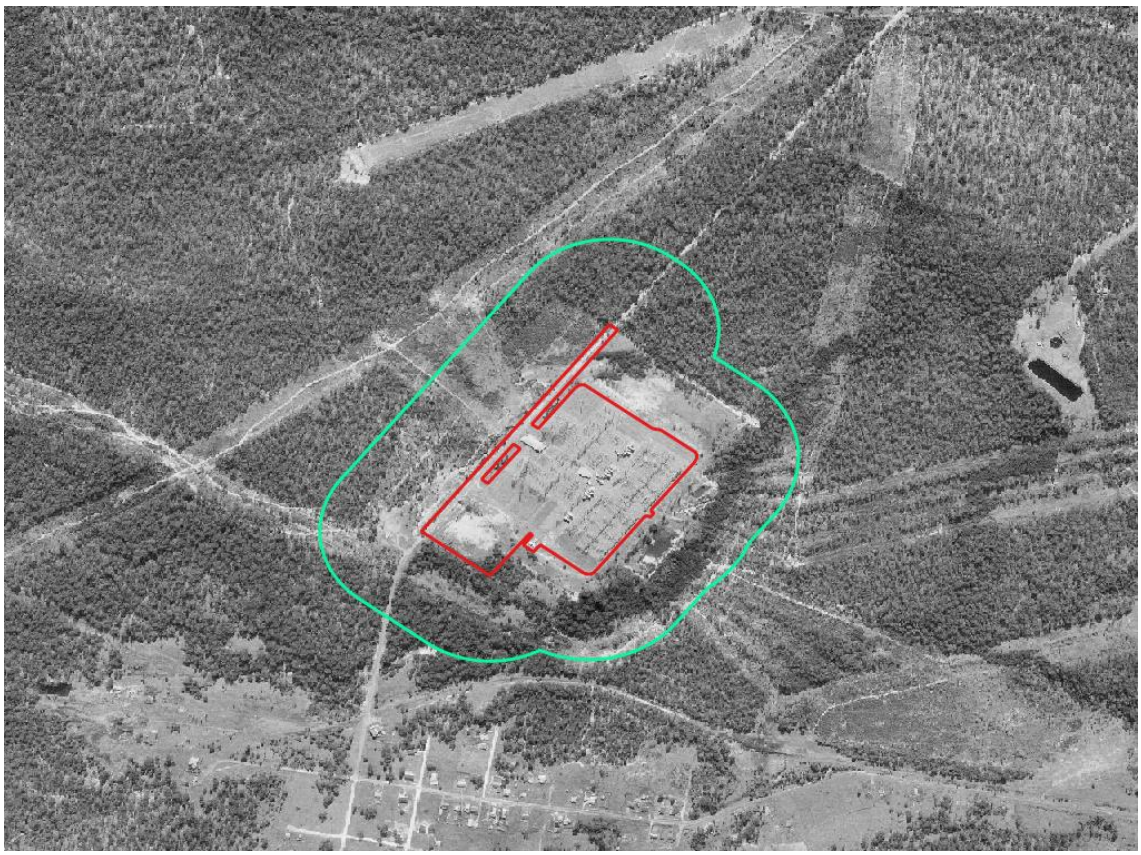


Figure 3-6 Historical aerial image from 1975 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

Figure 3-7 Historical aerial image from 1984 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

Figure 3-8 Historical aerial image from 2001 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

Figure 3-9 Historical aerial image from 2010 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

Figure 3-10 Historical aerial image from 2014 showing the relative location of the study area (in green) and impact area (in red) (Source: NSW Collaboration Portal, 8 May 2025)

Figure 3-11 Historical aerial image from 2015 showing the relative location of the study area (in green) and impact area (in red) (Source: Google Earth, 8 May 2025)

Figure 3-12 Historical aerial image from 2022 showing the relative location of the study area (in green) and impact area (in red) (Source: Google Earth, 8 May 2025)

Figure 3-13 Historical aerial image from 2025 showing the relative location of the study area (in green) and impact area (in red) (Source: Nearmap, 8 May 2025)

4.0 Archaeological potential

Archaeological potential in the context of the current assessment is defined as the potential for relics to be present within the proposed impact area, with relics comprising any archaeological deposit featuring artefacts, objects or material evidence that is of State or local heritage significance. To evaluate the archaeological potential of a site or area, it is necessary to understand its history and the sequence of activities that have taken place throughout its history. This information indicates where archaeological features and deposits may be located on a site as well as the likelihood that they have survived later phases of disturbance or development.

In NSW, Public Work sites, such as the proposed impact area, commonly contain the following types of relics – building structural remains and rubble, roadside refuse, construction equipment, fence lines and several other types of archaeological deposits.

As described in Section 3.0, Killingworth was established on the original 2,560 acre granted to William Bucknell in 1888. The history of Killingworth is dominated by the construction and use of the Killingworth Colliery, the 'Elcom Newcastle Substation', and the subsequent public amenities and residential development for colliery and substation workers. Historical aerials indicate that the land within the study area remained largely undeveloped before the construction of the substation and associated infrastructure in the late 1960s.

Table 4-1 presents an assessment of the potential for the various types of relics that, based on a review of the history of the 'Elcom Newcastle Substation' heritage curtilage, might be present within the proposed impact area. The archaeological potential for these remains to be present has been graded low, moderate and high. Low potential has been applied to remains that are considered highly unlikely to be present within the proposed impact area. Moderate potential means remains might be present and high potential indicates that there is a high likelihood that they are present.

As shown in Table 4-1, there is low potential for all identified types of archaeological deposits to be present within the vicinity of the proposed impact area. The proposal is therefore unlikely to result in impacts to historic archaeology.

Table 4-1 Archaeological potential

Remains	Potential	Comment
Building footings	Low	No evidence of additional footings or unknown structural building features have been identified.
Rubbish/Discarded material	Low	Discarded materials associated with the early period of land use may be located in subsurface deposits.
Historical road construction	Low	No evidence of historical road construction associated with the early period of land use has been identified.
Fence lines	Low	Fence lines associated with the early period of land use have not been identified. If present, only post holes would be present.
Electrical equipment	Low	Additional electrical equipment associated with historical land use has not been identified within the impact area, however, may be located in subsurface deposits.

5.0 Significance assessment

5.1 Background

An assessment of significance is undertaken to explain why a particular item is important and to enable the appropriate site management and curtilage to be determined. Cultural significance is defined in *The Australia ICOMOS Charter for Places of Cultural Significance 2013* (Australia ICOMOS, 2013) as meaning "aesthetic, historic, scientific, social or spiritual value for past, present or future generations" (Article 1.2). Cultural significance may be derived from a place's fabric, association with a person or event, or for its research potential. The significance of a place is not fixed for all time, and what is of significance to us now may change as similar items are located, more historical research is undertaken, and community tastes change.

The process of linking this assessment with an item's historical context has been developed through the NSW Heritage Management System and is outlined in the guideline *Assessing Heritage Significance* (Heritage NSW, 2023), part of the NSW Heritage Manual (Heritage Branch, Department of Planning, 1996). There are seven evaluation criteria that make up the NSW Heritage Significance Criteria under which a place can be evaluated in the context of State or local historical themes. Similarly, a heritage item can be significant at a local level (i.e., to the people living in the vicinity of the site), at a State level (i.e., to all people living within NSW) or be significant to the country as a whole and be of National or Commonwealth significance.

In accordance with the guideline *Assessing Heritage Significance*, an item would be considered to be of State significance if it meets two or more criteria at a State level, or of local heritage significance if it meets one or more of the criteria outlined in Table 5-1. The Heritage Council requires the summation of the significance assessment into a succinct paragraph, known as a Statement of Significance. The Statement of Significance is the foundation for future management and impact assessment.

Table 5-1 NSW Significance assessment criteria

Criterion	Inclusions/Exclusions
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	**Historical significance** – A place or object is important in the course or pattern of an area's history if it: • is the product of • is an example of • was influenced by • has influenced • is associated with • has a symbolic association with something that has made a strong contribution to the course or pattern of development of our cultural society or environment.
Criterion (b) – an item has strong or special association with the life or work of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	**Associative significance** – A place or object has special associational value if it is associated with a person, organization or group of people who have made an important or notable contribution to the course, pattern and development of our cultural and/or physical environment. In this context, a special association may relate not only to the 'great' and well-known, but also to the influential, the exemplary and the innovative.

Criterion	Inclusions/Exclusions
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	**Aesthetic, creative or technical significance** – A place or object is important because of its aesthetic significance if that place or object exhibits sensual qualities that can be judged to be of significance against various ideals including beauty, picturesqueness, evocativeness, expressiveness, landmark presence, streetscape contribution, symbolist or some other quality of nature or human endeavour. Alternatively, a place is important in demonstrating a high degree of creative or technical achievement at a particular period if that place illustrates artistic or technical excellence, innovation, accomplishment, extension or creative adaptation in a variety of fields of human endeavour including but not exclusive to art, engineering, architecture, industrial or scientific design, landscape design, construction, manufacture and craftsmanship or some other technical field.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	**Social significance** – A place or object is important for its strong or special association with a particular community or cultural group. This could be for social, cultural or spiritual reasons that have a perceived meaning or symbolic, spiritual or moral value that is important to them and which generates a strong sense of attachment. Alternatively, a place is important when the community exhibits strong or special feelings or attaches community identity to it, or the community gathers especially for spiritual reasons, recreation or resort. The place may be Aboriginal or non-Aboriginal or a natural environment. The natural place or object does not have to be a built/constructed/modified (culturally created) place and could be in an unmodified, natural form or format.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	**Research potential** – A place or object has potential to yield information that will contribute to an understanding of an area's history if it can be demonstrated that with further examination or research, it may reveal information that will contribute to our understanding of the past. The potential to contribute to our understanding of the past may be found in archaeological deposits, complexes, buildings and structures, gardens and plantings.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	**Rarity** – A place or object demonstrates rare, uncommon or endangered aspects of an area's cultural or natural heritage. The place or object illustrates past human activities or achievements that are at risk of being lost, and/or are of exceptional interest. Past human activities and achievements can include a way of life, custom, process, function, land use, design or some other activity or achievement that is no longer practiced.

Criterion	Inclusions/Exclusions
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): cultural or natural places cultural or natural environments.	**Representativeness** – A place or object is important in demonstrating the principal characteristics of a particular class of cultural or natural places or objects if it displays: • the defining features, qualities or attributes of a type • variation within a type • evolution of a type • transition of a type and where the type or class of cultural or natural places illustrates a range of human or environmental activities including: • a way of life • a custom • an ideology or philosophy • a process, land use, function, form, design, style or technique • some other activity or achievement.

5.2 Assessment of significance

The assessment of heritage significance for the 'Elcom Newcastle Substation' (LEP #108) was conducted by AECOM and is provided in Table 5-2. The Statement of Significance has been quoted from the NSW SHI listing.

Table 5-2 Assessment against SHR criteria for 'Elcom Newcastle Substation' (LEP #108) (Heritage NSW, 2008)

Significance Criteria	Application of Criteria
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The substation is a notable example of electricity transmission development within the Lake Macquarie area. The substation had a notable influence on the physical development of the area, providing a necessary amenity to the region. Historically the substation has been the main substation for the Hunter Region and remains a vital element of the power transmission system in NSW.
Criterion (b) – Historical Association	The item does not meet this significance criteria.
Criterion (c) – Aesthetic/Technical	The substation is a notable example of regional transmission of electricity as well as being one of the notable industries of the region.
Criterion (d) - Social/Cultural	The item does not meet this significance criteria.
Criterion (e) – Research Potential	The item does not meet this significance criteria.
Criterion (f) – Rarity	The item does not meet this significance criteria.
Criterion (g) - Representative	The substation is one of the largest substations in NSW and represents the process of transforming coal to electricity and one of the region's most important industries.
Integrity/Intactness	The substation has been modified over the years, keeping up to date with technological advancements, including the necessary changes in switchgear and adaption to changing sources and levels of electrical power.

5.3 Statement of significance

The following Statement of Significance for 'Elcom Newcastle Substation' (LEP #108) is quoted from the NSW SHI listing.

> *SIGNIFICANCE - 1993: The Newcastle Substation will probably remain a vital element on the State's power transmission system for the foreseeable future.*
>
> *Although the Substation would not yet be generally accepted as a heritage item, it is undoubtedly of State significance, as one of the largest substations in NSW, and of Regional significance as a vital & highly visible link in the generation & transmission of high-voltage electric power, which is now one of the Region's most important industries.*
>
> *The Substation, and the associated high-voltage transmission lines, represent the modern equivalent of transporting coal from the local collieries to the cities, but now after transforming the coal to electricity.*
>
> *LEVEL of SIGNIFICANCE - 1993:* *State Significance - moderate*
>
> *Regional Significance – high*
>
> *Local Significance – high*
>
> (Heritage NSW, 2008).

This Statement of Significance was last updated on 19 May 2008.

6.0 Impact assessment

This impact assessment has been prepared in accordance with the NSW Heritage Office & NSW Department of Urban Affairs and Planning (1996) *NSW Heritage Manual* and the Department of Planning and Environment's (2023) *Guidelines for Preparing a Statement of Heritage Impact*. The guidelines pose a series of questions as prompts to aid in the consideration of impacts due to the proposed activity – *Questions to be considered in a statement of heritage impact.*

Proposed works associated with the construction and operation of the proposed activity with the potential to impact the significance of the 'Elcom Newcastle Substation' are described in Section 1.3.

The principal direct impact of the proposed activity would be the neutral physical impact to land within the 'Elcom Newcastle Substation' curtilage. Construction of proposed foundations, footings and/or piles for syncon infrastructure would involve subsurface disturbance adjacent to existing substation infrastructure. There would be no physical impacts to listed significant fabric/elements of the heritage item, with the exception of new cables to be connected to the existing control building. Therefore, this would be considered a neutral impact.

In relation to indirect (visual) impacts, the proposed activity would have a potential positive visual impact, as the clearing adjacent to the 'Elcom Newcastle Substation' is sometimes utilised for stockpiling which can visually detract from the heritage item. The proposed activity would involve the installation of new/additional electrical infrastructure within this clearing, creating a sympathetic vista and contributing to the greater substation site.

Historically there have been several modifications to the substation, keeping up to date with technological advancements, including the necessary changes in switchgear and adaption to changing sources and levels of electrical power.

Shorter term visual impacts would occur during construction works within the proposed activity area, but these would not be permanent and would not impact the existing heritage significance of the item.

The proposed activity would not alter the existing overall significance of the 'Elcom Newcastle Substation'. The heritage significance of the substation is steeped in its ability to be a vital link in NSW's power transmission system. The proposed activity aims to ensure the substation systems strength is available to maintain its use within the NSW power system (see Table 6-1 and Table 6-2).

Overall, the proposed activity would enable the ongoing capability of the 'Elcom Newcastle Substation' with a less than minor impact to the heritage item's significant elements. The proposed activity would have a negligible impact on the overall significance of the 'Elcom Newcastle Substation'.

Table 6-1 Impact assessment 'Elcom Newcastle Substation' (NSW Department of Planning and Environment, 2023, 7-8)

Matter for consideration	Assessment
Do the proposed works include removal of unsympathetic alterations and additions? How does this benefit or impact the heritage item and its significance?	The proposed activity would involve the addition of electrical infrastructure to ensure the ongoing use of the heritage item. The proposed additions would not affect listed significant fabric/elements of the heritage item, except for the connection of new cables to the existing control building. The proposed activity would not impact the significance of the heritage item.
Do the proposed works affecting the setting of the heritage item, including views and vistas to and from the heritage item and/or a cultural landscape in which it is sited? Can the impacts be avoided and/or mitigated?	No. The proposed activity is limited to cleared land adjacent to listed significant fabric/elements of the heritage item and upgrades to the road leading to and from the heritage item. The heritage item would not be visually impacted from publicly accessible areas. The proposed road upgrades would positively impact the view across Killingworth Road, to and from the heritage item. Whilst the proposed activity would affect the views across bushland from the southwest to the heritage item, the works would be situated on a largely cleared area of land that is currently used for stockpiling which visually detract from the heritage item.

Are the proposed works part of a broader scope of works?	No.
Does this proposal relate to any previous or future works? If so, what cumulative impact (positive and adverse) will these works have on the heritage significance of the item?	No.
Has the applicant checked if any other approvals or a separate process to evaluate the potential for impacts is required?	There are no known other approvals required.
Do the proposed works trigger a change of use classification under the *National construction code* that may result in prescriptive building requirements? If so, have options that avoid impact on the heritage values been investigated?	The work does not trigger a change of use.
If the proposed works are to a local heritage item, are the requirements of the development control plans or any local design guidelines that may apply to the site considered?	Yes. The Lake Macquarie DCP 2014 was reviewed as part of this assessment. There were no controls within the DCP for the 'Elcom Newcastle Substation'.
Will the proposed works result in adverse heritage impact? If so, how will this be avoided, minimised or mitigated?	There would be no long term or permanent adverse impact. The proposed activity would not affect listed significant fabric/elements of the heritage item, but aims to ensure the ongoing use of the heritage item as its original function. The proposed activity would not impact the significance of the heritage item.

Table 6-2 Considerations for 'New services and service upgrades' and 'Alterations and additions' (NSW Department of Planning and Environment, 2023)

Questions	Assessment
Are any of the existing services of significance? In what way are they affected by the proposed works?	Yes. The heritage item consists of the existing electrical substation and its associated elements. The proposed activity would not negatively affect the listed significant fabric/elements of the heritage item, but rather aims to ensure the substation system strength is available to maintain its use within the NSW power system. The proposed additional electrical infrastructure would be constructed adjacent to existing elements, however new cables would be connected to the existing substation. The proposed activity would not impact the significance of the heritage item.
How have the impacts of the installation of new services on heritage significance been minimised?	The proposed activity aim to ensure the continued use of the heritage item, therefore providing a positive impact on the continuation of the substation's heritage significance.
Are any known or potential archaeological deposits affected by the proposed new services?	There are no known or potential archaeological deposits affected by the proposed activity.

Has specialist advice from a heritage consultant, architect, archaeologist or services engineer been sought?	This assessment has been prepared by a qualified heritage specialist

7.0 Conclusions and recommendations

The installation of the new syncons and their associated infrastructure would comprise a permanent physical impact to a cleared portion of land within the 'Elcom Newcastle Substation' curtilage, however there would not be an impact to any significant elements of the heritage item. No subsurface deposits associated with past operations of the substation site are expected to occur in the proposed impact area. The installation of sympathetic electrical infrastructure, on a portion of the site historically used for stockpiling, is considered to have a positive long term visual impact on the heritage item.

The proposed activity is consistent with previous modifications to the substation, adapting to changing sources and levels of electric power. The proposed activity would enable the ongoing capability of the 'Elcom Newcastle Substation' with a less than minor impact to the heritage item's significant elements. The proposed activity would have a negligible impact on the overall significance of the 'Elcom Newcastle Substation'.

Due to these findings, the following recommendations have been made:

Recommendation 1

The proposed activity would have a less than minor impact to the heritage item's significant elements and a negligible impact on the overall significance of the 'Elcom Newcastle Substation'. No further heritage investigation, assessment or reporting is required.

Recommendation 2

Workers undertaking activity within the heritage curtilage of the 'Elcom Newcastle Substation' are to be made aware of its heritage significance and protection measures enacted to ensure there are no accidental physical impacts to its heritage significant elements during works (i.e., temporary demarcation of work areas through signage or boundary tape, toolbox presentation to ensure workers do not go beyond the bounds of defined work areas and reduce the risk of accidental impacts to the heritage item). See Section 1.4 (Item description) for the heritage item's significant elements. Details of these protection measures should be included within the project's Construction Environmental Management Plan (CEMP). The temporary impacts to the 'Elcom Newcastle Substation' would not be permanent and the location would be returned to the same condition following the completion of works.

Recommendation 3

In the event that an unexpected heritage item (as defined by the *Heritage Act 1977*) is identified during the proposed activity, the works must cease at the location and no further harm to the item shall occur. The find must be immediately reported to Transgrid, and the regulator in accordance with legislation. No work must recommence in the vicinity of the unexpected find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the proposed activity, works must stop immediately and the area be secured to prevent unauthorised access, with NSW Police, Heritage NSW and Transgrid to be contacted to determine next steps.

8.0 References

AECOM Australia Pty Ltd (AECOM) (2024) *Lewisham Station Upgrade: Noise and Vibration Assessment*.

Australia ICOMOS (2013) *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Burwood, Victoria, Australia: Australia ICOMOS. Available at: http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf.

Ford, G.E. (2010) *Darkinung Recognition: An Analysis of the Historiography for the Aborigines from the Hawkesbury-Hunter Ranges ti the Northwest of Sydney*. University of Sydney.

Heritage NSW (2008) *Elcom Newcastle Substation*, *State Heritage Inventory*. Available at: https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=1910110 (Accessed: 3 April 2025).

Heritage NSW (2023) 'Assessing heritage significance: Guidelines for assessing places and objects against the Heritage Council of NSW criteria'. Sydney NSW: State of NSW and Department of Planning and Environment (DPE).

Heritas Architecture (2010) *Lake Macquarie City Thematic History*.

NSW Department of Planning and Environment (2023) *Guidelines for Preparing a Statement of Heritage Impact*. Sydney NSW.

NSW Heritage Office (2006) *Photographic recording of heritage items using film or digital capture*. Parramatta: Heritage Office. Available at: http://www.heritage.nsw.gov.au/docs/info_photographicrecording2006.pdf.

NSW Heritage Office and NSW Department of Urban Affairs and Planning (1996) *NSW Heritage Manual*. Parramatta: Heritage Office & Department of Urban Affairs & Planning. Available at: http://www.heritage.nsw.gov.au/03_index.htm#M-O.

Suters Architects Snell (1993) 'City of Lake Macquarie heritage study'. Newcastle: Report prepared for Lake Macquarie City Council by Suters Architects Snell.

Transport for NSW (2022) *Unexpected Heritage Items Procedure*. Available at: https://roads-waterways.transport.nsw.gov.au/documents/about/environment/protecting-heritage/managing-development/unexpected-heritage-items-procedure.pdf.

Transport for NSW (2024) *Unexpected Heritage Items Procedure*.

Appendix F Noise and Vibration Impact Assessment

Prepared for
Transgrid
ABN: 70 250 995 390

AECOM

Newcastle 330 kV Substation - new synchronous condenser

Noise and Vibration Impact Assessment

14-Nov-2025
Newcastle Synchronous Condenser
Doc No. 60750224-RPNV-01_A_Newcastle

aecom.com

Solar Farm, Darling Point, Australia

Delivering a better world

Newcastle 330 kV Substation - new synchronous condenser

Noise and Vibration Impact Assessment

Client: Transgrid

ABN: 70 250 995 390

Prepared by

AECOM Australia Pty Ltd
Gadigal Country, Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

14-Nov-2025

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Newcastle 330 kV Substation - new synchronous condenser
Ref	60750224
Date	14-Nov-2025
Originator	Sarah Lu
Checker/s	Gayle Greer
Verifier/s	Geoff Lucas

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	3-June-2025	Draft for Transgrid review	Alice Thurgood	AT
1	29-July-2025	Draft 2 for Transgrid review	Alice Thurgood	AT
2	28-Aug-2025	Draft 3 for Transgrid review	Neil Standen Associate Director	NS
3	27-Oct-2025	Final draft for Transgrid review	Neil Standen Associate Director	NS
4	03-Nov-2025	Final	Neil Standen Associate Director	NS
5	14-Nov-2025	Updated final	Neil Standen Associate Director	

Table of Contents

Glossary of terms and abbreviations

Term	Definition
Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Decibel [dB]	The measurement unit of sound.
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB(A) increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB(A) increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: 0 dB(A) Threshold of human hearing 30 dB(A) A quiet country park 40 dB(A) Whisper in a library 50 dB(A) Open office space 70 dB(A) Inside a car on a freeway 80 dB(A) Outboard motor 90 dB(A) Heavy truck pass-by 100 dB(A) Jack hammer / subway train 110 dB(A) Rock concert 115 dB(A) Limit of sound permitted in industry 120 dB(A) 747 take off at 250 metres.
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.

Term	Definition
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	Construction noise: The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays. Road traffic noise: The period from 0700 to 2200 h every day of the week.
Evening	Construction noise: The period from 1800 to 2200 h Monday to Sunday and Public Holidays. Road traffic noise: Not applicable.
Night	Construction noise: The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays. Road traffic noise: The period from 2200 to 0700 h every day of the week.
Noise reduction coefficient (NRC)	NRC values are calculated from the average sound absorption coefficients measured at four frequencies: 250, 500, 1,000 and 2,000 Hz.
Insertion loss	Difference in noise level at the receiver location before and after the installation of the noise-control treatment (eg barrier or enclosure).
Standard construction hours	Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays and public holidays
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.
Noise management level [NML]	The level which represents the point above which there may be some community reaction to noise.

1.0 Introduction

Transgrid is proposing to install and operate two synchronous condensers (syncons) at the existing Newcastle 330 kV substation site (the proposed activity). The proposed activity is part of Transgrid's broader initiative to ensure sufficient system strength services are available to maintain the stability of the New South Wales (NSW) power system and meet system strength requirements established by the Australian Energy Market Operator (AEMO) in their *2022 System Strength Report* (AEMO, 2022). The retirement of NSW's coal generators and the growth in inverter-based resources in the coming decade is driving an urgent need to add new sources of system strength to the power system.

AECOM Australia Pty Ltd (AECOM) has been commissioned by Transgrid to prepare a Summary Environmental Report (SER) to assess potential impacts from the proposed activity at the existing Newcastle 330 kV substation. This noise and vibration impact assessment considers the potential noise and vibration impacts of the proposed activity on nearby receivers and will be used to support the SER. This report considers the construction, commissioning and operation of the proposed activity, and includes recommendations for managing potential noise and vibration impacts.

1.1 Proposed activity description

The proposed activity involves the installation and operation of two syncons and associated infrastructure at the existing Newcastle 330 kV substation.

The scope of works would include:

- Site establishment activities, including installation of construction offices and amenities, equipment storage and construction laydown areas and vegetation removal
- Construction of a new internal access road and upgrades to Killingworth Road
- Installation of a new bench (concrete slab, foundations and associated earthworks), with an indicative maximum footprint of around 130 by 150 metres (m), immediately south of the existing Newcastle 330 kV substation to house the syncons and associated infrastructure
- 330 kV busbar extension with a new switch bay, which comprises a 330 kV circuit breaker, disconnector, current transformer, capacitive voltage transformer, earth switch, post insulators/busbar supports, and surge arrester
- Installation of the two new syncons and associated equipment, including:
    - Power transformer with firewalls
    - Auxiliary transformers
    - Syncon building and gantry crane
    - Oil lubrication and water-cooling systems
    - Control room and battery room
    - Low voltage AC and DC systems
    - Protection and control systems
    - Backup diesel generator
    - Pony motor
- Installation of a new demountable secondary systems building
- Installation of new spill oil tank, secondary containment dam(s), and drainage systems to cater for the new transformers, diesel generator and the syncon oil lubrication system
- Extension of the substation's stormwater drainage system, to cater for the new bench area
- Installation of new lighting protection masts

- Rehabilitation of the site including:
  - Removal of temporary construction facilities and equipment
  - Excavated material not reused on-site and waste materials would be disposed of at an appropriately licensed waste facility or as directed by Transgrid's environmental business partner in accordance with Transgrid's Waste Management of Spoil Work Instruction
  - Disturbed areas not required for the operation of the syncons or the existing Newcastle 330 kV substation will be rehabilitated to as close to pre-construction conditionsas possible.

Further details of the scope of works for the proposed activity are presented in Section 2 of the SER (AECOM, 2025).

1.2 Site description

The Newcastle 330 kV substation is located within the Lake Macquarie local government area (LGA) with the nearest major township being Killingworth, situated around 400 m to the south. The substation is within Lots 1 and 2 of DP619513, which is owned by the Electricity Transmission Ministerial Holding Corporation (ETMHC) and leased and managed by Transgrid (the substation site). The Newcastle 330 kV substation is located within the proposed impact area shown in Figure 1-1.

The substation site is located on land zoned as Infrastructure SP2. Adjoining land zones include C2 Environmental Conservation to the east and south, and RU6 Transition to the north and west. Land zoned as R2 Low Density Residential is located around 100 m south of the substation site. The substation site is located in a vegetated rural area surrounded by cleared transmission line easements, with Burkes Creek traversing the southern corner of the substation site. The nearest residential area is approximately 275 m south of the substation site.

The proposed impact area is the maximum footprint in which the construction and operation of the syncons would be carried out, as defined in Section 2 of the SER. The study area for the noise and vibration impact assessment is defined as the proposed impact area (refer to Figure 1-1) with a 2,000 m buffer applied.

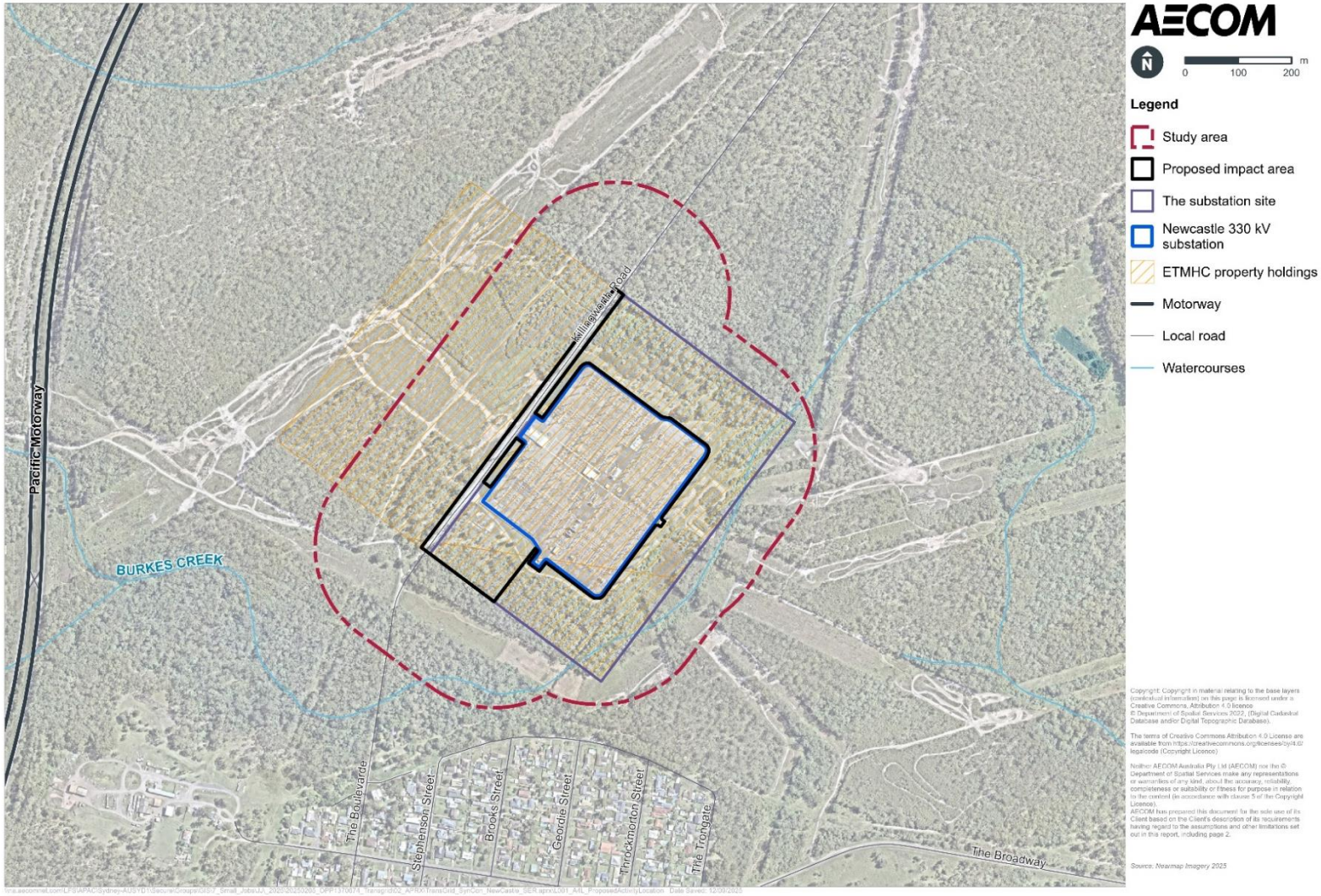


Figure 1-1 Proposed impact area and location

1.3 Purpose of this report

1.3.1 Assessment objectives

The objectives of this noise and vibration impact assessment are to:

- Identify nearby noise-sensitive receivers potentially impacted by the construction and operation of the proposed activity
- Conduct site work (including noise monitoring) to determine the relevant construction noise management levels and operational noise criteria for identified sensitive receivers
- Identify potential noise and vibration impacts from the construction and operation of the proposed activity
- Outline mitigation measures, if required, relating to noise and vibration during construction and operational phases of the proposed activity.

1.3.2 Report structure

This report is structured as follows:

- Section 1.0 introduces the proposed activity and the purpose of this noise and vibration impact assessment
- Section 2.0 provides a summary of the existing acoustic environment
- Section 3.0 presents the relevant construction management levels and vibration objectives
- Section 4.0 presents the operational noise criteria
- Section 5.0 details the assessment for construction noise impacts
- Section 6.0 details the assessment for operational noise impacts
- Section 7.0 describes the management measures identified to mitigate potential proposed activity impacts.

1.4 Relevant guidelines

This assessment has been undertaken in accordance with the following guidelines.

Construction

- *Interim Construction Noise Guideline,* Department of Environment and Climate Change, NSW (DECC 2009)
- *Assessing Vibration: a technical guideline,* Department of Environment and Conservation (DEC 2006)
- *Construction Noise and Vibration Guideline (Public Transport Infrastructure)*, Transport for NSW (TfNSW 2023)
- *NSW Road Noise Policy,* Department of Environment, Climate Change and Water NSW (DECCW 2011).

Operation

- *NSW Protection of the Environment Operations Act 1997* (POEO Act 1997)
- *NSW Noise Policy for Industry*, NSW Environment Protection Authority (EPA 2017)
- *NSW Road Noise Policy,* Department of Environment, Climate Change and Water NSW (DECCW, 2011).

2.0 Existing acoustic environment

2.1 Assessment receivers

The existing acoustic environment is largely defined by distant road traffic noise from the M1 Pacific Motorway located about 800 m west of the proposed activity and local road traffic noise on Killingworth Road.

Figure 1-1 shows nearby noise sensitive receivers which could potentially be affected by the proposed activity and have been assessed within this report. The closest residential receivers are located approximately 275 m to the south of the site. There are no non-residential noise sensitive receivers within 1.5 kilometres of the proposed activity.

The assessment receivers identified for construction and operational modelling consist of residential dwellings representative of receivers at a variety of distances away. The assessment receiver locations, along with the land use classification of each receiver (as defined in the *Noise Policy for Industry*), are presented in Table 2-1 and shown in Figure 2-1.

Compliance with the relevant criteria at the nearest receivers outlined in Table 2-1 means compliance at other residential and non-residential receivers located further away.

Table 2-1 Construction and operational assessment receiver locations

Assessment receiver	Address	Land use classification
R1	1 The Boulevarde, Killingworth	Residential
R2	10 Westcroft Street, Killingworth	Residential
R3	43 Killingworth Road, Killingworth	Residential
R4	37 Killingworth Road, Killingworth	Residential
R5	29 Killingworth Road, Killingworth	Residential
R6	23 Killingworth Road, Killingworth	Residential
R7	9 Brooks Street, Killingworth	Residential
R8	19 Killingworth Road, Killingworth	Residential
R9	1 Geordie Street, Killingworth	Residential
R10	11 Killingworth Road, Killingworth	Residential
R11	1 Throckmorton Street, Killingworth	Residential
R12	3 Brooks Street, Killingworth	Residential
R13	39 The Broadway, Killingworth	Residential
R14	59 Charlton Street, Barnsley	Residential
R15	9 Taylor Avenue, Barnsley	Residential
R16	1 King Street, Holmesville	Residential
R17	2 King Street, Holmesville	Residential
R18	40 William Street, Holmesville	Residential

Figure 2-1 Assessment receiver locations

2.2 Noise measurement methodology

Long term unattended and short term attended measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1-2004 *Electroacoustics - Sound level meters - Specifications* and were within their current National Association of Testing Authorities, Australia certified in-calibration period (i.e. calibration in the last two years).

2.2.1 Unattended noise measurement methodology

Unattended noise measurements were conducted with a Rion NL-52 noise logger in the front yard of 21 The Broadway, Killingworth from 26 February to 14 March 2025. Figure 2-2 shows the unattended noise logging location.

In accordance with the EPA's NSW *Noise Policy for Industry*, noise data over the monitoring period affected by adverse weather conditions or extraneous noise events were excluded from the monitoring data. The *Noise Policy for Industry* advises that data may be affected where adverse weather, such as wind speeds higher than 5 m/s or rain, occurs. Weather data was acquired from the Bureau of Meteorology's Lake Macquarie Cooranbong weather station (station number 95767).

The logger measured the noise levels over the sample period and determined L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels of the noise environment. The $L_{A1,}$ L_{A10} and L_{A90} noise levels are the levels exceeded for 1%, 10% and 90% of the measurement period respectively. The L_{A90} is taken as the background level. The L_{A1} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The L_{A90} noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the *Noise Policy for Industry*. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

Figure 2-2 Noise monitoring location

2.2.2 Attended noise measurement methodology

Attended noise measurements were conducted at the unattended monitoring location and near the existing substation on 101 Killingworth Road on 26 February 2025 during the daytime period. Each measurement was conducted over a 15-minute period. Weather conditions were clear on the day of monitoring.

Attended noise measurements were conducted using Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Class 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated before and after the measurements with no drift in calibration exceeding ±0.5 dB.

2.3 Noise measurement results

2.3.1 Unattended noise measurement results

Table 2-2 presents the existing overall representative L_{Aeq} ambient noise level and the background L_{A90} noise levels for the day, evening and night-time periods, in accordance with the *Noise Policy for Industry.* The overall representative L_{Aeq} noise levels were determined by logarithmically averaging each assessment period for the entire monitoring period.

Some periods of noise logging were excluded due to adverse weather. The data was processed in accordance with Fact Sheet B of the *Noise Policy for Industry*.

The results for each day and the graphical noise logging results are presented in Appendix A.

Table 2-2 Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels

Noise logger ID	Location	L_{A90} background rating noise level, dB(A)[1]			Log average noise (ambient) L_{Aeq} levels dB(A)		
		Day	Evening	Night	Day	Evening	Night
NL1	21 The Broadway, Killingworth	37	37[2] (38)	35	59	63	55

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.*
2. *Application notes to the Noise Policy for Industry indicate that the community generally expects a greater control of noise during the evening and night when compared to the daytime. Therefore, the rating background level for the evening is set to no more than that for the daytime. The measured rating background level is provided in brackets.*

2.3.2 Attended noise measurements

The results of the attended noise monitoring are presented in Table 2-3. The daytime measurements indicated that residential receivers are generally affected by local traffic noise.

Table 2-3 Attended noise measurements

Location	Date and time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
Southwest boundary of Newcastle Substation	26/02/2025 10:38am	57	50	Constant bird noise. Helicopter flyover. Distant construction vehicle noise on Killingworth Road. Slight low hum audible from substation.
21 The Broadway, Killingworth	26/02/2025 11:45am	54	40	Bird noise. Dog barking, 48 dB(A). Rooster crow, 45-49 dB(A). Car passby on The Broadway, 58-64 dB(A). Bus passby on The Broadway, 63 dB(A). Aircraft flyover, 55 dB(A). Light humming noise from powerlines audible intermittently.

2.4 Noise catchment areas

Noise catchment areas (NCAs) are used to group residential receivers within a similar noise environment and define appropriate construction noise management levels (NMLs). Generally, NCAs are defined based on the unattended noise monitoring locations. Unattended noise monitoring for the proposed activity was conducted at one location in Killingworth, and this logging location is considered to be representative of the noise environment in the Barnsley and Holmesville residential areas considered within NCA 1.

Table 2-4 Noise catchment areas

NCA	Description of NCA	L_{A90} background rating noise levels used
1	Residential receivers at Killingworth, Barnsley and Holmesville	Measured L_{A90} noise levels for NL1

Refer to Figure 2-3 below for the proposed activity NCA.

Figure 2-3 Noise catchment area

3.0 Construction noise criteria

3.1 Construction noise

The *Interim Construction Noise Guideline* is a NSW Government document that sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It presents assessment approaches tailored to the scale of construction projects and identifies practices to minimise noise impacts. As the proposed works are expected to continue for a period of more than three weeks, a quantitative assessment, based on worst-case construction scenarios, has been carried out for construction works.

Noise levels resulting from construction activities that are predicted at noise sensitive receivers (e.g. residences, schools, hospitals, places of worship, and active recreation areas) are compared to the NMLs determined in accordance with the *Interim Construction Noise Guideline*. Where an exceedance of the NMLs is predicted, the *Interim Construction Noise Guideline* advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details should they wish to make a complaint.

If construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

The *Interim Construction Noise Guideline* defines what is feasible and reasonable as follows:

- Feasible – a work practice or abatement measure is feasible if it is capable of being put into practice and is practical to build given project constraints such as safety and maintenance requirements
- Reasonable – selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic, and environmental effects, including the cost of the measure.

The construction NMLs for residential land uses are detailed in Section 3.1.1. These NMLs will be used to guide the management of construction noise throughout construction.

3.1.1 Residential receivers

Guidance for setting construction NMLs for residential receivers is summarised in Table 3-1.

Table 3-1 *Interim Construction Noise Guideline* residential NMLs

Time of day	NML, $L_{Aeq,15min}$, dB(A)[1]	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	'Noise affected' level RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: • Where the predicted or measured $L_{Aeq,15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level • The proponent should also inform all potentially impacted residents of the nature of work, the expected noise levels and duration, as well as contact details.
	'Highly noise Affected' level 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise: • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences) 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	'Noise affected' level RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practices have been applied and noise is still more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community • The *Interim Construction Noise Guideline* provides guidance on negotiating agreements.

Notes:

1. *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicted noise levels is at the most noise-affected point within 30 metres of the residence.*

Table 3-2 presents the NMLs applicable to residential receivers nearby to the proposed activity.

Table 3-2 Construction NMLs - Residential receivers

Noise catchment area	Construction NML $L_{Aeq,15min}$, dB(A)			
	Standard hours (RBL + 10)	Outside standard hours (RBL + 5)		Highly noise affected level
	Day	Evening	Night	
NCA 1	47	42	40	75

The *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* sets out community perceptions of construction noise dependent upon the level of exceedance of the RBLs and NMLs. These are presented in Table 3-3.

Table 3-3 Community perception of construction noise

Perception	dB(A) above RBL	dB(A) above NML – Standard hours	dB(A) above NML – Out of hours
Noticeable	5 – 10	0	0 - 5
Clearly audible	10 – 20	0 - 10	6 – 15
Moderately intrusive	21 – 30	11 – 20	16 – 25
Highly intrusive	> 30	> 20	> 25

3.1.2 Construction road traffic

Noise from construction traffic on public roads is not covered by the *Interim Construction Noise Guideline*. However, the *Interim Construction Noise Guideline* does refer to the *Road Noise Policy* for the assessment of noise arising from traffic on public roads.

In accordance with the *Road Noise Policy*, to assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criteria, then noise mitigation should be considered for those receivers affected. The road category specific criteria are presented in Table 3-4 below. The *Road Noise Policy* does not require assessment of construction road traffic noise impacts to commercial or industrial receivers.

Table 3-4 Road traffic noise assessment criteria

Road category	Type of land use	Assessment criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 dB(A)	$L_{Aeq,9hr}$ 55 dB(A)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 dB(A)	$L_{Aeq,1hr}$ 50 dB(A)

4.0 Operational noise criteria

4.1 Environment Protection Authority – NSW Noise Policy for Industry

Industrial noise has the potential to affect nearby noise sensitive receivers. The *Noise Policy for Industry* sets out a procedure to determine project noise trigger levels relevant to a development. If it is predicted that the development is likely to result in noise levels which exceed the project noise trigger levels at existing noise sensitive receivers, then mitigation measures need to be considered to reduce the predicted noise level.

The assessment procedure for industrial noise sources has two components that must be satisfied:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for residences and other land uses.

Both components are assessed at the most affected point on or within the property boundary of the noise sensitive receiver site. These criteria apply to environmental noise emissions from any plant installed as part of the proposed activity, and for residential receivers, represent the lower of the intrusive or amenity criteria.

4.1.1 Intrusive noise impacts

The *Noise Policy for Industry* states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15-minute period, does not exceed the background noise level measured by more than 5 dB. The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the *Noise Policy for Industry*.

The intrusive noise criteria are shown in Table 4-1 (based on unattended noise measurements conducted at the NL1 location)

Table 4-1 Recommended $L_{Aeq,15min}$ intrusive noise criteria levels from industrial noise sources

Time of day[1]	RBL, $L_{A90,15min}$, dB(A)	Intrusive criterion RBL + 5, $L_{Aeq,15min}$, dB(A)
Day	37	42
Evening	37	42
Night	35	40

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*

4.1.2 Protecting noise amenity

To limit continuing increases in noise levels from the application of the intrusiveness level alone, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the recommended amenity noise levels specified in Table 2.2 of the *Noise Policy for Industry*.

The relevant amenity criteria are shown in Table 4-2.

Table 4-2 Recommended L_{Aeq} amenity noise levels from industrial noise sources

Type of Receiver	Time of Day	Recommended $L_{Aeq,period}$ Noise Level dB(A)
Residence - Suburban	Day	55
	Evening	45
	Night	40

As per the *Noise Policy for Industry*, the project amenity level for residential receivers is converted to a 15-minute period by adding 3 dB(A).

4.1.3 Proposed activity specific noise criteria

A summary of the residential noise criteria for the operation of the proposed activity is presented in Table 4-3.

Table 4-3 Proposed activity specific noise levels

Receiver	Period[1]	Intrusive criterion, $L_{Aeq,15min}$, dB(A)	Amenity criterion, $L_{Aeq,15min}$, dB(A)	Project specific noise criteria, $L_{Aeq,15min}$, dB(A)[2]
Residential	Day	42	58	42
	Evening	42	48	42
	Night	40	43	40

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.*
2. *Project specific noise levels determined as the lowest of the intrusive and amenity criteria.*

4.1.4 Applying the *Noise Policy for Industry* to existing sites

Section 6.1 of the *Noise Policy for Industry* acknowledges that many existing industrial sites were designed for higher noise emission levels than the proposed activity noise trigger levels noted in Table 4-3. Industrial sites may have existed before any noise-sensitive developments occurred in the area, or may have been designed before noise control legislation was introduced.

The *Noise Policy for Industry* notes there is no 'one-size-fits-all' approach to determine noise impacts from existing industry. However, it notes that the following governing principles should be applied when determining the project noise trigger levels and/or assessment requirements for existing industry:

> *"The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.*
>
> *Where an existing industry has been in operation for more than 10 years and existing site operations exceed the project amenity noise level, the project amenity noise level may be adopted as the project noise trigger level to assess existing, and existing plus proposed site operations, as relevant.*
>
> *Where a development proposal involves a discrete process, and premises-wide mitigation has or is to be considered outside of the development proposal, a project noise trigger level for noise from new/modified components (not the whole site) of the operation may be set at 10 dB(A) or more below existing site noise levels or requirements. This approach means that the increase in noise from the whole site is minimised and provides scope for existing components to achieve noise reductions over time"*

4.1.5 Tonality and *Noise Policy for Industry* modifying factors

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level.

Fact Sheet C in the *Noise Policy for Industry* sets out corrections for annoying characteristics. The corrections are to be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location
- The nature of the noise sources and its characteristics.

Table 4-4 presents the annoying characteristic corrections potentially applicable to the proposed activity.

Table 4-4 Modifying factor corrections (*Noise Policy for Industry* Factsheet C, Table C1)

Factor	Assessment/ measurements	When to apply	Correction[1]	Comments
Tonal	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: • 5 dB or more if the centre frequency of the band containing the tone is in the range 500-10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160-400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25-125 Hz	5 dB[2,3]	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low - frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10-160 Hz	Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB(A) positive adjustment applies for the daytime period.	2 or 5 dB[2]	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for the UK Department for Environment, Food & Rural Affairs (DEFRA) fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Notes:

1. *Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.*
2. *Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.*
3. *Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.*

Table 4-5 presents the low frequency noise thresholds from the *Noise Policy for Industry*.

Table 4-5 One-third octave low-frequency noise thresholds (*Noise Policy for Industry* Factsheet C Table C2)

Hz/dB(Z)	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

4.1.6 Maximum noise level assessment

The *Noise Policy for Industry* requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is the greater, and/or
- $L_{AF,max}$ 52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is the greater.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria required for compliance for the nearest noise sensitive residential receivers are presented in Table 4-6.

Table 4-6 Night-time sleep disturbance screening levels

Location	Measured night-time RBL, $L_{A90,15min}$ dB(A)	Sleep disturbance screening levels for compliance, dB(A)	
		$L_{Aeq,15min}$	$L_{AF,max}$
Residential receivers	35	40	52

The proposed activity is proposed to operate during all periods of the day. Noise from the syncons and other equipment on-site is predicted to be steady-state and non-impulsive and therefore $L_{AF,max}$ noise levels are likely to be very similar to the $L_{Aeq,15min}$ noise levels. Given this, compliance to the EPA's project noise trigger levels will imply compliance to sleep disturbance criteria for these steady-state noise sources.

4.2 Operational road traffic noise criteria

To assess noise impacts from increases in operational traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels will increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected. The *Road Noise Policy* does not require assessment of noise impact to commercial or industrial receivers.

4.3 Operational vibration

Operational vibration is not expected to be an issue as a result of the proposed activity as the operational activities would not involve vibration-generating activities that would create significant vibration levels at nearby sensitive receivers. Therefore, an assessment of the operational vibration impacts is not required.

5.0 Construction noise assessment

5.1 Construction noise modelling scenarios

Table 5-1 provides a summary of the scenarios associated with the construction of the proposed activity, including indicative construction plant/equipment for each scenario and their associated sound power levels. The three noisiest construction scenarios which have been assessed are as follows:

- Scenario 1 – Site establishment
- Scenario 2A – Access road construction
- Scenario 2B – Syncon bench installation.

All three scenarios were assessed as standard hours construction work. All major construction work is expected to be completed during standard hours only.

Table 5-1 Construction assessment scenarios

Scenario ID	Scenario	Construction activity	Equipment	SWL per unit, dB(A)
1	Site establishment	Site area establishment	Backhoe	96
			Excavator	98
			Grader	114
			Chainsaw	115
			Mulcher	116[1]
			Dump truck	108
			Compactor	106
			Truck	108
2A	Main construction works	Access road construction	Pavement laying machine	105
			Dump truck	108
			Asphalt truck and sprayer	105
			Concrete truck	106
			Roller	105
			Concrete saw	115[1,2]
			Truck	108
2B		Syncon bench installation	Concrete truck	106
			Concrete pump	106
			Bored piling rig	111[1]
			Mobile crane	103
			Truck	108
2C		Syncon building construction	Concrete truck	106
			Concrete pump	106
			Agitator	109
			Mobile crane	103
			Truck	108

Scenario ID	Scenario	Construction activity	Equipment	SWL per unit, dB(A)
2D		Miscellaneous civils works including drainage, cable trenches and conduits, and fencing	Backhoe	96
			Front end loader	104
			Excavator	98
			Truck	108
2E		Syncon and associated equipment installation	Mobile crane	103
			Elevated work platform	87
			Handtools	98
			Truck	108
3	Testing and commissioning	Syncon and associated equipment testing and commissioning	Hand tools	98
			Truck	108
			Light vehicles	90
4	Rehabilitation	Demobilisation and rehabilitation of disturbed areas	Excavator	98
			Backhoe	96
			Bobcat	104
			Mobile crane	103
			Truck	108

Notes:

1. *For modelling purposes, the SWL of the loudest piece of equipment in each scenario will represent the overall SWL of the scenario/activity.*
2. *Equipment with special audible characteristics, likely to cause annoyance due to tonality, low frequency noise, impulsive or intermittent noise events. Penalty of +5 dB included in the sound power level.*

5.2 Noise modelling methodology

Noise levels due to the construction activities shown in Section 5.1 have been predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software. The noise model was created to represent ‘reasonable’ worst-case periods of construction works. The following features were included in the noise model:

- Ground topography
- Ground absorption and reflection
- Receivers
- Construction noise sources.

It is noted that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant/equipment in operation during the measurement and also the location of the plant/equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction plant/equipment moves around the site.

5.2.1 Construction modelling assumptions

The following assumptions have been made in modelling all construction noise scenarios:

- For each construction scenario, the overall SWL of the scenario is represented by the SWL of the loudest piece of equipment proposed
- Plant/equipment is assumed to be operating at the proposed activity boundary at the closest point to each receiver, in order to present the worst-case scenario for each receiver. In reality, the plant/equipment would only be at the closest point to each receiver for limited periods

- Neutral atmospheric conditions, i.e. relatively calm, no wind.

5.3 Predicted construction noise levels

The identified residential receivers have been assessed against the standard hours NML. The level of impact may change depending on the final construction methodology and further assessment would be undertaken if required.

Construction noise contours calculated at 1.5 m above ground level are presented in Appendix B.

Table 5-2 presents the construction noise modelling results for the assessed residential receivers. Receivers where the construction NML is likely to be exceeded during standard hours are formatted in bold text.

Table 5-2 Predicted construction noise levels – standard hours

Receiver	Distance from proposed activity area (metres)	Standard hours noise management level, dB(A)	High affected level, dB(A)	Construction scenario dB(A)		
				Site establishment	Access road construction	Syncon bench installation
R1	305	47	75	**51**	**48**	47
R2	690	47	75	43	41	39
R3	496	47	75	46	44	42
R4	414	47	75	**48**	46	44
R5	303	47	75	**51**	**48**	46
R6	278	47	75	**52**	**49**	47
R7	373	47	75	**51**	**49**	47
R8	291	47	75	**52**	**51**	47
R9	295	47	75	**50**	**48**	45
R10	312	47	75	**49**	47	44
R11	352	47	75	**48**	46	43
R12	314	47	75	**51**	**48**	45
R13	538	47	75	**48**	46	43
R14	1,006	47	75	39	38	34
R15	1,967	47	75	33	32	28
R16	1,569	47	75	34	33	29
R17	1,579	47	75	34	33	29
R18	1,498	47	75	34	33	29

The results show that construction noise levels are predicted to exceed the NML during standard hours for 11 assessment residential receivers (R1 and R4 – R13) during site establishment, and for seven assessment residential receivers (R1, R5-R9 and R12) during access road construction. The exceedances range from 1 to 5 dB(A). The receivers predicted to experience NML exceedances are all located in Killingworth. There are no residential receivers predicted to experience NML exceedances during the syncon bench installation scenario. There are also no residential receivers predicted to be 'highly affected' for the three construction scenarios assessed.

5.4 Construction traffic assessment

The predicted construction traffic volumes required for the proposed activity during the peak construction period along The Broadway and Killingworth Road include the following:

- Maximum of 110 light vehicle movements per day (55 vehicles entering and leaving the site)
- Maximum of 140 heavy vehicle movements per day (70 vehicles entering and leaving the site) or maximum of 60 oversize and/or overmass (OSOM) vehicle movements per day (30 vehicles entering and leaving the site).

OSOM vehicles (vehicles exceeding the standard width, height or length limits and/or exceeding the legal weight limits) are used to transport large machinery or equipment. Noise from OSOM vehicles is assumed to be just louder than two heavy vehicles. On the days when there are OSOM vehicle movements the number of heavy vehicle movements will be reduced. Whilst traffic counts for The Broadway and Killingworth Road are not available these roads are the main access roads into Killingworth and therefore it is likely that the additional construction traffic numbers detailed above would not lead to an increase of more than 2 dB(A).

5.5 Construction vibration assessment

From the indicative construction equipment listed in Table 5-1, there is no vibration-intensive equipment proposed to be used for any construction scenario. In addition, the nearest sensitive receiver is located approximately 275 m from the proposed activity. Therefore, a construction vibration assessment is not deemed necessary and has not been considered further in this report.

6.0 Operational noise assessment

The operational noise sources that have the potential to affect nearby residential receivers include the syncons, syncon cooling systems, transformers and a diesel generator.

6.1 Modelling methodology

6.1.1 General modelling assumptions

Noise levels due to operation of the proposed activity were predicted for nearby noise sensitive receivers using SoundPLAN version 8.2 (industry standard) noise modelling software. The operational noise levels were predicted using an implementation of the CONCAWE propagation algorithm under both neutral and noise-enhancing meteorological conditions.

6.1.2 Modelling conditions

The noise modelling includes:

- Neutral and noise-enhancing meteorological conditions
- Ground topography
- Buildings and structures
- Operational equipment behaving as point sources
- Ground absorption.

The noise model considers significant noise sources and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions.

All predicted noise levels are at the reasonably most-affected point on or with the residential boundary, 1.5 m above ground level.

6.2 Modelled operational scenarios

The location, quantity, and specification of equipment is subject to change during the detailed design stage. This operational noise assessment should be treated as a proof of concept for the overall noise levels generated by the proposed activity, and the type of equipment to be installed.

6.2.1 Existing operational scenario

An audible low humming noise was observed from the existing substation during attended measurements conducted at the southwest boundary of the substation. At the noise logging location, no audible noise from the Newcastle substation was observed. Local construction and road traffic noise made it difficult to accurately determine the noise contribution from the substation. Hence, previously tested sound power levels of the existing substation transformers and capacitors were used in modelling the existing substation noise.

Existing operational equipment data was extracted from the *Transgrid Newcastle 330kV substation – Noise Impact Assessment* report prepared by Sinclair Knight Merz, and dated 23 November 2011. The existing equipment SWLs are presented in Table 6-1 below.

Table 6-1 Existing plant items sound power levels

Plant item/operation	Sound power level, L_{Aeq}, dB(A)
Existing Transformer 1 (3 phase)	87
Existing Transformers 2 and 3 (3 phase)	96
Existing capacitor bank 1	82
Existing capacitor bank 2	91
Existing capacitor bank 3	88
Existing capacitor bank 4	90

6.2.2 Future operational scenarios

To assess a reasonable worst-case operational scenario, modelling assumes that all of the proposed equipment within the site would operate at full capacity, 24 hours per day, seven days per week. This is a conservative assumption as time periods where equipment would generate the highest noise levels are not known and therefore this methodology ensures that operational noise impacts are not underpredicted.

Compliance with the night-time project noise trigger level would demonstrate compliance for all residential receivers during the evening.

The operational equipment is generally categorised as steady-state or quasi steady-state noise sources which typically produce continuous and consistent noise levels.

It is expected that the operational equipment would be required for the proposed activity in the following numbers:

- 2 x syncon units
- 2 x syncon cooling systems
- 1 x power transformer
- 2 x auxiliary transformers
- 1 x diesel generator.

The diesel generator has been assumed to only operate during an emergency situation, and would be tested once a month for up to one hour in duration during the daytime only. According to the *Noise Policy for Industry*, a single-event continuous noise for a period of 15 minutes to one hour is given an allowable exceedance of 5 dB(A) of the project noise trigger level during the daytime period.

The sound power levels for the operational equipment were provided by Transgrid and have been used to model the noise emission from the site. The indicative location of proposed equipment is shown in Figure 6-1. The syncon units and some cooling plant will be located within a building, as shown in Figure 6-1. The required acoustic treatments of the building have been determined through an iterative design process. The iterative design process comprised modelling the future operational scenarios assuming various building construction and acoustic treatments to determine when compliance at receivers was achieved. Only the predicted noise levels with the final minimum acoustic insertion loss and acoustic treatments adopted for the project have been presented in Section 6.4 (noise assessment with mitigation measures). A noise wall is also proposed around the outdoor cooling system to mitigate acoustic impacts.

The required acoustic treatments to ensure compliance at the receivers are detailed in Section 7.2.

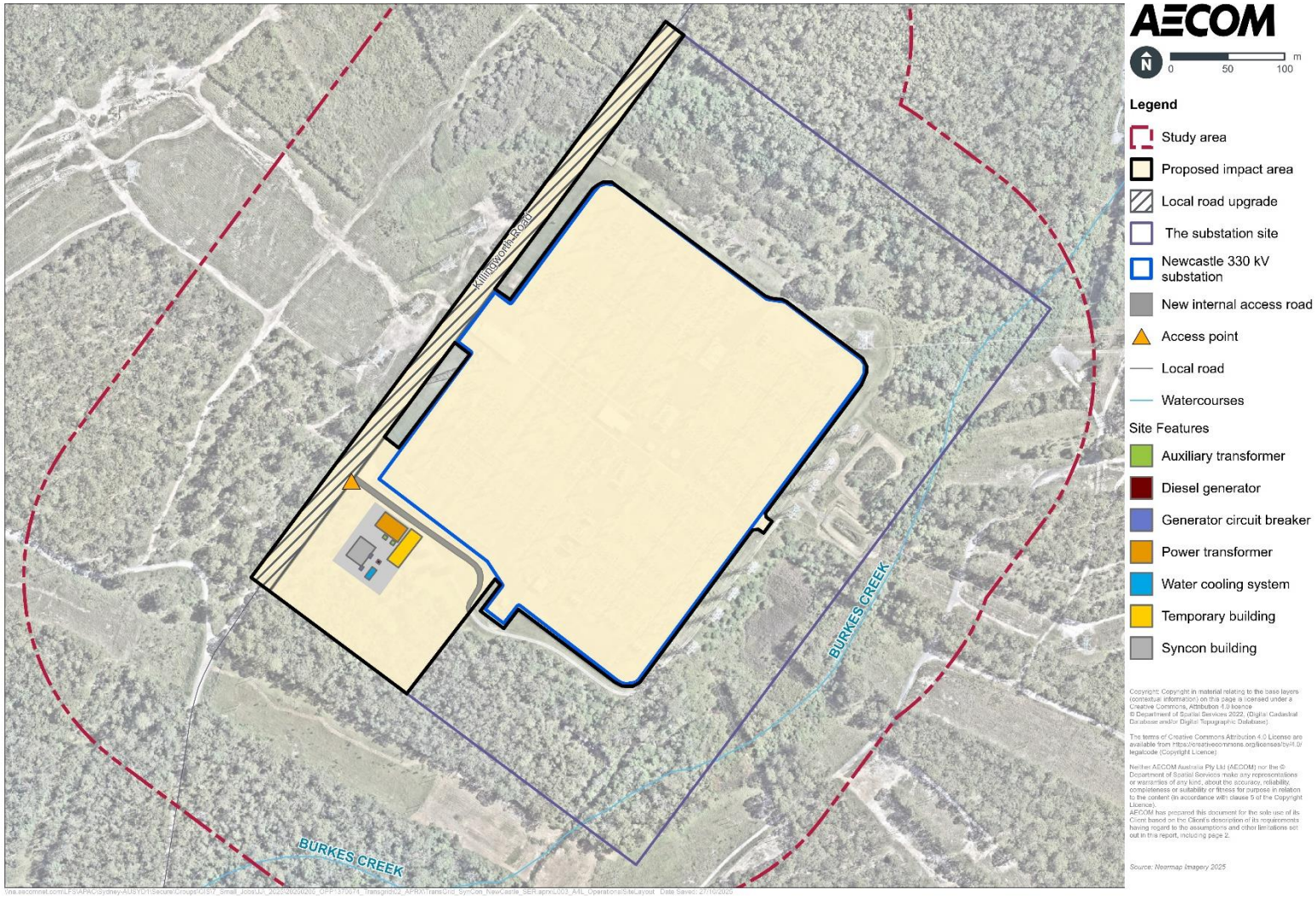


Figure 6-1 Indicative operational site layout

The sound power level inputs presented in Table 6-2 used in the noise modelling were assumed to be operating continuously for an entire 15-minute assessment period.

Table 6-2 Plant items sound power levels

Plant item/operation	Number of items	Sound power level, L_{Aeq}, dB(A)
Syncon & pony motor – inside building	2	115
Syncon cooling plant – inside building	2	95
Syncon cooling plant – outside building	2	100
Power transformer	1	92
Auxiliary transformer	2	75
Diesel generator	1	107

6.2.3 Maximum noise levels

In AECOM's experience, L_{Amax} sound power levels of electrical equipment are typically not greater than 5 dB(A) above L_{Aeq} sound power levels. Given that the sleep disturbance criterion is 10 dB(A) less stringent than the project noise trigger level, compliance with the project noise trigger level would result in compliance with the sleep disturbance criteria. Therefore, no further consideration has been given to the sleep disturbance assessment.

6.3 Existing operational noise levels

Section 6.1 of the *Noise Policy for Industry* details the approach for applying the policy to existing industrial premises. Existing operational noise levels were predicted at nearby sensitive receivers and at the attended measurement location at the southwest boundary of the substation using the methodology outlined in Section 6.1, and the inputs from Section 6.2.1 under noise-enhancing conditions.

Table 6-3 Comparison of measured and modelled existing substation noise levels

Location	Measured L_{A90} level, dB(A)[1]	Modelled L_{Aeq} level, dB(A)
Attended measurement location on substation southwest boundary	49.6	49.8

Notes:

1. *The measured L_{A90} level best represents the existing steady state noise from the substation, as it excludes erroneous noise sources such as birdsong and construction*

It is noted that whilst a low frequency hum was heard at the measurement location the attended measurement was not found to be 'tonal' as defined in the *Noise Policy for Industry*. Comparison of the modelled and measured levels presented in Table 6-3 indicate that the SoundPLAN model is predicting accurately.

The modelled noise levels for the existing scenario have been assessed against the project amenity noise levels shown in Section 4.1.2 in accordance with Section 4.1.3 to determine the suitability of using the project noise trigger levels for future compliance.

The one third octave noise levels at the worst affected residential receiver were assessed against the modifying factor criteria in Table 4-4 and were not found to contain significant tonal components or low frequency components.

Table 6-4 Existing operational noise levels

Receiver	Project amenity noise levels, $L_{Aeq,15min}$, dB(A)	Predicted noise levels, dB(A)	Exceedance, dB(A)	Compliance
R1	58	33	-	Yes
R2	58	27	-	Yes
R3	58	27	-	Yes
R4	58	29	-	Yes
R5	58	37	-	Yes
R6	58	38	-	Yes
R7	58	34	-	Yes
R8	58	39	-	Yes
R9	58	39	-	Yes
R10	58	38	-	Yes
R11	58	37	-	Yes
R12	58	31	-	Yes
R13	58	31	-	Yes
R14	58	27	-	Yes
R15	58	19	-	Yes
R16	58	22	-	Yes
R17	58	22	-	Yes
R18	58	20	-	Yes

Results in Table 6-4 indicate that existing noise emissions from the substation are currently compliant with the project amenity noise levels. As a result, the future operation of the project should be assessed against the project noise trigger levels in accordance with Section 6.1 of the *Noise Policy for Industry*.

6.4 Predicted operational noise levels

Predicted operational noise levels are presented in the following sections.

In order to assess tonality the one third octave noise levels at the worst affected residential receiver were assessed against the modifying factor criteria in Table 4-4 to check for tonal or low frequency components for each operational scenario.

Operational noise contours calculated at 1.5 m above ground are provided in Appendix C. These contours are indicative only and should not be referred to for noise levels at specific receiver locations. Operational noise levels and contours presented in this report have been calculated under neutral and noise-enhancing meteorological conditions.

6.4.1 Daytime operation with generator testing

Predicted noise levels at nearby noise sensitive receivers for the daytime scenario with the generator operating for testing purposes are presented in Table 6-5.

Operational noise contours calculated at 1.5 m above ground are provided in Appendix C. These contours are indicative only and should not be referred to for noise levels at specific receiver locations.

Operational noise levels and contours presented in this report have been calculated under neutral and noise-enhancing meteorological conditions.

Table 6-5 Predicted operational noise levels – Daytime (with generator)

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Neutral meteorological conditions			Noise-enhancing meteorological conditions		
		Predicted L_{Aeq} noise levels, dB(A)	Exceedance dB(A)	Compliance	Predicted L_{Aeq} noise levels, dB(A)	Exceedance dB(A)	Compliance
R1	47[1]	42	-	Yes	45	-	Yes
R2		29	-	Yes	32	-	Yes
R3		32	-	Yes	35	-	Yes
R4		33	-	Yes	36	-	Yes
R5		44	-	Yes	47	-	Yes
R6		45	-	Yes	48	1	Yes[1]
R7		40	-	Yes	43	-	Yes
R8		44	-	Yes	47	-	Yes
R9		44	-	Yes	47	-	Yes
R10		43	-	Yes	45	-	Yes
R11		41	-	Yes	44	-	Yes
R12		41	-	Yes	44	-	Yes
R13		39	-	Yes	42	-	Yes
R14		28	-	Yes	31	-	Yes
R15		19	-	Yes	23	-	Yes
R16		25	-	Yes	28	-	Yes
R17		25	-	Yes	29	-	Yes
R18		24	-	Yes	27	-	Yes

Notes:

1. *+5 dB(A) is applied to the daytime project noise trigger level due to the diesel generator being a single-event noise source of 15 minute – 1 hour duration, in accordance with the Noise Policy for Industry*
2. *In accordance with the Noise Policy for Industry, exceedances of up to 2 dB(A) are considered negligible. They would not be discernible to the average listener and therefore would not warrant receiver-based treatments or controls.*

Table 6-5 demonstrates that under neutral meteorological conditions the predicted operational noise emissions from the proposed activity comply with the adjusted daytime noise criteria at all assessed residential receivers when the diesel generator is in operation. Under noise-enhancing meteorological conditions a minor exceedance of 1 dB(A) at one receiver is predicted. Exceedances of up to 2 dB(A) are considered negligible as they are not discernible to the average listener and therefore would not warrant receiver-based treatments or controls, assuming all feasible and reasonable treatments at source have been implemented. Given that the generator testing is undertaken once per month and complies under neutral meteorological conditions no further mitigation has been recommended.

6.4.2 Typical daytime and evening operation

Predicted noise levels at nearby noise sensitive receivers for the daytime and evening scenario, without the generator operating, are presented in Table 6-6. It is noted that the daytime and evening criteria are both 42 dB(A) as identified in Section 4.1.3.

Table 6-6 Predicted operational noise levels – Daytime and evening typical operation

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Neutral meteorological conditions			Noise-enhancing meteorological conditions		
		Predicted L_{Aeq} noise levels, dB(A)	Exceedance dB(A)	Compliance	Predicted L_{Aeq} noise levels, dB(A)	Exceedance dB(A)	Compliance
R1	42	36	-	Yes	38	-	Yes
R2		27	-	Yes	30	-	Yes
R3		30	-	Yes	33	-	Yes
R4		31	-	Yes	34	-	Yes
R5		37	-	Yes	39	-	Yes
R6		38	-	Yes	41	-	Yes
R7		34	-	Yes	37	-	Yes
R8		39	-	Yes	41	-	Yes
R9		38	-	Yes	41	-	Yes
R10		37	-	Yes	40	-	Yes
R11		36	-	Yes	38	-	Yes
R12		34	-	Yes	36	-	Yes
R13		31	-	Yes	34	-	Yes
R14		27	-	Yes	30	-	Yes
R15		19	-	Yes	22	-	Yes
R16		23	-	Yes	26	-	Yes
R17		23	-	Yes	26	-	Yes
R18		23	-	Yes	27	-	Yes

In the daytime scenario when the diesel generator is not in operation, operational noise levels are predicted to comply at all receivers under both neutral and noise-enhancing meteorological conditions.

6.4.3 Typical night-time operation

Predicted noise levels for the night-time scenario are presented in Table 6-7. The night-time project noise trigger level has been identified in Section 4.1.3.

Table 6-7 Predicted operational noise levels – Night-time

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Neutral meteorological conditions			Noise-enhancing meteorological conditions		
		Predicted L_{Aeq} noise levels, dB(A)	Exceedance, dB(A)	Compliance	Predicted L_{Aeq} noise levels, dB(A)	Exceedance, dB(A)	Compliance
R1	40	36	-	Yes	38	-	Yes
R2		27	-	Yes	30	-	Yes
R3		30	-	Yes	33	-	Yes

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)	Neutral meteorological conditions			Noise-enhancing meteorological conditions		
		Predicted L_{Aeq} noise levels, dB(A)	Exceedance, dB(A)	Compliance	Predicted L_{Aeq} noise levels, dB(A)	Exceedance, dB(A)	Compliance
R4		31	-	Yes	34	-	Yes
R5		37	-	Yes	39	-	Yes
R6		38	-	Yes	41	1	Yes[1]
R7		34	-	Yes	37	-	Yes
R8		39	-	Yes	41	1	Yes[1]
R9		38	-	Yes	41	1	Yes[1]
R10		37	-	Yes	40	-	Yes
R11		36	-	Yes	38	-	Yes
R12		34	-	Yes	36	-	Yes
R13		31	-	Yes	34	-	Yes
R14		27	-	Yes	30	-	Yes
R15		19	-	Yes	22	-	Yes
R16		23	-	Yes	26	-	Yes
R17		23	-	Yes	26	-	Yes
R18		23	-	Yes	27	-	Yes

Notes:
1. *In accordance with the Noise Policy for Industry, exceedances of up to 2 dB(A) are considered negligible. They would not be discernible to the average listener and therefore would not warrant receiver-based treatments or controls.*

The night-time operational noise levels are predicted to comply at all receivers under neutral meteorological conditions. Under noise-enhancing meteorological conditions minor exceedances of up to 1 dB(A) are predicted at three receivers (R6, R8 and R9).

6.4.4 Operational noise discussion

The main sources contributing to the exceedances under noise-enhancing meteorological conditions during both the daytime/evening and night-time are Transformers 2 and 3 in the existing substation.

Further details of the required building construction are discussed in Section 7.2.

6.5 Operational road traffic noise

Ongoing maintenance for the syncons and associated equipment would include daily and weekly visual inspections, as well as routine planned maintenance. For the most part the site will not be occupied permanently by staff. Minimal traffic movement generation is expected as a result of the operation of the syncons. Therefore, noise impacts arising from operational traffic need not be considered any further as an increase of more than 2 dB(A) would not occur. An increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible.

7.0 Mitigation measures

7.1 Construction noise and vibration mitigation measures

7.1.1 Construction Noise and Vibration Management Plan

A construction noise and vibration management plan (CNVMP) would be developed and implemented for the proposed activity. The CNVMP would include feasible and reasonable safeguards to manage noise emissions from the proposed activity and complaints received in relation to construction noise or vibration. The CNVMP should include, as a minimum, the following:

- identification of nearby residences and other sensitive land uses
- description of approved hours of work
- description and identification of all construction activities, including work areas, equipment, and duration
- description of what work practices (generic and specific) would be applied to minimise noise and vibration
- a complaints handling process
- noise and vibration monitoring procedures
- overview of community consultation required for identified high impact work.

Construction work should be planned and carried out during standard construction hours wherever possible. Table 7-1 presents a summary of the standard mitigation measures which should be considered as mitigation measures within the CNVMP where feasible and reasonable.

Table 7-1 Transport *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* standard mitigation measures

Action required	Safeguard details
Management measures	
Implement stakeholder consultation measures	• Periodic notification (monthly letterbox drop and website notification) detailing any night-time works at least seven days prior to the commencement of works • Maintain a register for any noise complaints received • The worksite must have signage with a 24 hour contact number.
Site inductions	• All employees, contractors and subcontractors would receive an environmental induction.
Behavioural practices	• No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors • No excessive revving of plant and vehicle engines • Plant and vehicles to be turned off when not in use.

Action required	Safeguard details
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels would be scheduled during less sensitive time periods as far as practicable. This would include the use of demolition saws, coring machines, grinders, impact drills and jackhammers.
Construction respite period	Noise with special audible characteristics and vibration generating activities (including concrete sawing) would only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than a 1-hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work would be undertaken in the same NCA over any 7-day period, unless otherwise approved by the relevant authority.
Equipment selection	Quieter and less vibration emitting construction methods should be used where feasible and reasonable (e.g. rubber wheeled instead of steel tracked plant). Equipment would be regularly inspected and maintained to ensure it is in good working order.
Maximum noise levels	The noise levels of plant and equipment would have operating sound power or sound pressure levels that would meet the predicted noise levels.
Rental plant and equipment	Noise emissions would be considered as part of the selection process.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver would be avoided. The offset distance between noisy plant and adjacent sensitive receivers would be maximised. Plant used intermittently would be throttled down or shut down. Plant and vehicles would be turned off when not in use. Noise-emitting plant would be directed away from sensitive receivers where reasonable and feasible.
Plan work site and activities to minimise noise and vibration	Traffic flow, parking and loading/unloading areas would be planned to minimise reversing movements within the site. Truck drivers would be advised of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (i.e. minimising the use of engine brakes, and no extended periods of engine idling).
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) would be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work.

Action required	Safeguard details
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries would occur as far as possible from sensitive receivers or alternately planned during a work period that minimises the risk of noise exceedances. Dedicated loading/unloading areas would be shielded if close to sensitive receivers. Delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible.
Silencers on mobile plant	Where possible, noise from mobile plant would be reduced through additional fittings including: • residential grade mufflers • silencing air parking brake engagement.
Construction related traffic	Vehicle movements would be routed away from sensitive receivers and scheduled during less sensitive times where possible. The speed of vehicles would be limited and the use of engine compression brakes would be minimised. On-site storage capacity would be maximised to reduce the need for truck movements during sensitive times.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources would be enclosed or shielded to the greatest extent possible whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Structures to shield residential receivers from noise such as site building placement; earth bunds; fencing.

7.1.2 Community consultation and complaints handling

Residents impacted by noise levels from the proposed activity during construction activities, should be notified prior to the commencement.

The information provided to the residents would include:

- programmed times and locations of construction work
- the hours of proposed work
- construction noise and vibration impact predictions
- construction noise and vibration mitigation measures being implemented on site.

Community consultation regarding construction noise and vibration would be detailed in a Community Action Plan for the construction of the proposed activity and would include a 24-hour hotline and complaints management process.

7.2 Operational noise mitigation measures

Noise mitigation measures to be implemented in order for the operation of the proposed activity to comply with the project noise trigger levels at sensitive receivers include the following:

- Housing the syncon units inside a building to provide attenuation. This may also provide screening for other noise sources such as existing transformers and capacitors. The building should provide a minimum insertion loss of 26 dB to the most affected receiver, this is inclusive of doors and any ventilation openings.
- If feasible, ventilation openings should be directed away from noise sensitive receivers and acoustic louvres used to reduce noise emissions, if necessary.

- Construction of a noise wall on three sides of the syncons' external cooling system, (northwest, southwest and southeast, noting that the proposed sycon building may serve as the northwest wall), the height should extend around 1.0 m beyond the top of the cooling system. The wall must have no gaps and a minimum surface density of 5 kg/m^2.
- Acoustic absorption is required on at least two adjacent surfaces of the noise walls facing the equipment (northwest and southwest walls). The acoustic absorption must have a minimum noise reduction coefficient (NRC) of 0.8.
- Regular maintenance of mechanical equipment (e.g. fans, motors, air conditioning units and pumps) to minimise noise from wear, loose components, or deteriorated insulation.
- During detailed design it is recommended that the final site layout, equipment selections and building construction details (dimensions, materials, openings and location) are reviewed to confirm compliance with the project noise trigger levels.
- Noise monitoring shall be undertaken post construction to ensure operational noise has reduced to a level that does not result in adverse impacts to nearby sensitive receivers.

8.0 Conclusion

A construction and operational noise and vibration impact assessment has been completed for the proposed syncons at the existing Transgrid Newcastle 330 kV substation site (the proposed activity).

Nearby noise sensitive residential receivers were identified, no non-residential receivers are located close to the proposed activity. Attended and unattended noise measurements were completed to characterise the existing noise environment. The measured noise levels were used to establish construction NMLs and operational project noise trigger levels.

Construction noise impacts were assessed at nearby representative residential receivers for the three most noise critical construction scenarios – site establishment, access road construction and syncon bench installation. Predicted construction noise levels were exceeded at 11 assessment residential receivers during site establishment and at seven assessment residential receivers during access road construction. No receivers were predicted to experience exceedances of the NML during syncon bench installation, and no residential receivers were predicted to be highly noise affected for the construction scenarios. The use of vibration intensive equipment was not proposed.

An CNVMP would be developed for the proposed activity and implemented prior to commencement of construction activities. The CNVMP would include all reasonable and feasible safeguards to manage the noise emissions from the proposed activity and any complaints which may occur due to construction noise. Implementation of specific mitigation measures outlined within the CNVMP would aim to minimise and manage noise impacts where possible.

Significant noise sources for the proposed activity include the syncons and associated equipment, such as transformers, a diesel generator, and a cooling system. Predicted operational noise from the proposed activity was modelled and compared against established project noise trigger levels. Under neutral meteorological conditions results of the noise modelling showed that the operation of the syncons including generator testing results in no exceedances at any noise sensitive receiver during the daytime, evening or night-time periods. Under noise-enhancing meteorological conditions the results of the noise modelling showed that with the generator testing an exceedance of 1 dB(A) may occur at one receiver. With no generator testing predicted operational noise levels comply with the project noise trigger levels at all receivers during the daytime/evening and exceed the project noise trigger level at three assessment residential receivers during the night-time by 1 dB(A).

Mitigation measures to minimise and manage noise from the operation of the syncons have been provided and would include housing the syncon units inside a building to provide attenuation and the construction of a noise wall around external cooling plant.

Appendix A

Unattended Noise Monitoring Results

Noise Logger Report

21 The Broadway, Killingworth

Item	Information
Logger Type	NL-52
Serial number	164394
Address	21 The Broadway, Killingworth
Location	21 The Broadway, Killingworth
Facade / Free Field	Free field
Environment	Bird noise. Dog barking, 48 dB. Car and bus passby on The Broadway, 58-64 dB. Slight humming noise from powerlines. Rooster crow, 45-49 dB.

Measured noise levels

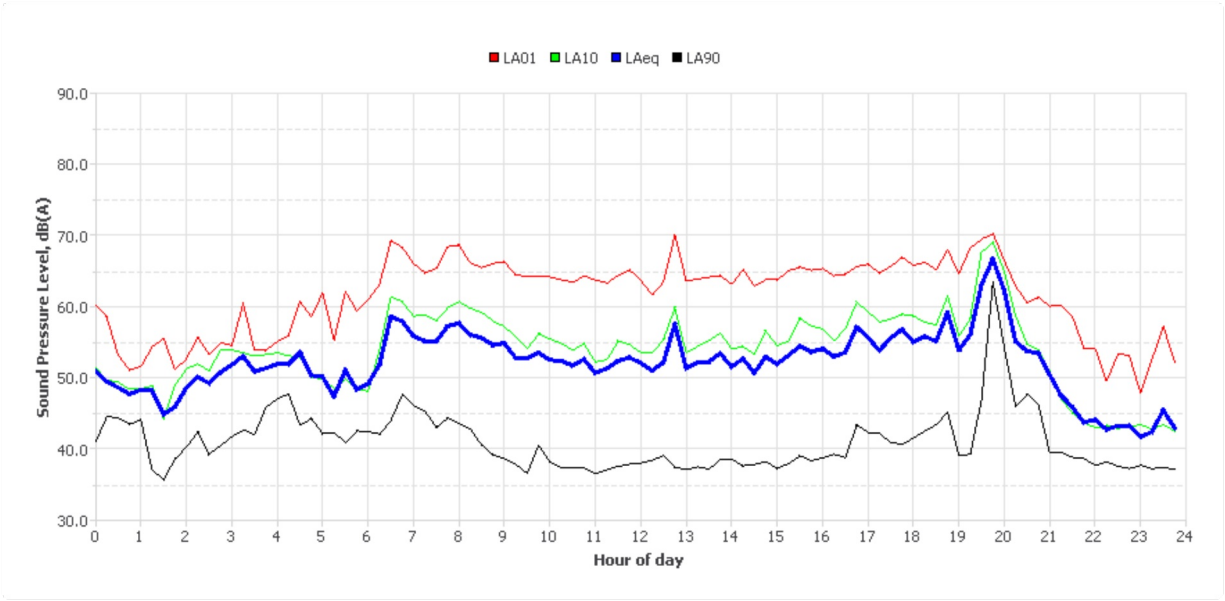
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Wed Feb 26 2025	56	57	44	-	39	-	57	44
Thu Feb 27 2025	57	56	54	36	40	37	56	54
Fri Feb 28 2025	57	56	53	37	37	37	57	53
Sat Mar 1 2025	59	58	56	37	38	35	58	56
Sun Mar 2 2025	59	54	53	37	39	37	58	53
Mon Mar 3 2025	62	51	56	41	-	-	61	56
Tue Mar 4 2025	68	56	61	39	-	-	67	61
Wed Mar 5 2025	58	60	59	41	-	35	58	59
Thu Mar 6 2025	56	69	55	40	37	34	64	55
Fri Mar 7 2025	55	59	53	41	35	32	57	53
Sat Mar 8 2025	56	69	46	-	38	-	65	46
Sun Mar 9 2025	55	68	49	39	37	33	63	49
Mon Mar 10 2025	55	62	55	37	35	34	58	55
Tue Mar 11 2025	54	57	54	-	35	-	55	54
Wed Mar 12 2025	55	60	52	35	38	32	57	52
Thu Mar 13 2025	55	59	52	36	39	36	57	52
Fri Mar 14 2025	54	-	53	-	-	-	54	53
Summary	**59**	**63**	**55**	**37**	**38**	**35**	**61**	**55**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

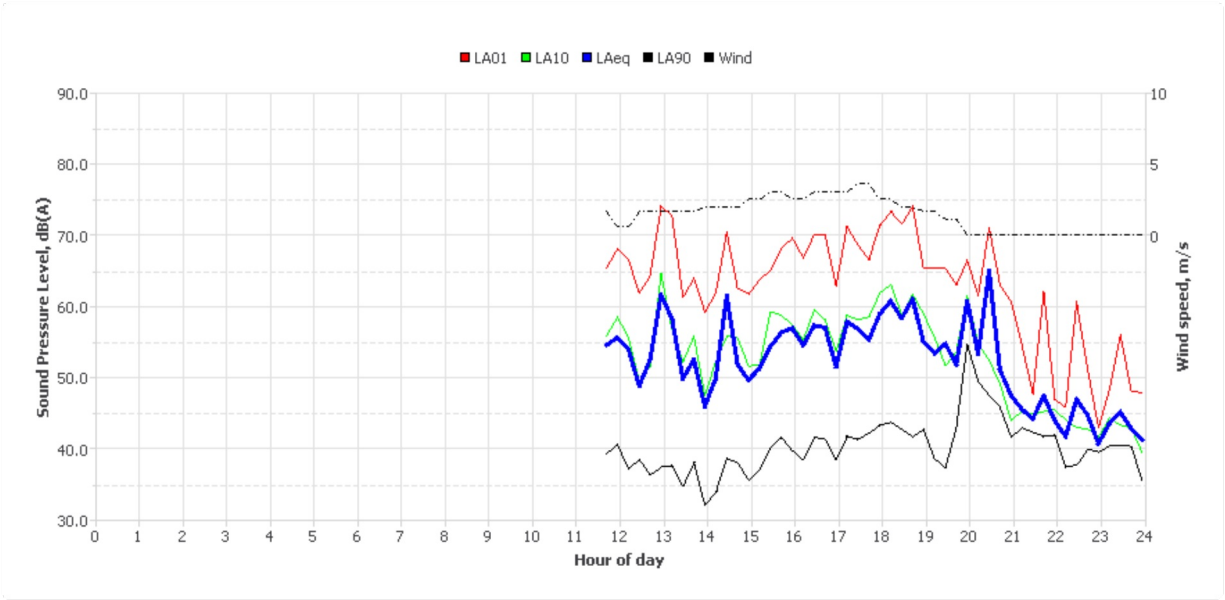
Logger Location	Logger Deployment Photo
	

21 The Broadway, Killingworth

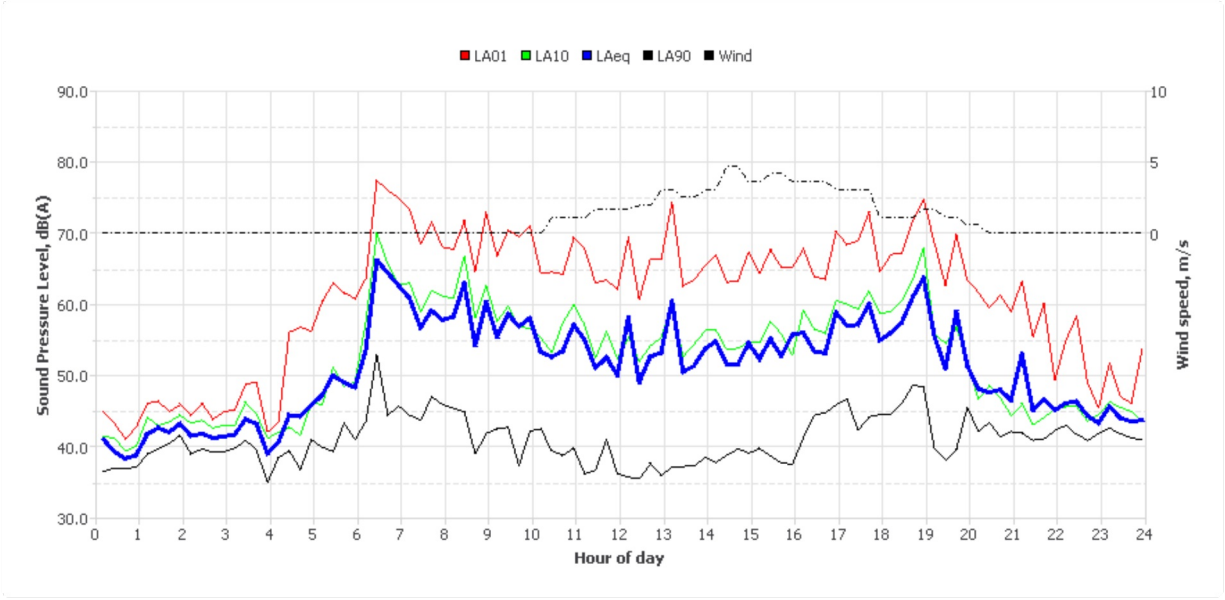
Typical Day



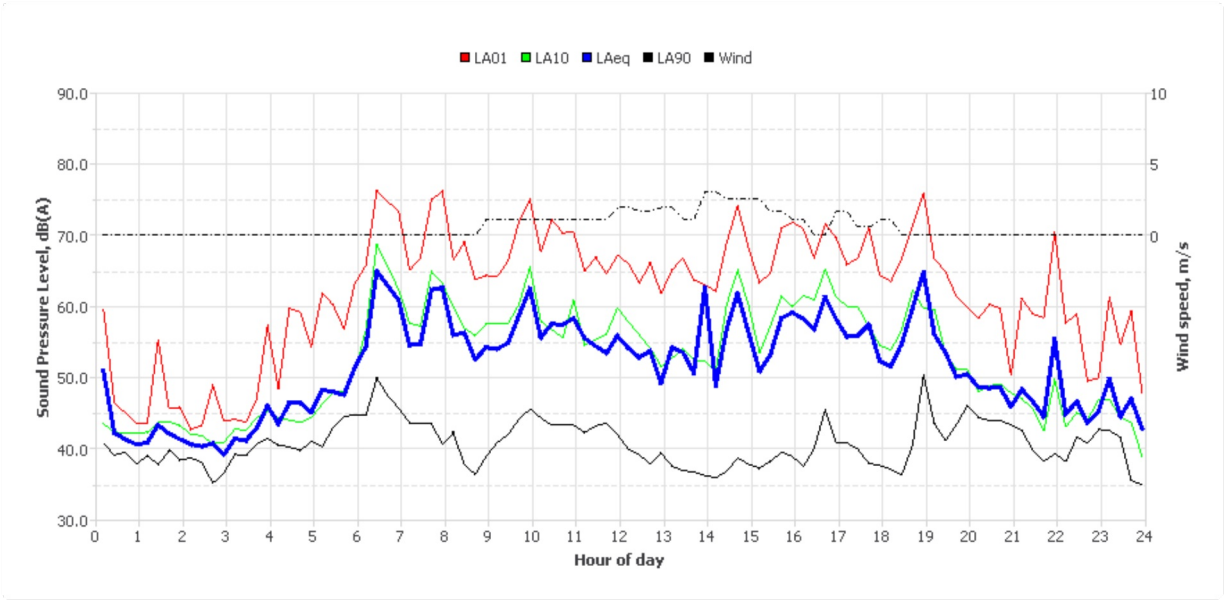
Wednesday, 26 Feb 2025



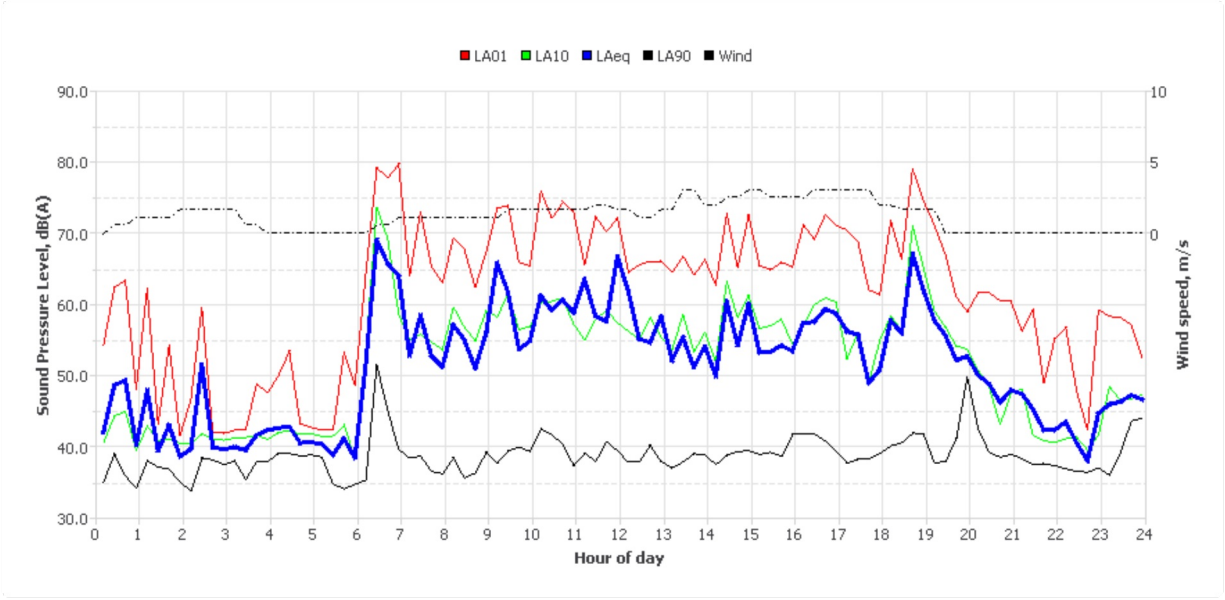
Thursday, 27 Feb 2025



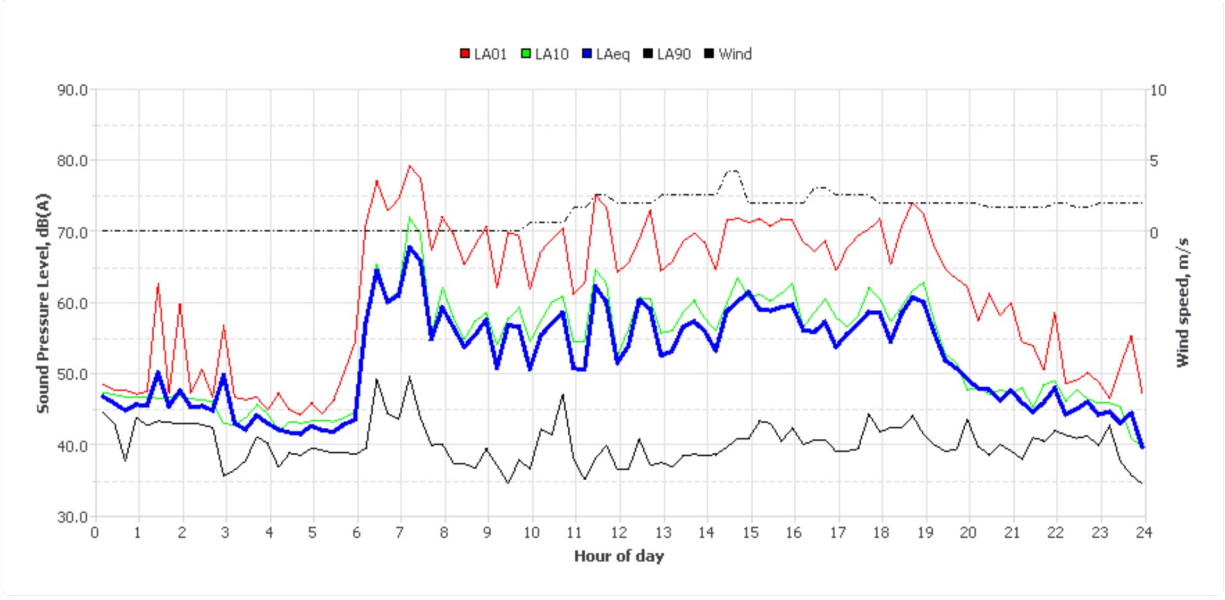
Friday, 28 Feb 2025



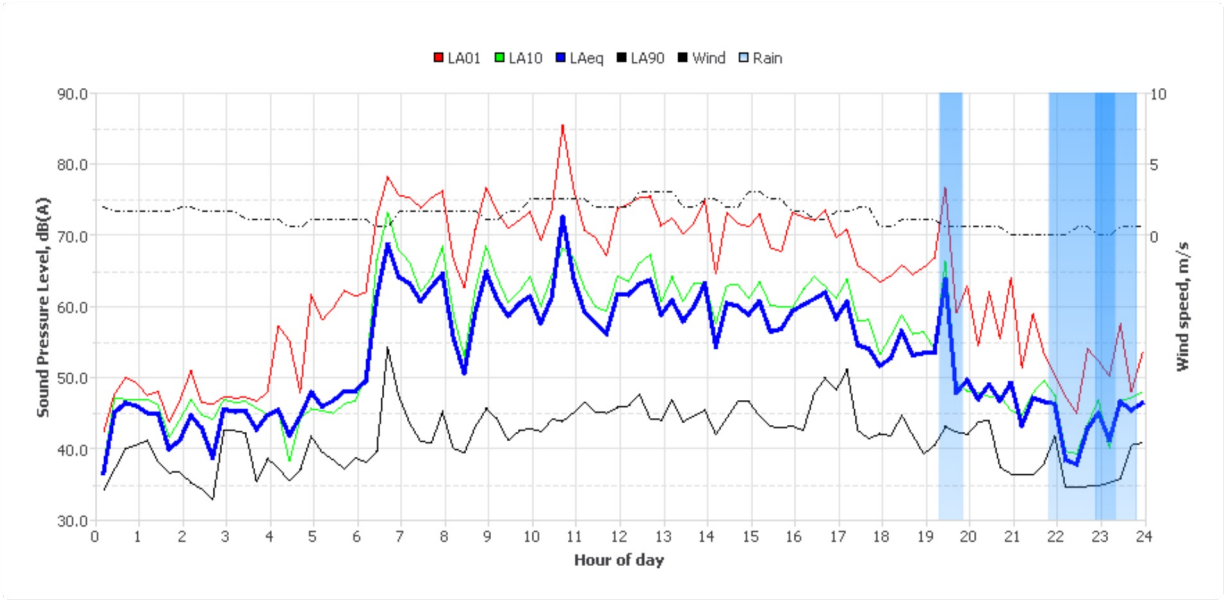
Saturday, 01 Mar 2025



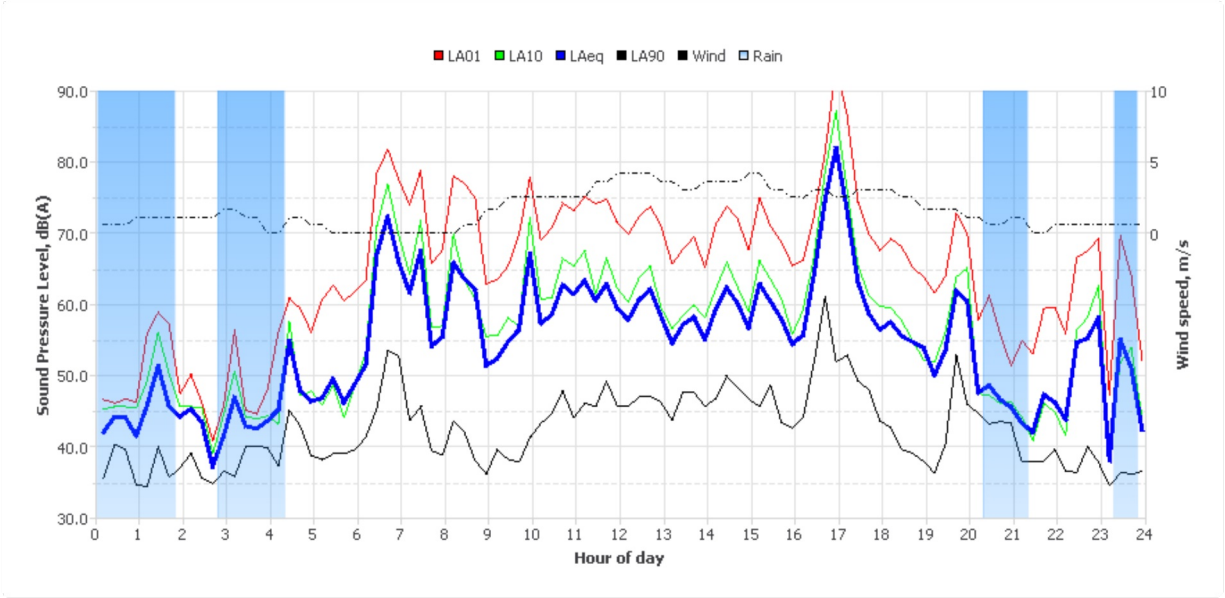
Sunday, 02 Mar 2025



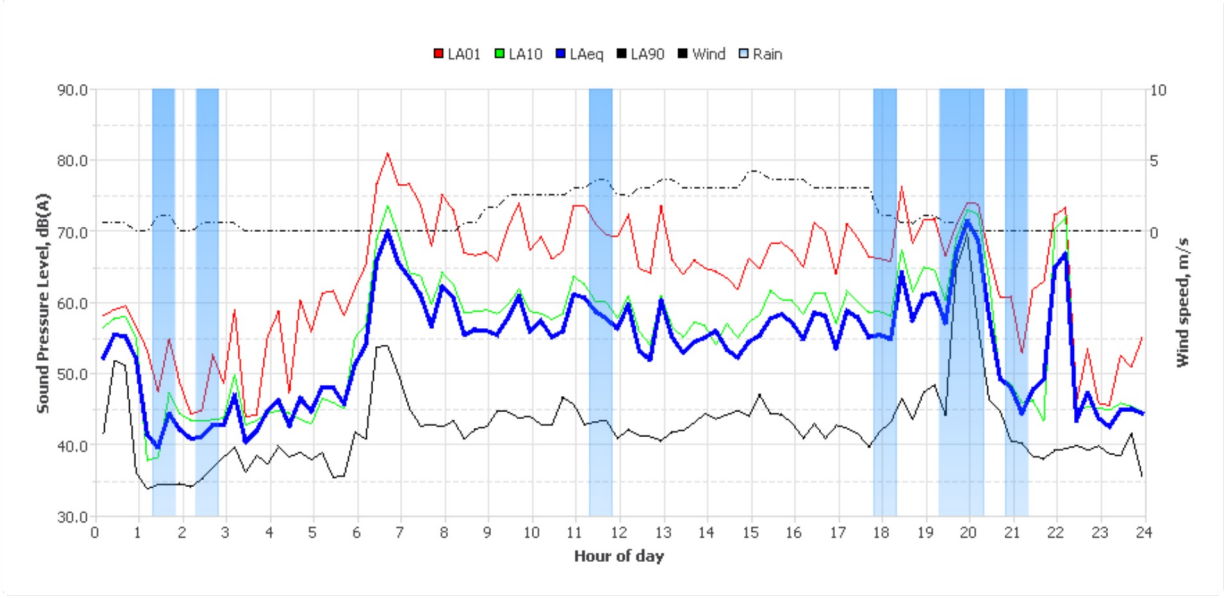
Monday, 03 Mar 2025



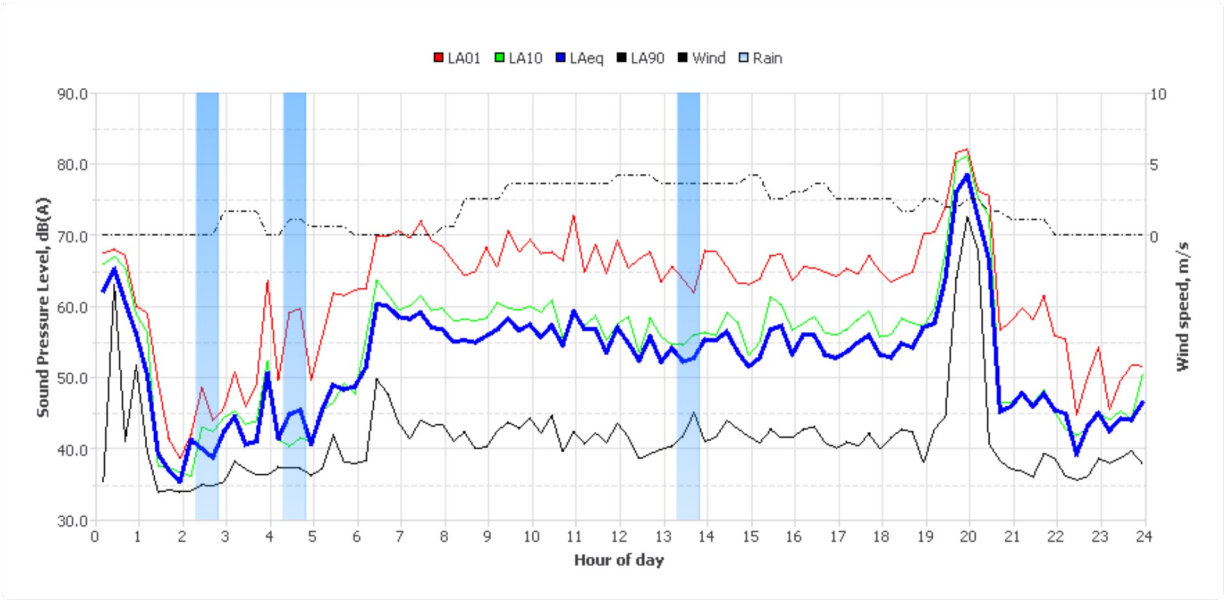
Tuesday, 04 Mar 2025



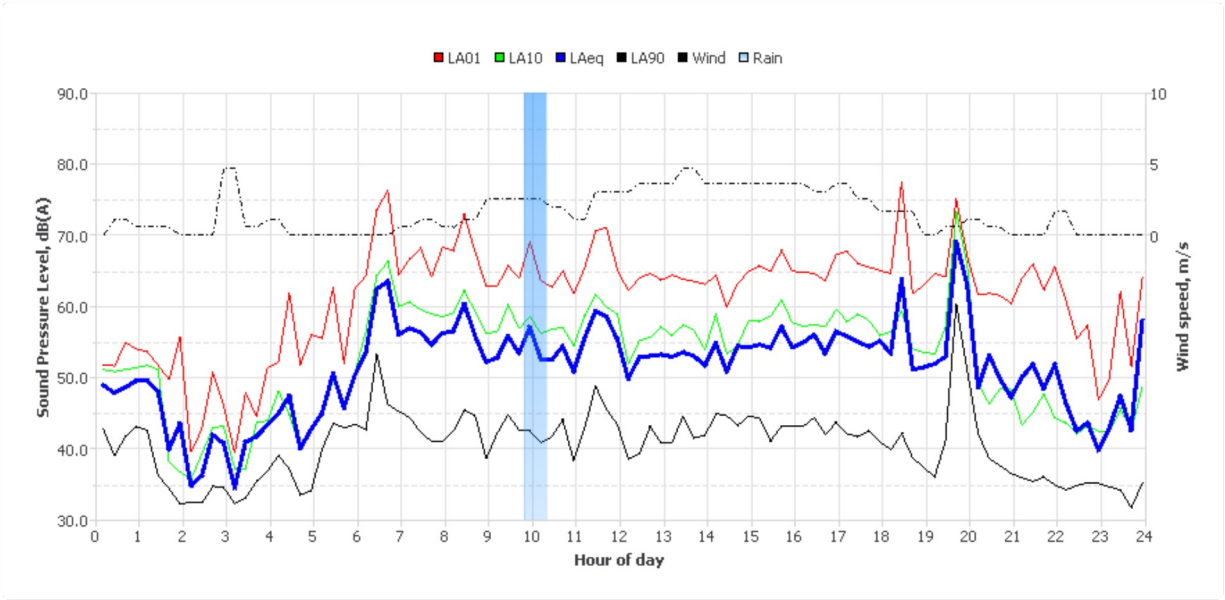
Wednesday, 05 Mar 2025



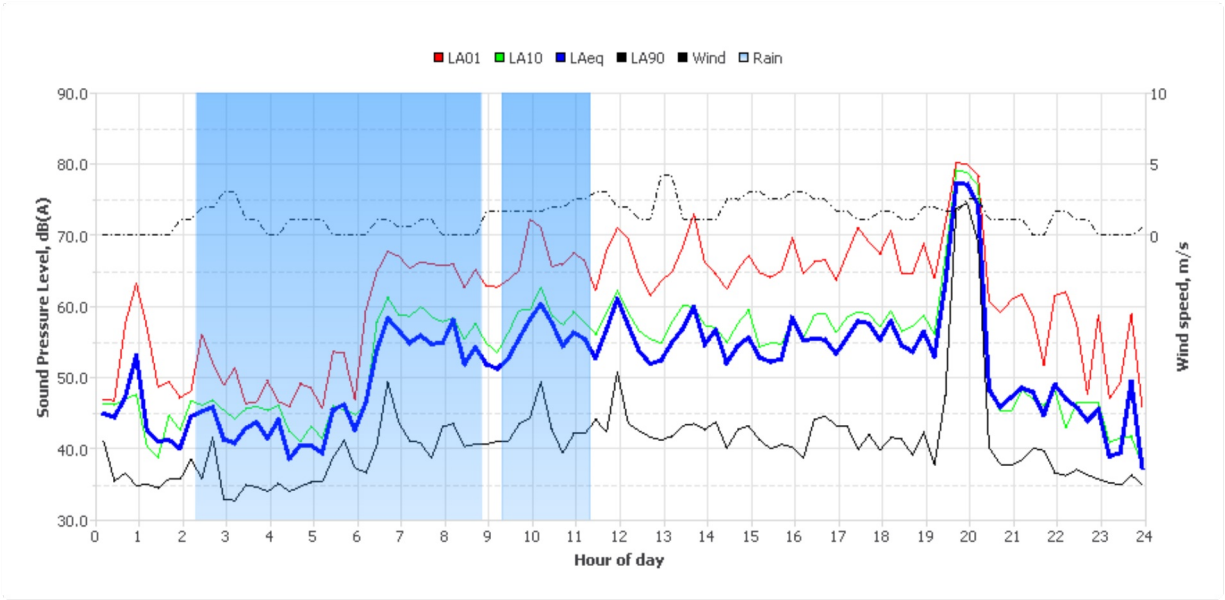
Thursday, 06 Mar 2025



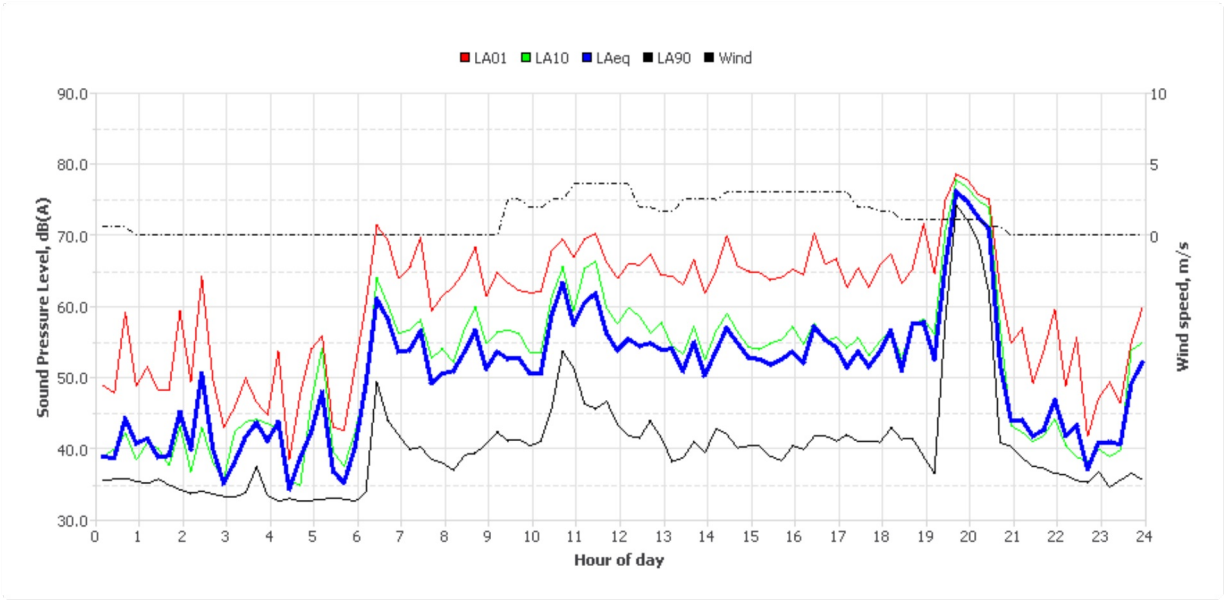
Friday, 07 Mar 2025



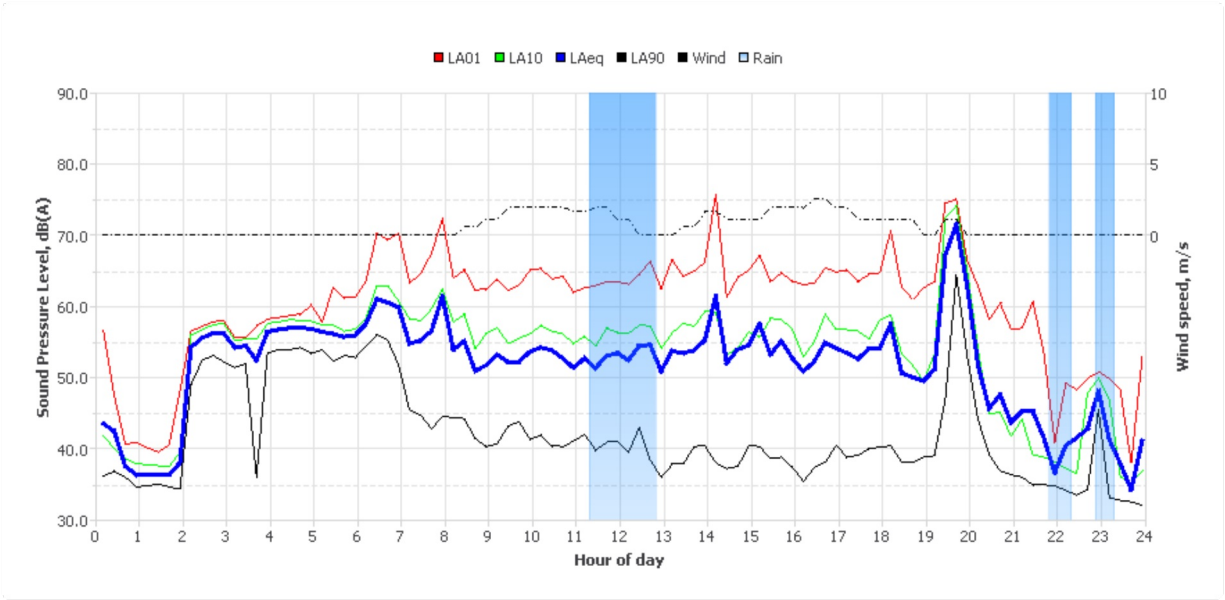
Saturday, 08 Mar 2025



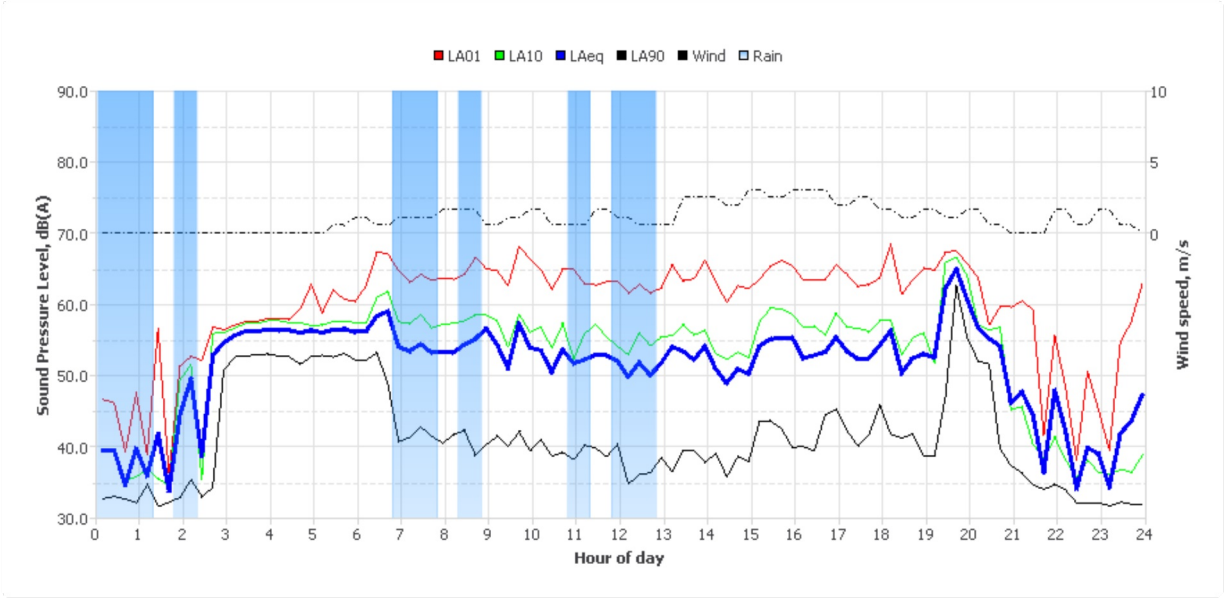
Sunday, 09 Mar 2025



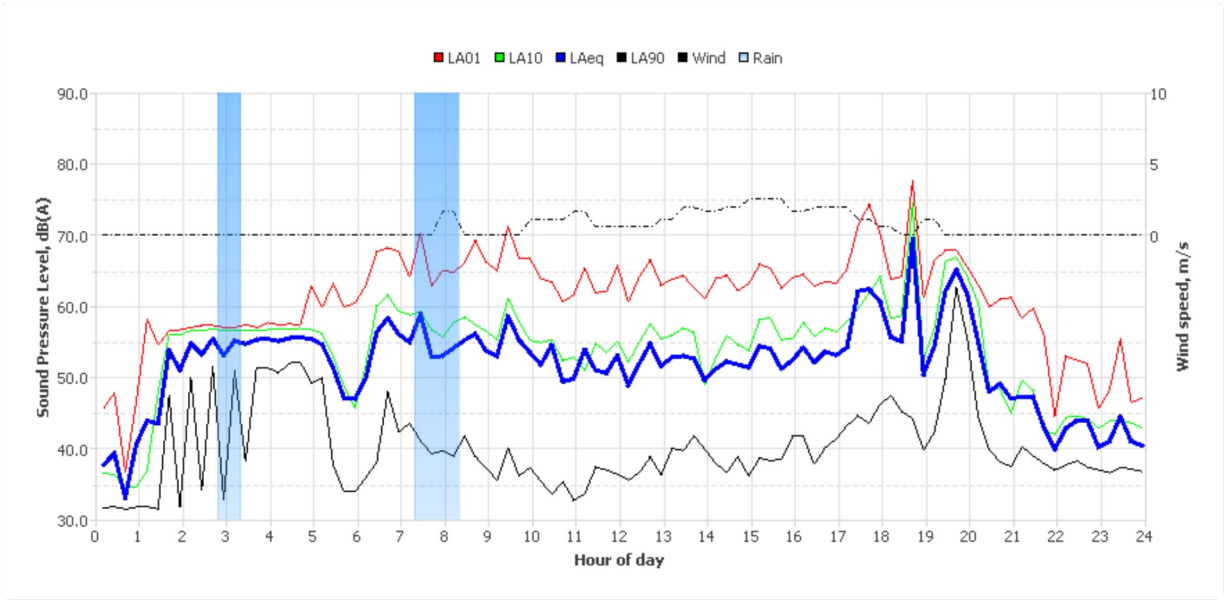
Monday, 10 Mar 2025



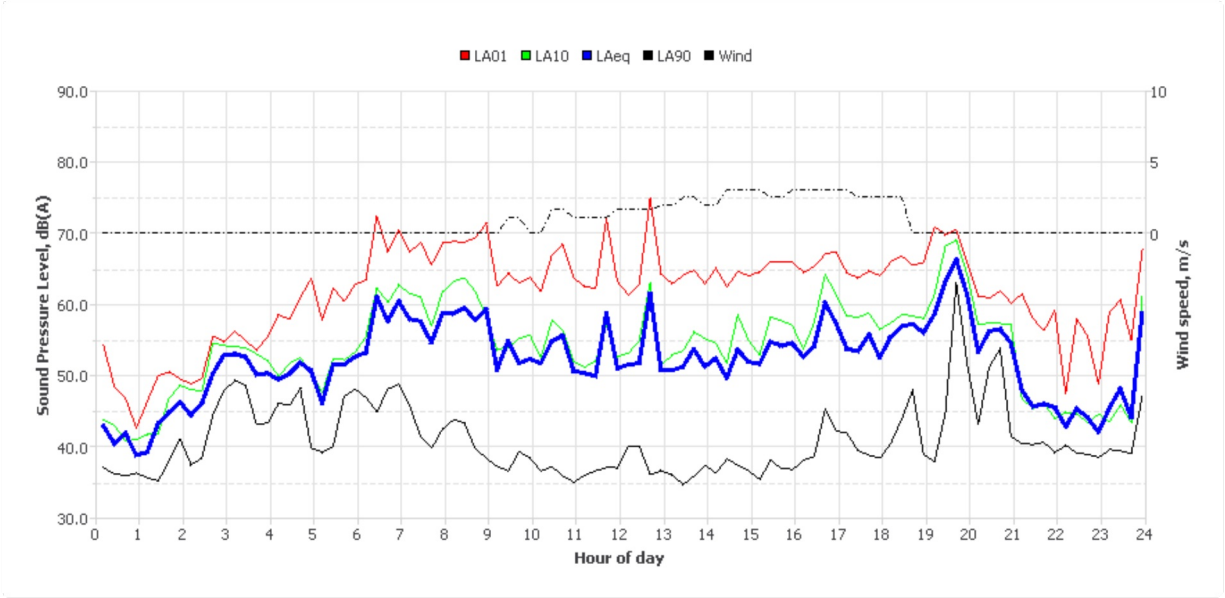
Tuesday, 11 Mar 2025



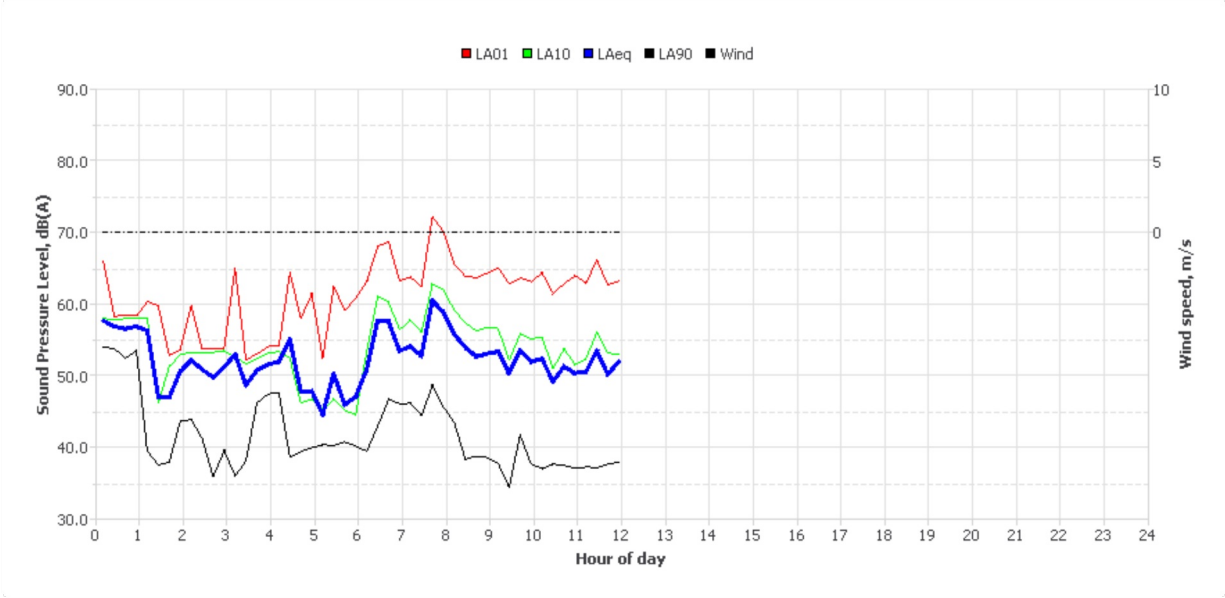
Wednesday, 12 Mar 2025



Thursday, 13 Mar 2025

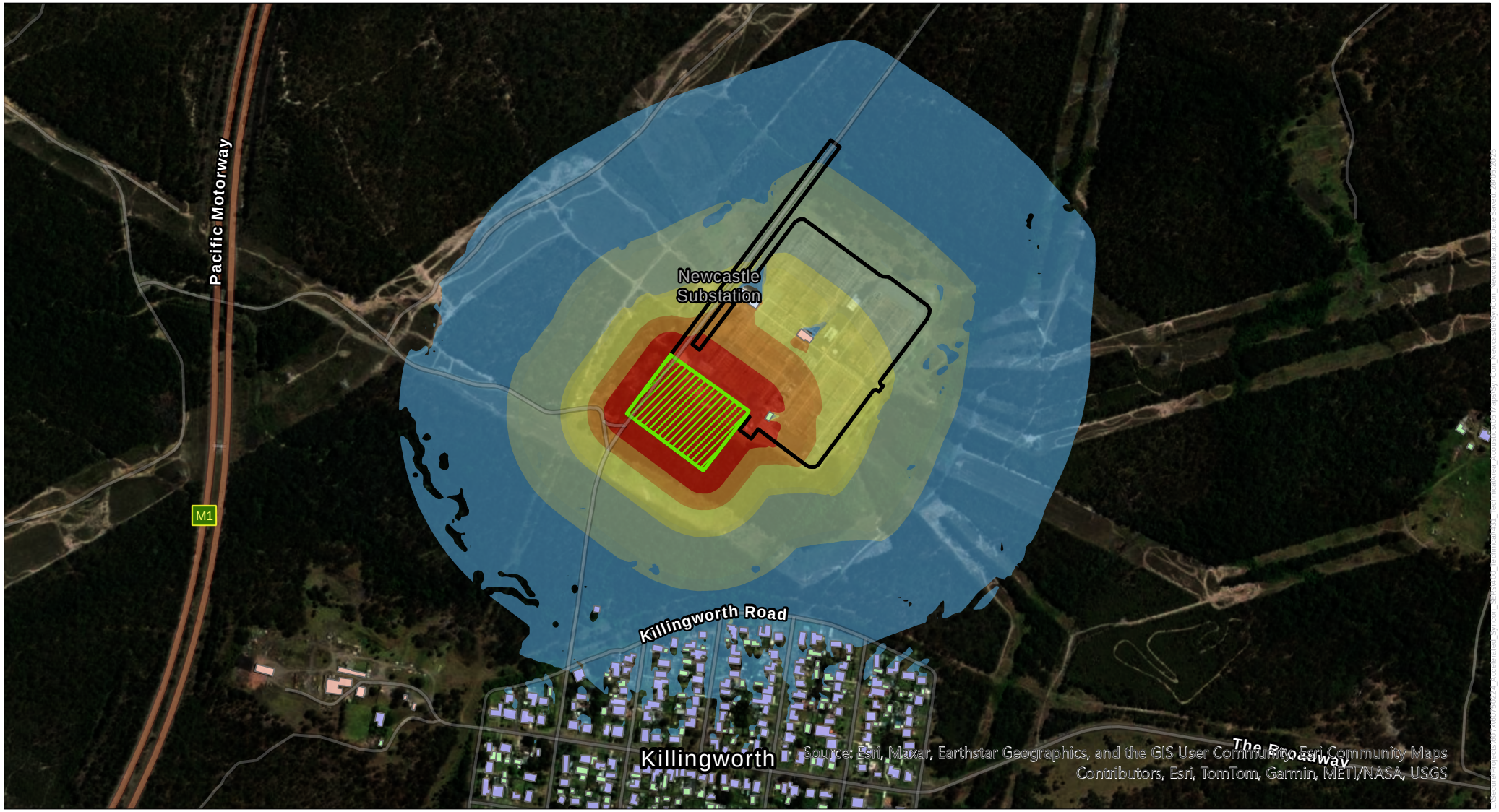


Friday, 14 Mar 2025



Appendix B

Construction Noise Contour Maps



Newcastle Accelerated Synchronous Condenser
Construction Contours - Scenario 1 - Site Establishment

Noise contours are shown 1.5 meters above ground level

- Proposed impact area
- Scenario 1

Usage

- Commercial
- Industrial
- Residential
- Shed

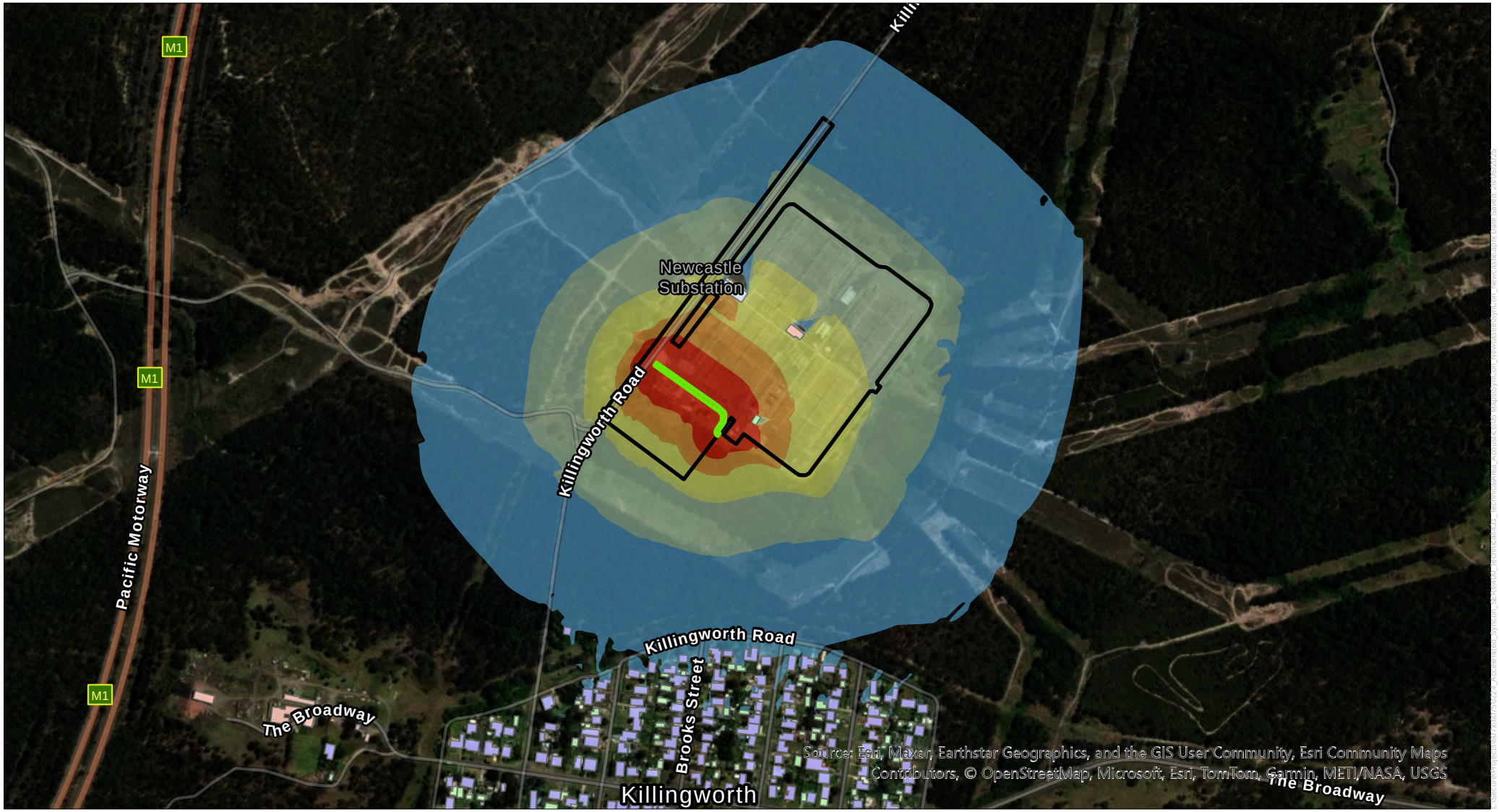
Predicted noise level $L_{Aeq,15min}$ dB(A)

48 - 53 | 54 - 59 | 60 - 65 | 66 - 71 | 72 - 77

N

0 140 280 Meters

AECOM



Newcastle Accelerated Synchronous Condenser
Construction Contours - Scenario 2 - Access Road Construction

Noise contours are shown 1.5 meters above ground level

Proposed impact area

Scenario 2

Usage

Commercial

Industrial

Residential

Shed

Predicted noise level $L_{Aeq,15min}$ dB(A)

48 - 53

54 - 59

60 - 65

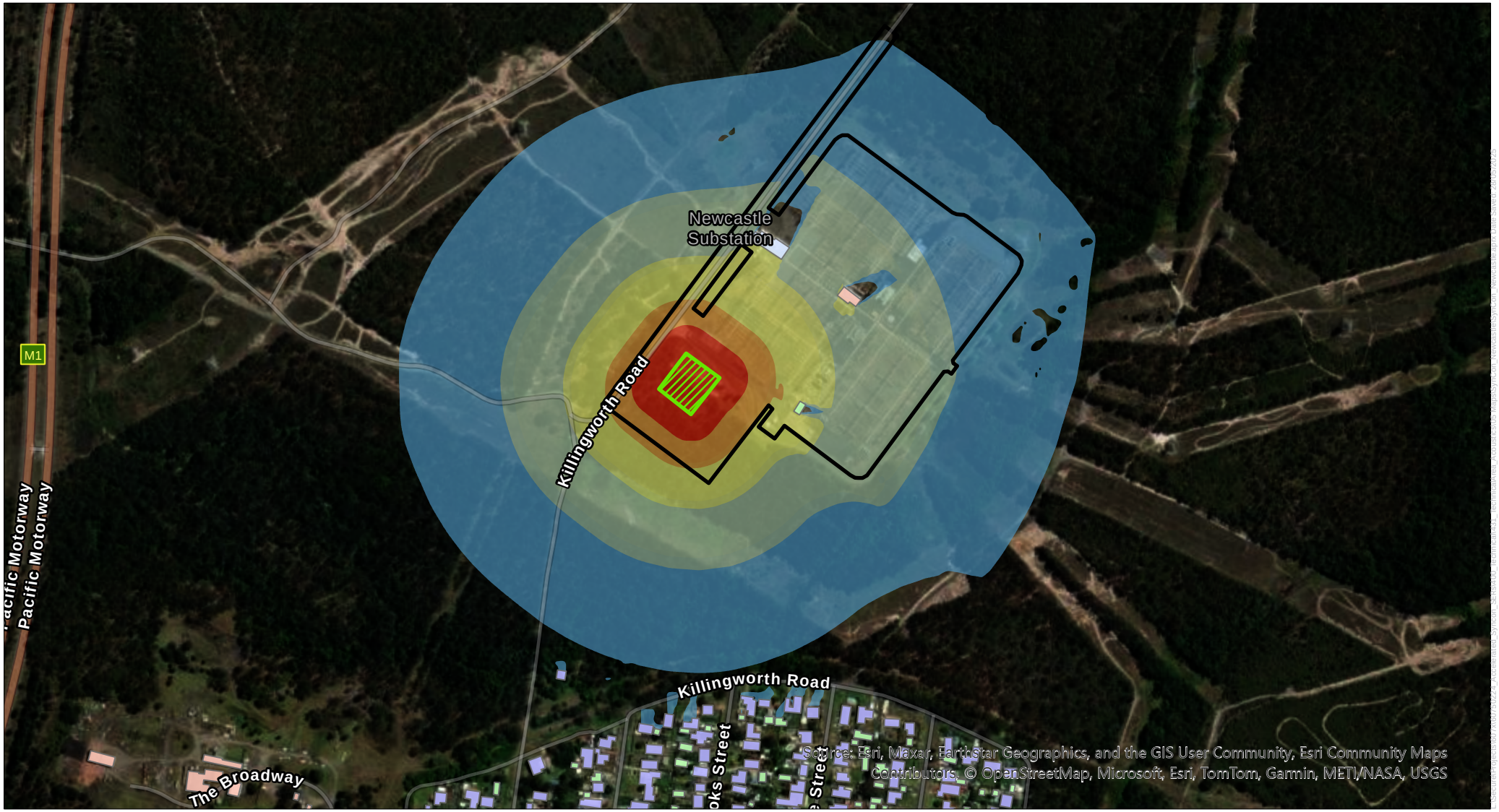
66 - 71

72 - 77

N

0 125 250 Meters

AECOM



Newcastle Accelerated Synchronous Condenser
Construction Contours - Scenario 3 - Syncon Bench Installation

Noise contours are shown 1.5 meters above ground level

Proposed impact area

Scenario 3

Usage

Commercial

Industrial

Residential

Shed

Predicted noise level $L_{Aeq,15min}$ dB(A)

48 - 53

54 - 59

60 - 65

66 - 71

72 - 77

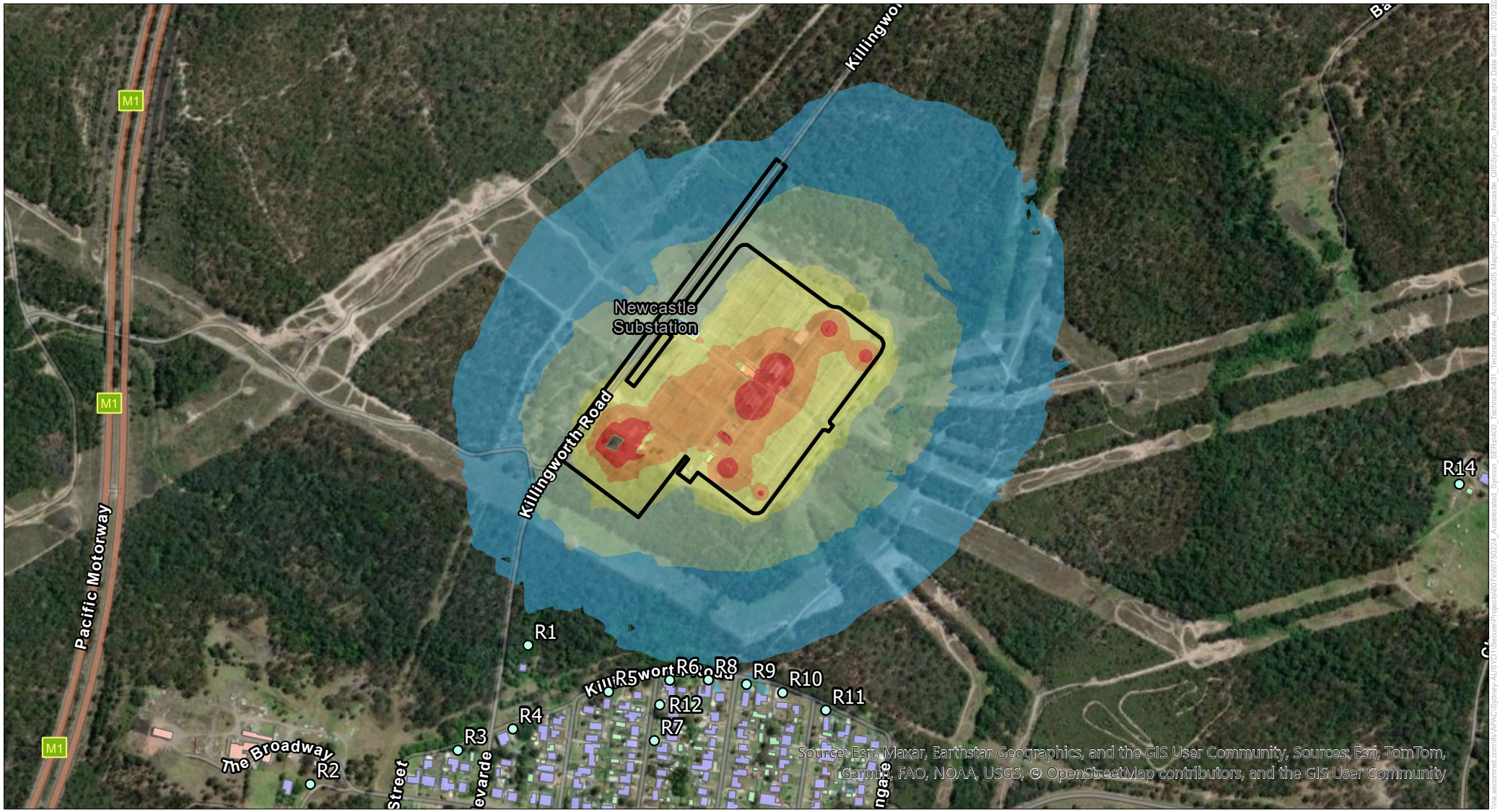
N

0 100 200 Meters

AECOM

Appendix C

Operational Noise Contour Maps



Newcastle Accelerated Synchronous Condenser
Operational Contours - Daytime, evening or night (Typical operation)

Noise contours are shown 1.5 meters above ground level

Proposed impact area

Assessment receivers

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level $L_{Aeq,15min}$ dB(A)

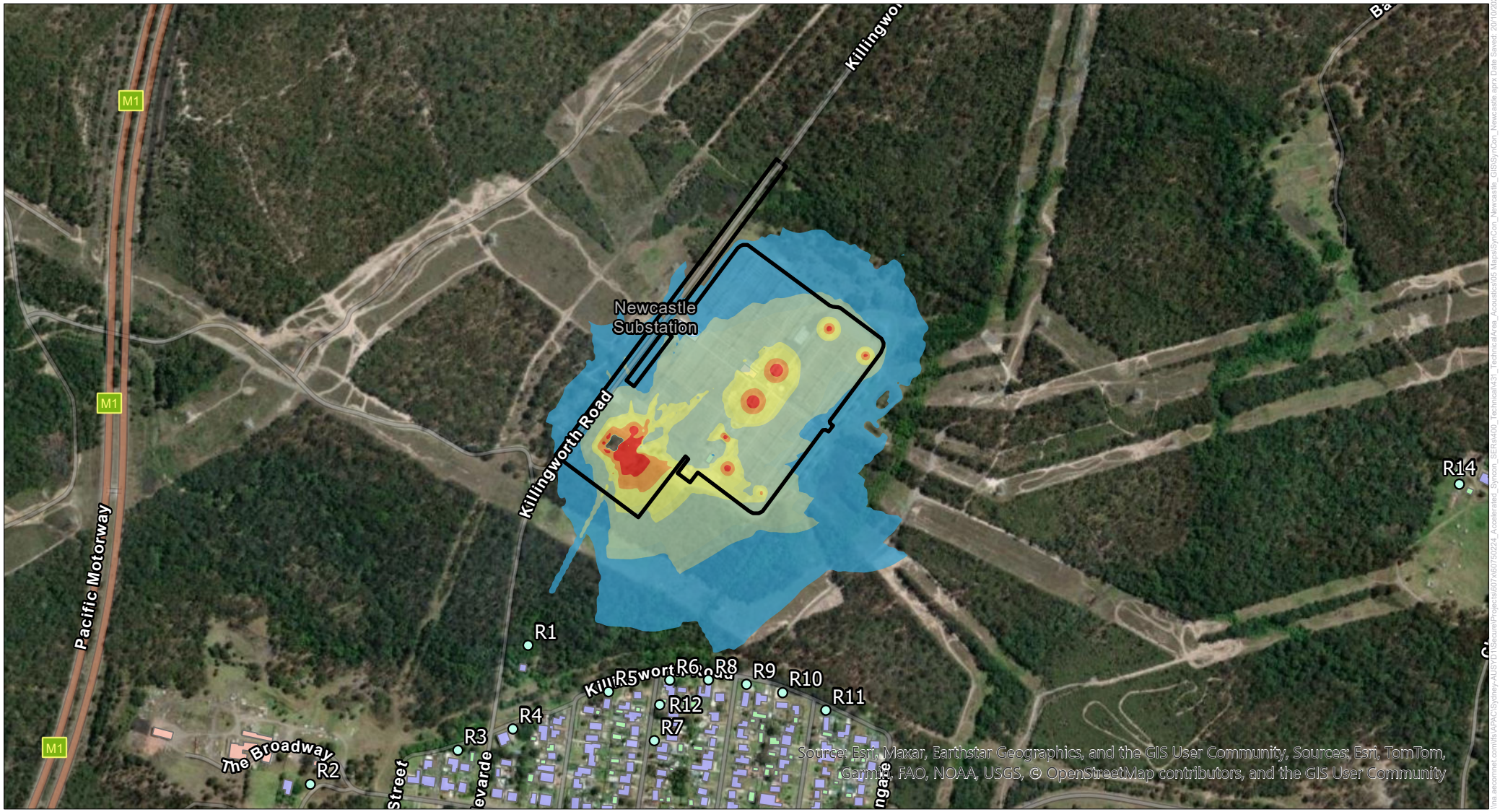
40 - 44 | 45 - 49 | 50 - 54 | 55 - 59 | >= 60

Note: Contours have been calculated under adverse weather conditions.

N

0 130 260 Meters

AECOM



Newcastle Accelerated Synchronous Condenser Operational Contours - Daytime (with generator)

Noise contours are shown 1.5 meters above ground level

Proposed impact area

Assessment receivers

Usage

- Commercial
- Industrial
- Residential
- Shed

Predicted noise level $L_{Aeq,15min}$ dB(A)

48 - 52	53 - 57	58 - 62	63 - 67	>= 68

Meters

0 130 260

AECOM

Note: Contours have been calculated under adverse weather conditions.