Eraring Battery Energy Storage System

Visual Impact Assessment

IS365800_VIA | 02

21 October 2021

Origin Energy Eraring Pty Limited

SSD-15950052 EIS Appendix I

Eraring Battery Energy Storage System

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Project Manager:	Thomas Muddle
Author:	Thomas Muddle
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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Leve 4, 12 Steward Avenue
Newcastle West NSW 2302 Australia
PO Box 2147 Dangar NSW 2309 Australia
T +61 2 4979 2600
F +61 2 4979 2666
www.jacobs.com

www.jacobs.com

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Contents

1. Introduction

1.1 Project background

Origin Energy Eraring Pty Limited (Origin) owns and operates the Eraring Power Station (EPS) which is one of Australia's largest power stations, having a capacity of 2,880 megawatts (MW). EPS is scheduled to be among 14 gigawatts (GW) of coal-fired generation plants to be retired within the next few decades (AEMO, 2020). The retirement of the EPS will support Origin's carbon emission reduction goals. As such, Origin is currently progressing an application to provide energy storage and key network services that would facilitate long term emissions reduction in the National Electricity Market (NEM) while supporting the delivery of secure and reliable electricity for consumers and businesses.

Origin is seeking regulatory and environmental planning approval for the construction and operation of a grid-scale Battery Energy Storage System (BESS) with a discharge capacity of 700 MW and storage capacity of 2,800 megawatt hours (MWh) within the Origin landholding associated with the EPS (the Project).

The Project is a State Significant Development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) and subject to Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). As such, the Project requires the preparation of an EIS in accordance with Secretary's Environmental Assessment Requirements (SEARs) and the approval of the Independent Planning Commission under circumstances described in SRD SEPP or the NSW Minister for Planning and Public Spaces.

1.2 Purpose of this report

This visual impact assessment (VIA) has been prepared in accordance with the SEARs issued for the Project on 19 April 2021 by the Planning Secretary of the NSW Department of Planning, Industry and Environment (DPIE).

The SEARs relevant to this VIA are presented in **Table 1-1**.

Table 1-1: VIA SEARs

SEARs	Section addressed
▪ Visual – including a detailed assessment of the likely visual impacts (including any glare, reflectivity and night lighting) of all components of the project (including transmission lines, substations and any other ancillary infrastructure) on surrounding residences and key locations, scenic or significant vistas, air traffic and road corridors in the public domain and provide details of measures to mitigate and/or manage potential impacts (including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners).	**Section 4** provides assessment of likely visual impacts and **Section 5** provides recommended mitigation measures.

1.3 Project location

The Project will be situated on land zoned SP2 Infrastructure for electricity generating purposes and within an area previously disturbed by power station activities. No re-zonings or land acquisitions are required. The Project is located within, Lots 10 and 11 DP 1050120, Rocky Point Road Eraring, within the Lake Macquarie City Council (LMCC) LGA, as illustrated in **Figure 1-1**.

Figure 1-1 Project location

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Surrounding land external to the EPS consists of broadacre, low-density residential properties. The largest commercial centre and population centre nearby is Charlestown (29.1 kilometres (km) north east), and the closest residential suburb is Dora Creek (1.2 km south). The Great Northern Railway alignment runs along the border of Dora Creek and Eraring suburbs, approximately 200 metres (m) west of the Project area.

The Project area is surrounded by the following features with the Origin landholding:

- EPS operations area, elevated TransGrid switchyard, coal yards and extensive EPS buffer lands to the north;
- Elevated attemperation reservoir to the east;
- Elevated EPS inlet canal to the south and east; and
- Mature vegetation within E2 environmental protection zoned land along a ridge line to the west.

The nearest private receptors to the Project area are located as follows:

- Rural residential dwellings approximately 600 m to the west on Gradwells Road beyond the Great Northern Railway;
- Dora creek township approximately 1.2 km to the south;
- Properties on Border Street approximately 600 m to the south which are screened by the EPS inlet canal and attemperation reservoir and beyond Wangi Road; and
- Dwellings to the north of Project area located over 4 km away beyond the EPS and mining operations.

1.4 Report structure

The report structure is as follows:

- **Section 1** provides the Project background and briefly describes the Project location;
- **Section 2** describes the key Project features including component dimensions;
- **Section 3** provides contextual analysis including site and surrounding visual context and land use and strategic context;
- **Section 4** provides visual impact assessment; and
- **Section 5** outlines the proposed mitigation measures in the form of a draft landscape management plan.

2. Project description

Origin is seeking regulatory and environmental planning approval for the construction and operation of a grid-scale BESS with a discharge capacity of 700 MW and storage capacity of 2,800 MWh at the Project area. The Eraring BESS would be among the largest battery projects in NSW and Australia in terms of peak power output and discharge duration. The Project would provide energy storage and key network services that would facilitate long term emissions reduction in the NEM while supporting the delivery of secure and reliable electricity for consumers and businesses.

The Project would be situated within the Origin landholding associated with the EPS located on the western shore of Lake Macquarie. EPS is approximately 40 km south of Newcastle and approximately 120 km north of Sydney in NSW. The total area of the Origin's landholding is approximately 1,200 hectares (ha), including EPS operational areas, Eraring Ash Dam and surrounding buffer lands consisting of bushland and grassland interspersed with roads, water management and electricity transmission infrastructure. The Project area is about 25 ha and is shown in **Figure 2-1**.

The Project would include the construction and operation of:

- BESS compounds comprising of rows of enclosures housing lithium-ion type batteries connected to associated power conversion systems (PCS) and high voltage (HV) electrical reticulation equipment;
- A BESS substation housing HV transformers and associated infrastructure;
- Approximately 400 m of overhead 330 kilovolt (kV) transmission line connecting the BESS substation to the existing 330 kV TransGrid switchyard; and
- Ancillary infrastructure and facilities including safety protection systems and site ancillary facilities such as laydown areas and site offices.

A full description of the Project is included in Section 3 of the EIS.

The BESS will be capable of providing Energy Frequency Control Ancillary Services (FCAS), System Restart Ancillary Services (SRAS), as well as Fast Frequency Response (FFR) and synthetic inertia - security services currently under consideration in the NEM.

The Project maximum disturbance area is approximately 25 ha in size with permeant infrastructure likely to cover half this area. Construction may require temporary compounds or laydown areas outside the permanent footprint but within the Project area and would be located in existing vacant areas of the Project area as illustrated in **Figure 2-1.**

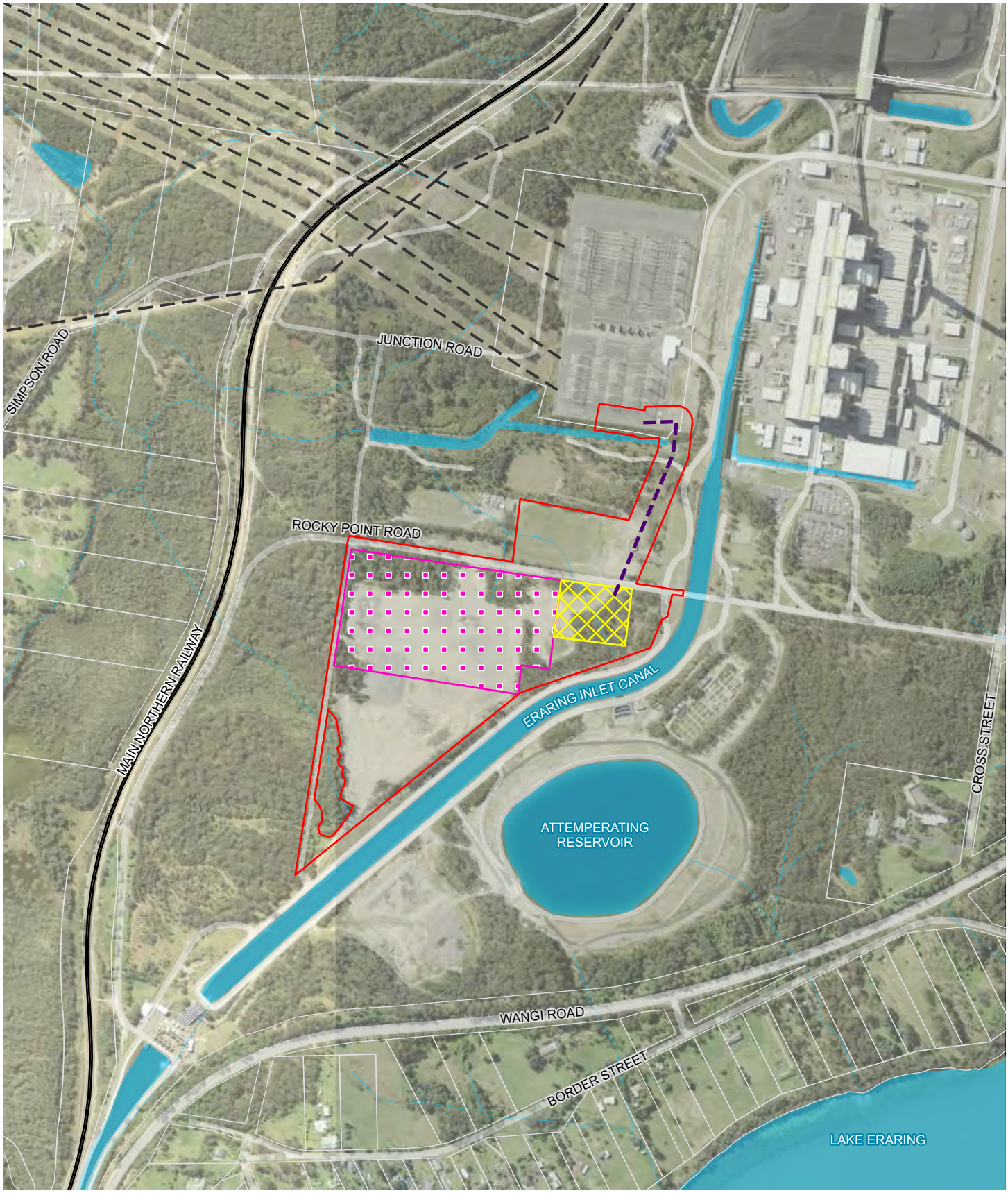
2.1 Battery system

The BESS technology provider is not yet confirmed; however, the batteries are likely to consist of modular Lithium-ion type racks, housed within battery enclosures containing protection, control and heating, ventilation and air conditioning.

Other infrastructure within the BESS compound will include:

- PCS comprising of inverters and battery transformers;
- HV reticulation including ring main unit (RMU), cables and switchboards; and
- Switch rooms and control rooms.

The PCS will be four-quadrant bidirectional type, with capability for both charge/ discharge in leading and lagging reactive power scenarios. The PCS will also have Grid forming capability to allow islanded operation and SRAS where required.



Project area
Proposed 330kV transmission connection
Battery Energy Storage System
Substation
Electricity transmission line
Railway
Cadastre

0 300 m

1:10,000 at A4
GDA94 MGA56

N

Data sources

Origin 2021,
Aerometrex 2020,
© Department Finance, Services and Innovation Dec 2020
© Department Customer Service

Figure 2-1 Project overview

2.2 Network connection

The Project would take advantage of the close proximity to the existing TransGrid owned 330 kV switchyard which has sufficient spare capacity for the size of the proposed BESS. The Project's connection will be electrically separate to that of EPS, so it can be operated independently of the EPS.

The following components are required to connect the BESS to the NEM:

- 33/330 kV transformers in a bunded transformer area;
- Overhead steel structure lattice towers c/w insulators and conductor(s) spanning the distance between the Project area and the existing TransGrid 330 kV switchyard;
- Associated protection and control systems.

Connection works into the TransGrid switchyard is targeting existing vacant connection bays but allowance is made for bench extension and installation of additional infrastructure.

2.3 Additional description for visual assessment purposes

The following description is provided for context and general awareness of a BESS that is typical of the concepts being considered by Origin and the basis on which the visual impacts have been assessed. The final layout and design have not been determined.

Origin has completed a request for tender process from which the preferred technologies will be selected for the development of the first stage of the Project but ultimate technology selection is not complete and as such no detailed design is currently available. However, based on Origin's selection process a good understanding of available technology on offer is available. The Project description is typical of the concepts being considered by Origin and where necessary ranges are provided to accommodate options currently under consideration. It should be noted that the pace at which technology is developing in the battery storage space means that the option selected for early stages may not be replicated throughout subsequent stages. In general, environmental performance, energy density and built-in controls are expected to improve such that reasonable worst-case assumptions based on current technology would be unlikely to be exceeded and may be reduced.

The BESS compound is proposed to be installed in up to three stages and targets land within the Project area immediately south of Rocky Point Road. Flexibility is available within the BESS compounds for each stage to arrange power islands in different ways. This flexibility would facilitate necessary separation distances, asset protection and otherwise respond to constraints. Origin is considering various stage layouts and the detailed design of each stage would consider technology selection, design mitigation measures, layout and location to best balance environmental impacts, cost and achieve assessed performance outcomes. Visualisations depicting an aerial view of the BESS compound at full development is depicted in **Photo 2-1.**

Conceptually, the 700 MW – 2,800 MWh Project may comprise in the order of 2,000 to 8,500 battery enclosures, dependant on the selected supplier, containing battery modules with individual capacity of 0.3 to 1.4 MWh of energy storage. The largest enclosure type under consideration is be in the order of 2.5 m x 2.5 m x 2.8 m (length x width x height). When arranged in rows, all enclosures under consideration resemble a shipping container as depicted in **Photo 2-2**.

Photo 2-1: Indicative aerial visualisation of Project at full development

Photo 2-2: Indicative visualisation of within BESS compound

The enclosures would likely be organised in rows and integrated with power conversion systems (inverter / transformers) servicing a number of enclosures to convert direct current from the battery to alternating current required within the electricity network. The rows of BESS enclosures would be physically separated and each enclosure substantially self-contained with local control and protection devices. Each enclosure would contain racked battery modules. A battery module is typically a standalone component, which, depending on the technology chosen may be as small as the size of a briefcase. Each enclosure would typically be cooled by conventional cooling systems. Enclosures would likely include electronics such as battery management systems and battery control systems and cabling. Multiple enclosures would connect to an inverter that converts direct current DC electricity to alternating current AC for distribution and ultimate transmission to the electricity network.

Power distribution feeding electrical power to a substation is expected to include both underground and above ground cabling. A transmission connection consisting of above ground 330 kV transmission lines to the electricity network would be run from the transformer bay to the TransGrid switchyard and require the establishment of an easement. Firefighting tanks, pumps and water reticulation may be located at the site as well as surface water drains and retention ponds.

2.3.1 Dimensions and layout

For the purposes of identifying potential Project viewpoints the following has been assumed:

- Transmission structures of 50 m height above existing ground level;
- Structures of up to 9 m above the 16 m AHD finished surface level (FSL) within the BESS substation; and
- Structures of up to 5 m above the 16 m AHD FSL within the BESS compound area.

These assumptions are based on the indicative dimensions of key Project features that could affect visibility as summarised in **Table 2-1**.

Table 2-1: Component dimensions

Component	Description
BESS and Transformer bay finished surface level (FSL)	Finished surface level of BESS compound and transformer bay would be approximately 16 m AHD (Average elevation across site).
Battery enclosures	Up to approximately 8500 enclosures of up to 3 m height above FSL arranged in strings and spread across the BESS compound area. Colour treatment would be white for thermal management and longevity requirements.
Power conversion systems (inverter transformers)	Up to 350 arranged amongst battery enclosure strings with height of up to 2.5 m. Preference for muted pallets for components where feasible.
330/33KV transformers	Up to three transformers (235 -285 MVA) located to the east of the Project area with following typical heights: ▪ Tips of bushings approximately 11 m ▪ Fire wall (if required) of approximately 9 m ▪ Conservator tank of approximately 8 m ▪ Radiators of approximately 7 m ▪ Main tank of approximately 4.5 m. For the purpose of visual impact assessment, a height of 9 m has been applied for the indicative BESS substation area as items exceeding this height would be less noticeable.
Transmission structures	Five double circuit steel lattice suspension towers with a height of 50 m. Steel lattice conductor landing gantries at the BESS substation and TransGrid switchyard.
Other	The following ancillary items may also be located within the Project area and specifically within the BESS compound and transformer bay area: ▪ Ancillary buildings including control rooms, switch rooms and amenity buildings that would not exceed 5 m above FS; ▪ Lighting and lightning protection poles (height to be determined); and ▪ Fencing of approximately 3 m surrounding BESS compound and transformer bay areas.

3. Contextual Analysis

3.1 Project area and visual context

The Project area is set within the existing Origin landholding which includes vegetated and topographical buffers between the EPS and sensitive receptors. The Project would be installed in close proximity to existing EPS operational areas and targets the use of land previously disturbed by the EPS construction and upgrades that has subsequently been rehabilitated in places.

The general Project area context is depicted in **Photo 3-1** with the BESS compound to be located in the area of disturbance directly above the inlet canal and circular attemperation dam and network connection running to the TransGrid switchyard in the centre of the photo. Nearest neighbours on Border Street are depicted in the foreground below Wangi Road with nearest neighbours in Gradwells Road located in the light green cleared area in the centre left of the photo.

Photo 3-1: Aerial view of Origin landholding associated with the EPS from above Lake Eraring (south east)

Infrastructure associated with the EPS is evident and typical within the landscape surrounding the Project area which is otherwise largely vegetated with interspersed rural residential development and road, water management and electrical infrastructure.

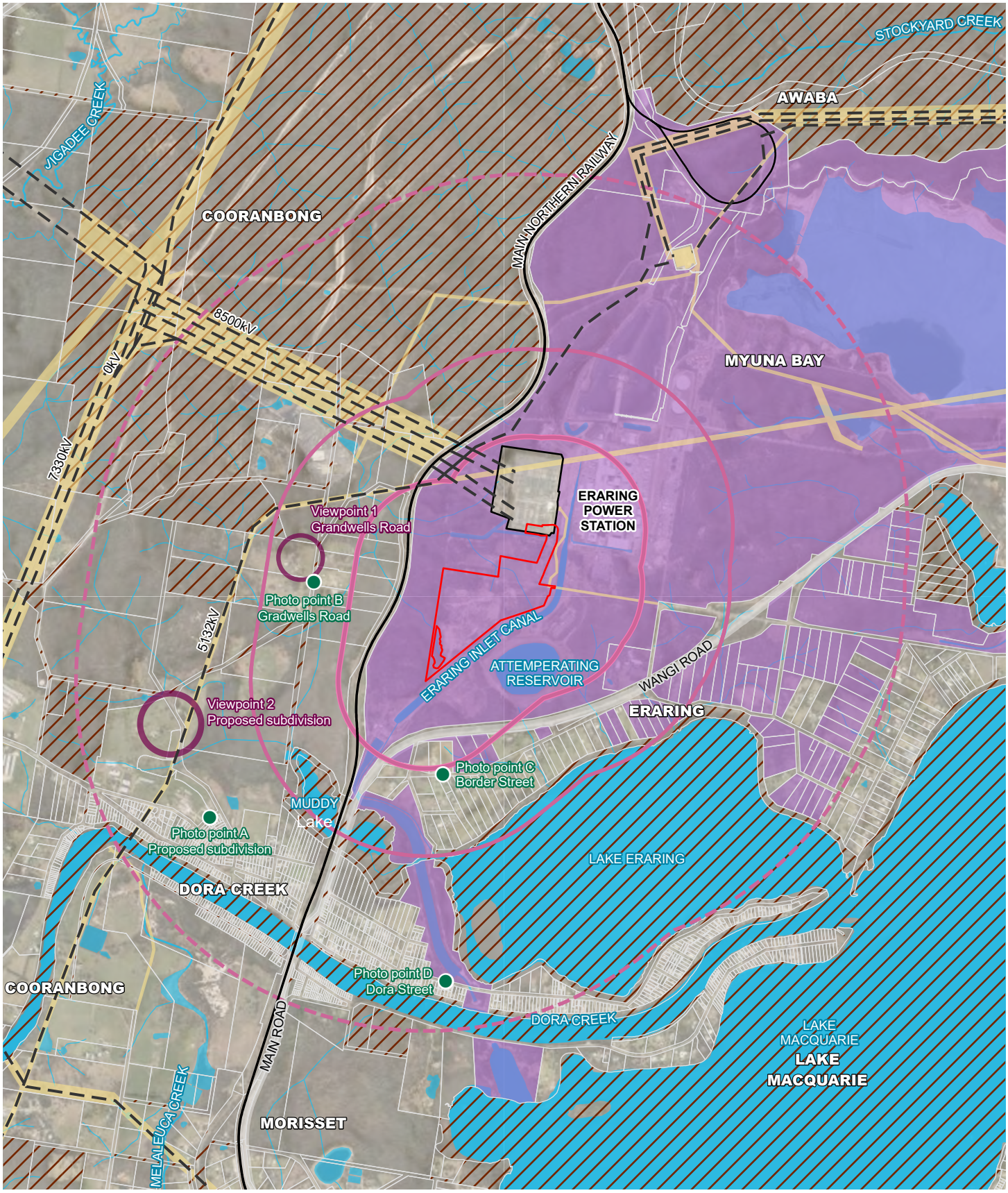
The BESS compound and transformer bays would be located approximately 400 m south west of the EPS turbine hall and 300 m south of the existing TransGrid switchyard. The network connection would be installed between the proposed transformer bays to the east of the Project area to the south east corner of the existing TransGrid switchyard where it would connect into existing or extended gantries and existing 330 kV transmission network which are depicted in **Photo 3-2**.

Photo 3-2: View of vacant gantry at TransGrid switchyard

Both the EPS turbine hall and TransGrid switchyard have FSLs of approximately 16 m AHD. The tops of the existing EPS turbine hall and tower structures are approximately 100 and 200 m above ground level respectively and are partially visible from some publicly accessible locations Refer to Photos 3-3 to 3-6 below). Infrastructure within the existing TransGrid switchyard is in the order of 20 m in height above ground level.

The Project area comprises land immediately adjacent to the EPS turbine hall and TransGrid switchyard. This area is not visually prominent within the landscape due to mature trees that heavily filter intervisibility and existing power-related infrastructure surrounding the Project area.

The visual context of the Project is illustrated in **Figure 3-1** (land tenure), **Figure 3-2** (topography) and **Figure 3-3** (land use zones). **Table 3-1** summarises land use zones, dwellings and publicly accessible locations within 2 km of the Project and the potential for these sensitive receptors to view the Project.



Project area

Distance from Project area
- 500m
- 1000m
- 2000m

Photo location

Viewpoint

TransGrid switchyard

Crown land

Origin landholding

Easement

Cadastre

Railway

Electricity transmission line

0 1000 m

1:30,000 at A4
GDA94 MGA56

Data sources

Origin 2021, Jacobs 2021

Figure 3-1 Land tenure

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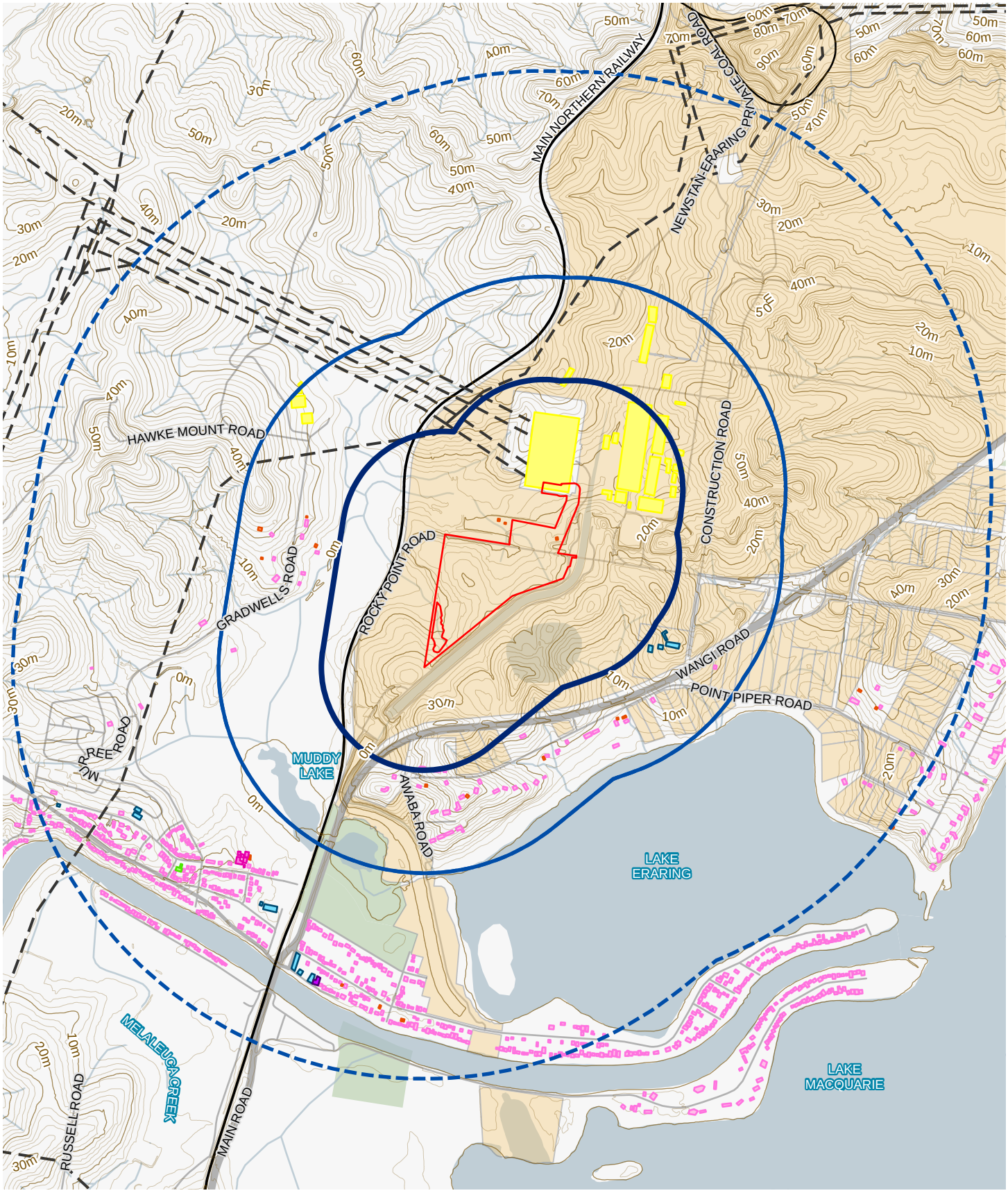

Figure 3-2 Surrounding Land Usage

Project area
Photo location
Viewpoint

Distance from Project area
500m
1000m
2000m

Land zoning
B1 Neighbourhood Centre
E2 Environmental Conservation
E3 Environmental Management
E4 Environmental Living
R2 Low Density Residential
RE1 Public Recreation
RU2 Rural Landscape
RU4 Rural Small Holdings
RU6 Transition
SP1 Special Activities
SP2 Infrastructure
SP3 Tourist
W1 Natural Waterways
Electricity transmission line
Railway

0 1000 m
1:30,000 at A4
GDA94 MGA56

Data sources

Origin 2021, Jacobs 2021

Figure 3-3 Land use zones

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Table 3-1: Potential visual receptors

Distance	Land zoning	Potential for views
Within 250 m	SP2 or E2 zones only.	There are no residential dwellings or publicly accessible viewpoints within 250 m of the Project. The Great North Railway line passes within 250 metres at its nearest point but is screened by vegetation within the E2 zoned land which would not be impacted by the Project and is otherwise unlikely to be removed.
250 - 500 m	Predominantly SP2 and E2 zoning with RU4 zoned land on Border Street to the south.	The Publicly accessible Wangi Road is located within 500 metres of the Project along with approximately five dwellings on Border Street, Lake Eraring. No views to the Project are likely from these publicly accessible locations due to intervening topography and infrastructure associated with EPS attemperation dam and inlet canal. Portions of private property within 500 m but zoned E2 to the west are not screened by topography but dense vegetative screening is present and protected by E2 zoning and Origin ownership.
500 m – 1 km	Predominantly E2 and SP2 with RU2 zoned land along Gradwells Road to the west and RU4 and E4 along Border Street to the south east.	Approximately nine dwellings are located within 1 km to the west on Gradwells Road and 25 dwellings to the south east on Border Street. No views to the Project are likely from publicly accessible locations due to intervening topography, infrastructure associated with EPS attemperation dam and inlet canal and dense vegetation protected by E2 zoning and Origin ownership.
1 km – 2 km	Predominantly E2 and SP2 with R2 zoned areas of Dora Creek to the south and E4 zone area towards lake Eraring in the east.	Approximately 800 dwellings are associated with the suburb Dora Creek and 100 with the suburb of Eraring with most located between 1.5 and 2.5km from the Project to the south. No views to the Project are likely from publicly accessible locations in any direction due to intervening topography, infrastructure associated with EPS attemperation dam and inlet canal and dense vegetation protected by E2 zoning and Origin ownership.

Sensitive receivers and social infrastructure in the locality of the Project are largely related to Lake Macquarie and publicly accessible shoreline and recreation areas. No near or medium field scenic or significant vistas are identified as having views impacted by the Project. The tops of the EPS turbine hall and tower structures are visible from public recreation areas and for recreational users of Lake Macquarie, however, the intervening topography and vegetation and the lower nature of the Project means these vistas are not likely to experience disruption. The nearest airport (Lake Macquarie Airport) is located 11 km from the Project at Marks Point. Flights arriving and departing to and from the west would be able to observe the Project within the landscape.

A number of images from publicly accessible areas have been included to illustrate the visual context of the Project area. The area north of the Project is not publicly accessible.

Figure 3-1 shows the location of each image. The images shown are:

- **Photo 3-3**: Location A – Looking north east from Greenway Street (indicative of subdivision under construction);
- **Photo 3-4**: Location B – Looking east from Gradwells Road (indicative of nearest neighbour views);
- **Photo 3-5**: Location C – Looking north to Project area from Border Street; and
- **Photo 3-6**: Location D – Looking North from Dora Street.

Photo 3-3: View from southwest from proposed subdivision looking across Project area to EPS

Photo 3-4: View towards Project area from Gradwells Road – nearest publicly accessible receptor

Photo 3-5: View from south east from Border Street to EPS

Photo 3-6: View from south on Dora Street towards Project area and EPS

Photo 3-3 to **Photo 3-6** illustrate how views from the surrounding area are filtered by intervening vegetation and topographic screening. The filtering of views towards the Project area is provided by mature vegetation along a ridge line to the west, the elevated landform of the EPS inlet canal to the south and east, elevated attemperation dam to the east and main EPS operations area, elevated TransGrid switchyard, coal yards and extensive buffer lands to the north of the Project area. A small depression in the ridgeline to the west may provide views into the Project area from the nearest dwelling to the west, were it not for the presence of vegetative screening which has canopy heights of approximately 26 m AHD. Intervening vegetation is zoned E2 Environmental Protection and would not be impacted by the Project and is unlikely to be otherwise removed.

3.2 Land Use and Strategic Context

3.2.1 Lake Macquarie Local Environment Plan 2014

The Project is located entirely within the Lake Macquarie Council Local Government Area (LGA).

The Project area is zoned SP2: Infrastructure under the *Lake Macquarie Local Environmental Plan 20014* (Lake Macquarie LEP). The objectives of the SP2 zone 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; and
- To provide land required for the development or expansion of major health, education and community facilities.

Any development type not listed as "permitted with or without consent" are considered development that is prohibited. The Project purpose being for the development of electricity generation works is accordingly an activity that is permissible with development consent under the Lake Macquarie LEP. The Project is considered consistent with the objectives of the SP2 zone.

3.2.2 Lake Macquarie Community Strategic Plan 2017-2027

The Lake Macquarie Community Strategic Plan (LMCC, 2017) sets out community visions and values such as the need to protect and enhance natural environments and to encourage an adaptable and diverse economy.

In particular, Lake Macquarie Council seeks to achieve the established values through actions such as supporting key industries to change and adapt to a diversifying economy, and to support businesses to build capability in using new technology in order to realise economic opportunities. Origin is capitalising on emerging technology in battery storage and facilitate industry transitioning away from coal towards renewable energy. The Project is not inconsistent with the community visions established in the Lake Macquarie Community Strategic Plan.

3.2.3 Lake Macquarie City Council Environmental Sustainability Strategy and Action Plan 2020-2027

The *Lake Macquarie City Council 2020 Together Lake Mac, Our Plan for a Sustainable City, Environmental Sustainability Strategy and Action Plan 2020-2027* (LMCC, 2020) sets out how the council can approach and implement key strategic directions in the Community Strategic Plan. Key environmental concerns for the community include efficient use of energy and water and climate change mitigation and adaptation. Targets set for 2027 include creating sustainable city and communities that maximise the efficient use of energy and reduce reliance on non-renewable energy sources. The Lake Macquarie key community values also emphasise creative process and outcomes that bring together history, culture knowledge and expertise that support new technologies and ways of thinking.

The Project is consistent with the established environmental and sustainability strategies as it highlights the use of emerging low emissions technology such as battery storage to facilitate the transition towards renewable energy on a local and regional scale.

3.2.4 Imagine Lake Mac 2050 and beyond

Imagine Lake Mac 2050 and Beyond (LMCC, 2019) aims to make the most of identified opportunities and public and private investment aligned with efforts to enhance social and environmental wellbeing to become one of the most productive, adaptable, sustainable and liveable places in Australia. It outlines the aspirations, strategies and how progress will be evaluated.

The following strategies and their evaluation are of relevance to the Project:

- Maximise the potential of existing infrastructure and natural assets to encourage investment, and economic and employment growth and provide for more diverse industries, including renewables, emerging and creative industries and the development of new small business in the new economy with evaluation linked to increased use of alternative energy sources;
- Avoid and minimise the impact of development on areas of high ecological value, while supporting opportunities to enjoy our natural areas as evaluated by the percentage of high ecological value areas maintained; and
- Once operations cease, Eraring Power Station is remediated and repurposed to another economic use, such as renewable energy generation.

The Project is wholly aligned with the aims of Imagine Lake Mac 2050 (LMCC, 2019) in that it seeks to repurpose previously disturbed land associated with the EPS while avoiding the high ecological value E2 zoned land and facilitating the increased penetration of renewables. The Project represents a significant private investment in infrastructure required to support renewables and does not preclude the future economic use of the wider Origin landholding.

4. Visual Impact Assessment

4.1 Introduction

When considering the predicted effect of changes upon views/ visual receptors, the sensitivity of the view to change is combined with the magnitude of the change to give an overall judgement of significance of impact supported by analysis of evidence and professional judgement. The *Guideline for landscape character and visual impact assessment* (Transport for NSW, 2020) is regarded as best practice for visual impact assessments within NSW and provides the following definitions:

Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed nature of change. For example, a pristine natural environment is likely to be more sensitive to a change of the nature of a four-lane motorway than a built-up industrial area.

Magnitude refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition. For example, a large interchange would have a very different impact on landscape character than a localised road widening in the same area.

Table 4-1 is taken from the Transport for NSW (**TfNSW**) guidelines and has been used to rank the criteria above and provide an overall impact assessment as a conclusion to this assessment. The assessment should also include a description to support the degree of sensitivity and magnitude assigned by the assessor.

Table 4-1: Impact assessment rating matrix

		MAGNITUDE			
		High	Moderate	Low	Negligible
SENSITIVITY	High	High	Moderate/High	Moderate	Negligible
	Moderate	Moderate/High	Moderate	Moderate/Low	Negligible
	Low	Moderate	Moderate/Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

4.2 Sensitivity, Magnitude and Impact

The sensitivity to change within the selected views is evaluated using the criteria set out below:

- **High** - Views and/ or receptors from or within areas of recognised national or local importance for their landscape value. Residential areas and occupied properties afforded existing, attractive views. Recreational users of footpaths including walkers and riders. Recreational road users. Visual receptors that are likely to contemplate, spend long periods of time and focus on particular views and, through the position of the receptor relative to the development have the capacity to experience the view.
- **Moderate** - Recreational users of the landscape that are site or activity focussed (i.e. hunting, shooting, nature conservation, golf, etc.) and outdoor workers where time to appreciate the view is limited. Visual receptors whose attention is likely to be focussed on their work or activity rather than the wider view.
- **Low** - Travellers and people at their place of work or users of indoor facilities. Visual receptors where exposure to the view is short-term and whose attention is likely to be focussed on their work or activity within an indoor environment. Receptors that are less sensitive to the type of changes to the pre-development view that would result from the Project.
- **Negligible** - Views from areas of low landscape quality/value within which visual receptors would not value the view. Travellers and people at their place of work where exposure to/appreciation of the view would be short-term and likely screened or heavily filtered. Receptors that are less sensitive to the type of changes to the predevelopment view that would result from the Project.

The magnitude of change upon views resulting from the project is evaluated using the criteria set out below:

- **High** - Complete or very substantial adverse change in view: change very prominent involving complete or very substantial obstruction of existing view or complete change in character and composition of baseline i.e. predevelopment view through removal of key elements or addition of uncharacteristic elements.
- **Moderate** - Partial obstruction of existing view or partial change in character and composition of pre-development view through the introduction of new elements or removal of existing elements. Change may be prominent but not substantially different in scale and character from the surroundings and the wider setting. Composition of the view will alter. View character may be partially changed through the introduction of features which, though uncharacteristic, may not be visually discordant.
- **Low** - Minor adverse change in baseline i.e. predevelopment view – change will be distinguishable from the surroundings whilst composition and character (although altered) will be similar to the pre-change circumstances.
- **Negligible** - Very slight change in baseline i.e. predevelopment view – change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.

4.3 Visual impact mechanisms

The Project has the potential to impact the visual amenity of receptors within the surrounding landscape through the installation of extensive areas of containerised batteries, electrical infrastructure and overhead powerlines within an area dominated by existing, larger energy generation and transmission infrastructure.

4.4 Viewshed

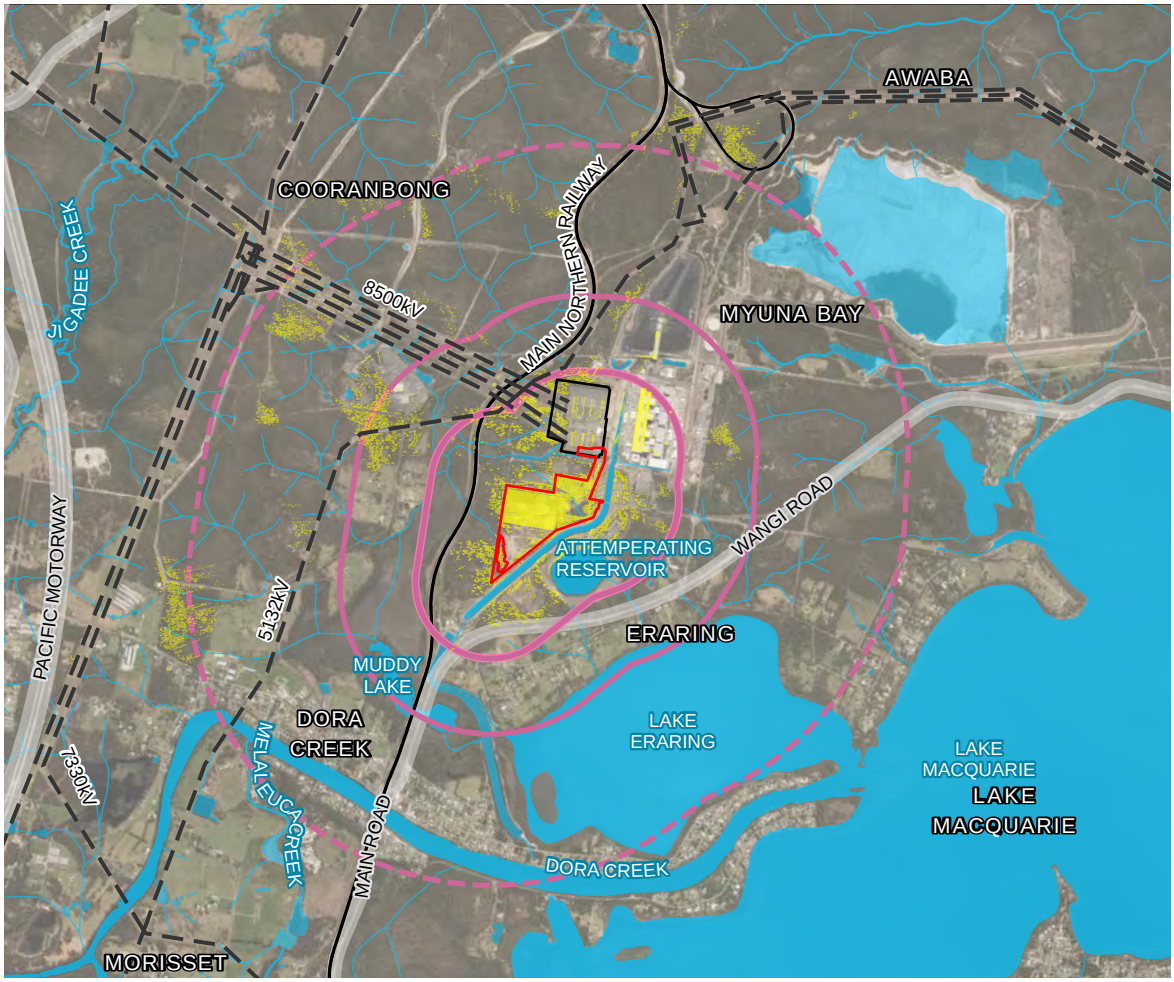
The viewshed comprises the area from within which the Project area would likely be visible. The extent of the viewshed is influenced by a combination of factors including elevation, landform and vegetation. **Figure 4-1** and **Figure 4-2** illustrate the area from which the BESS compound and substation and network connection structures may be visible.

This viewshed has been generated using the following method:

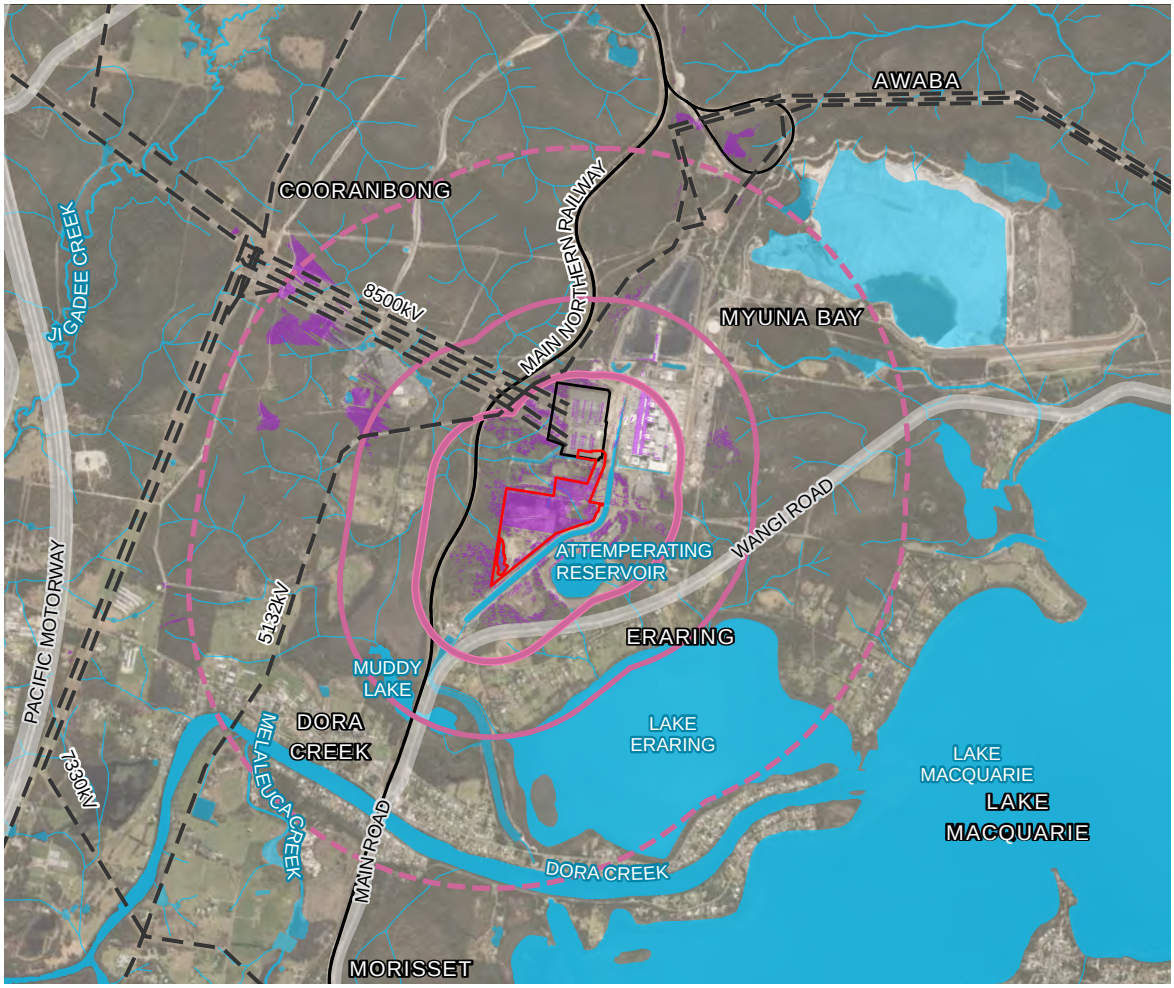
- Establishment of elevation models for both ground, buildings and vegetation from Lidar data;
- Establishment of the building envelope for major components of the Project (BESS compound and substation and transmission structures) reflecting assumptions presented in **Section 2.2**;
- Applying points to top of building envelope along all sides and tops of transmission structures; and
- Using Geographic Information Systems (GIS) to identify locations from which these points have unobstructed views.

The viewshed of transmission structures (refer to **Figure 4-2**) has been assessed separately from views of the BESS compound and TransGrid switchyard (refer to **Figure 4-1**). This has been done on the basis that due to their height they would be more likely to be visible while also less obtrusive than the building envelope of the BESS infrastructure due to their lattice type structure and consistency with existing transmission structures in the area.

Viewsheds for each infrastructure type are also presented with and without vegetation external to the Origin landholding. While neither scenario is perfect, the "with vegetation" versions illustrate where views are most likely even if they are from tops of trees, while no vegetation version indicates ground level viewpoints with no intervening offsite vegetation. Both are considered conservative in different ways so are used to inform identification of potential viewpoints and are not specifically indicative of a visual impact being likely.



Project area
TransGrid switchyard
Distance from Project area
500m
1000m
2000m
Views to BESS compound and substation (includes external vegetation and buildings)
Electricity transmission line
Railway



Project area
TransGrid switchyard
Distance from Project area
500m
1000m
2000m
Views to BESS compound and substation (excludes external vegetation and buildings)
Electricity transmission line
Railway

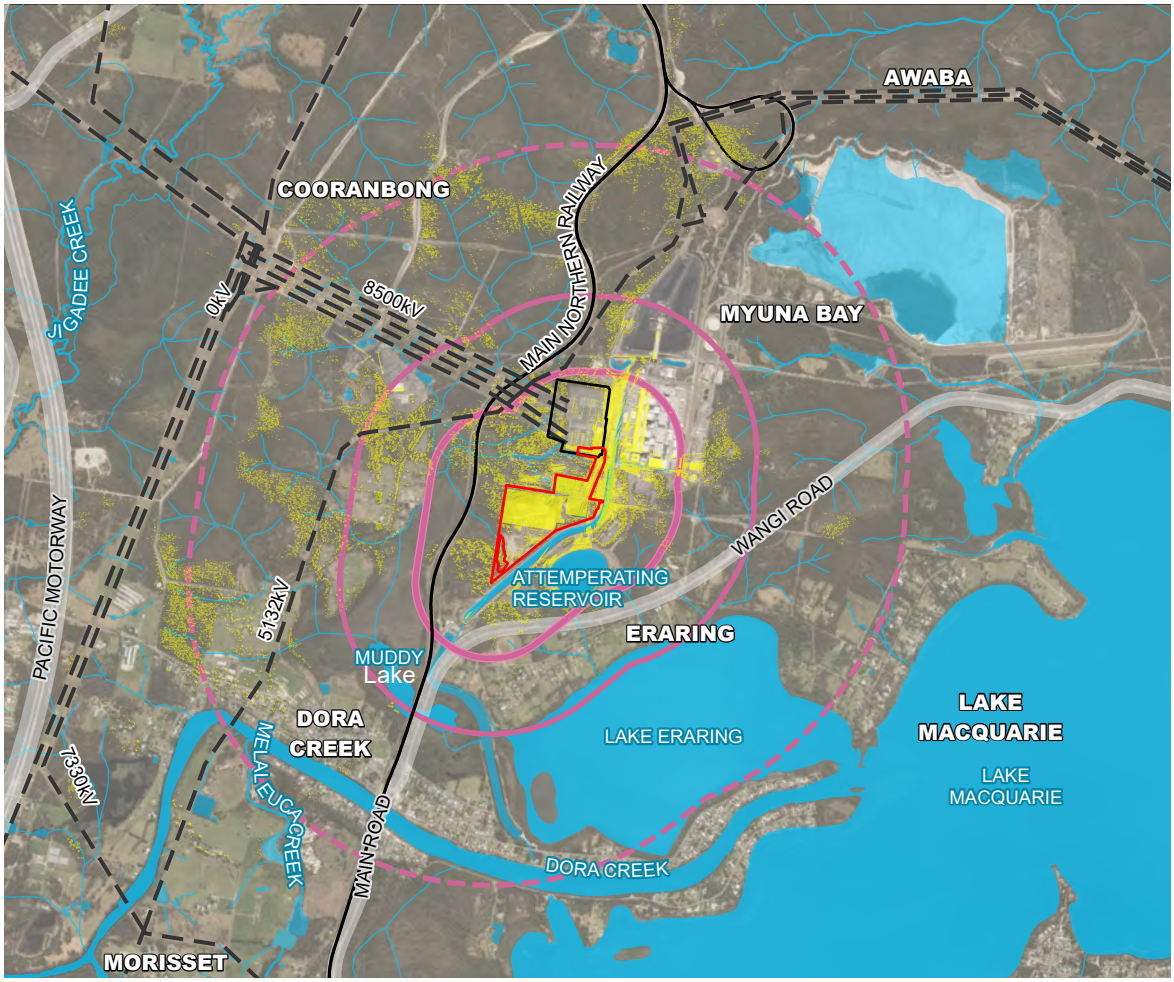
Data sources

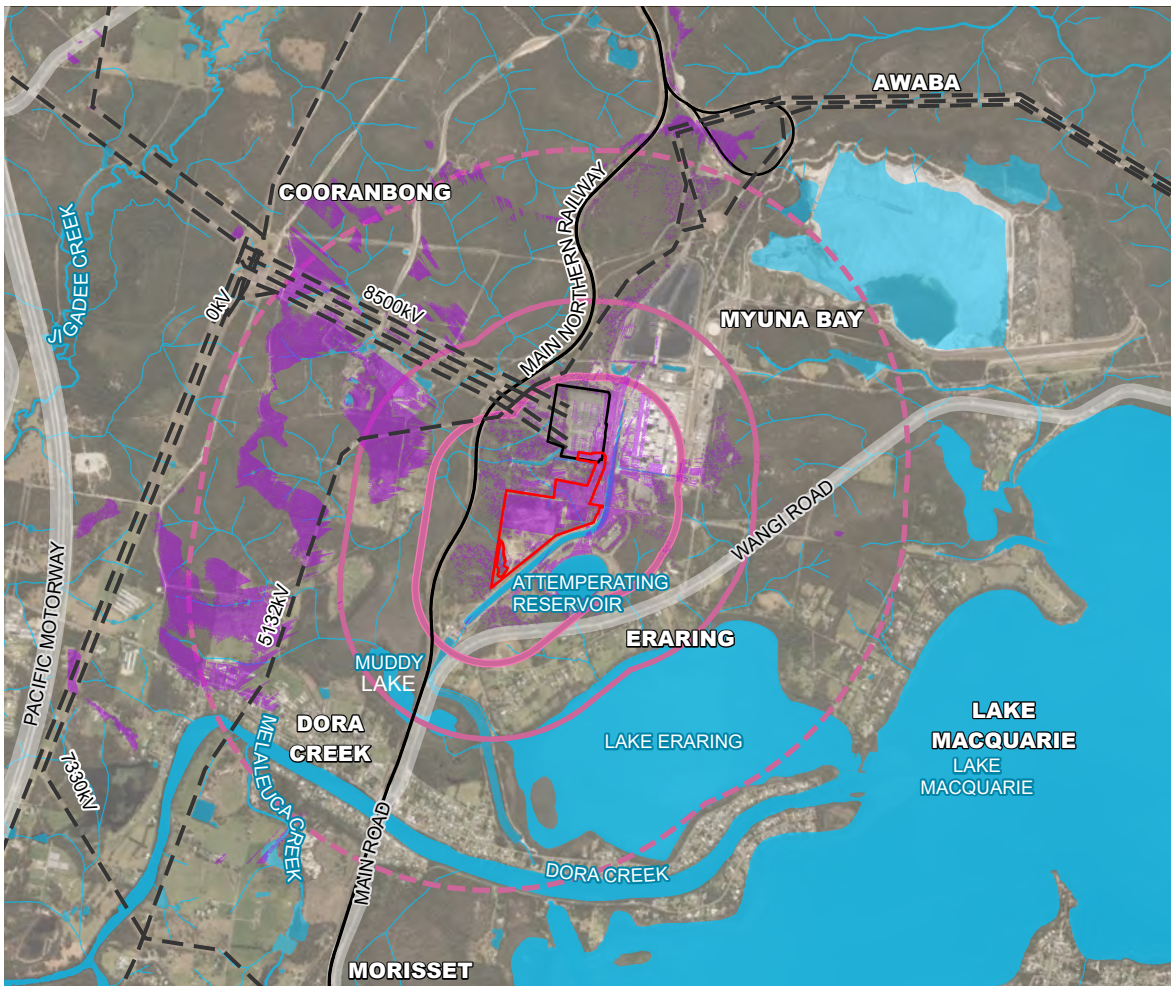
Origin 2021
Jacobs 2021,
© Department Finance, Services and Innovation Dec 2020

0 1000 m

1:50,000
GDA94 MGA56

Figure 4-1 BESS compound and substation view shed analysis





Project area
TransGrid switchyard
Distance from Project area
500m
1000m
2000m
Views to transmission structures (includes external vegetation and buildings)
Views to transmission structures (excludes external vegetation and buildings)
Electricity transmission line
Railway

Data sources

Origin 2021
Jacobs 2021,
© Department Finance, Services and Innovation Dec 2020

0 1000 m

1:50,000
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Figure 4-2 Transmission structures view shed analysis

As illustrated in **Figure 4-1** by the area coloured yellow (includes vegetation) and purple (excludes external vegetation) the BESS compound and substation are likely to be readily visible within the landscape from publicly accessible locations. While views from tree tops are illustrated, these are almost exclusively limited to within heavily wooded areas of crown land or Origin landholdings (refer to **Figure 3-1** and **Figure 3-3**). Views from ground level are limited to densely wooded areas within crown land or otherwise access restricted land where dense woodland would heavily filter any potential views towards the BESS compound and substation.

Figure 4-2 illustrates a larger area potentially being afforded views of the transmission structures. Unlike for the BESS compound and substation, off-site vegetative screening is of greater importance in obscuring views and a number of locations in public ownership may be able to see the tops of tower structures. Two locations from **Figure 4-2** have been selected for further analysis on the basis that they are most likely to be impacted. These are:

- Viewpoint 1: High points in private property west of Gradwells Road to the west; and
- Viewpoint 2: High points in private property west of Gradwells Road to the south west.

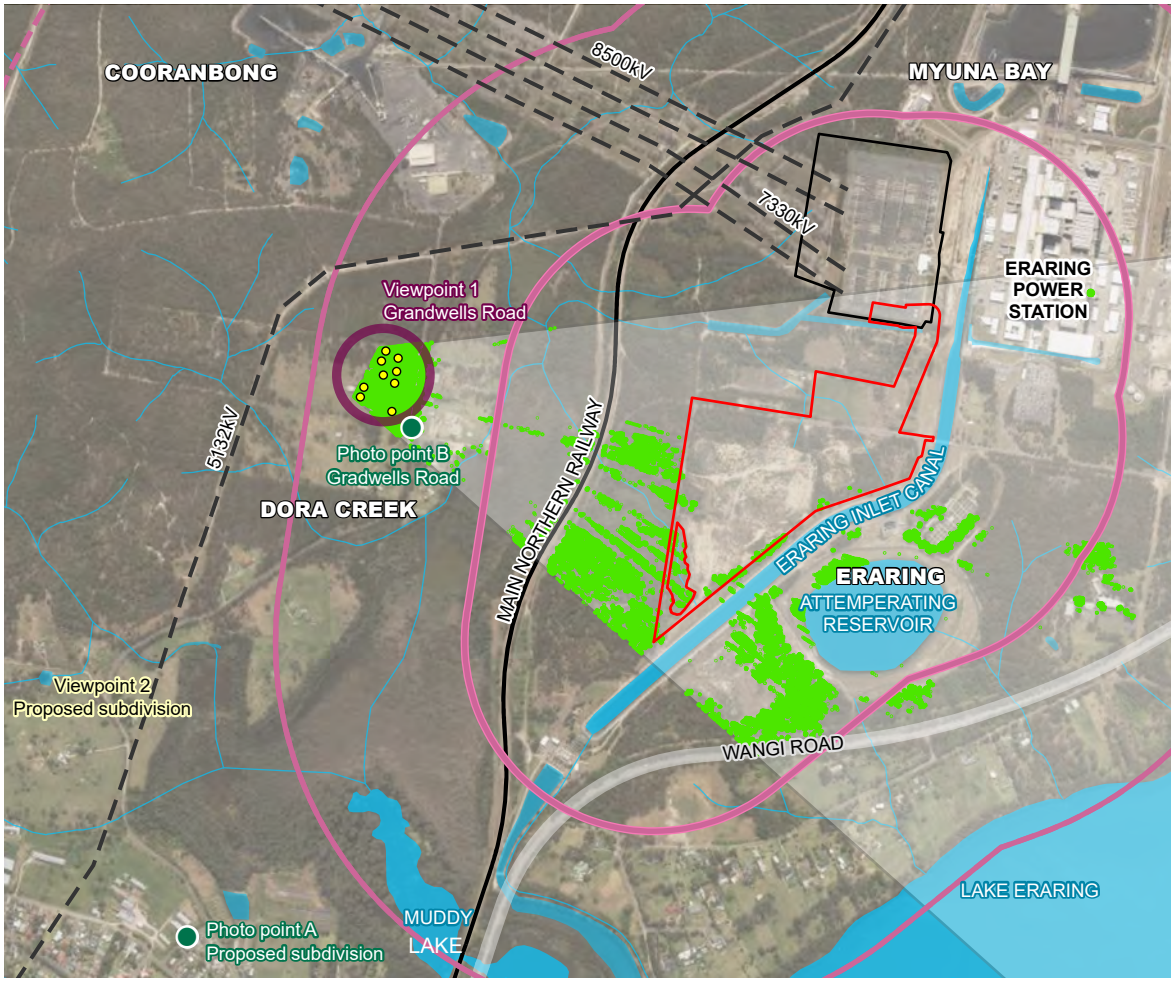
Further analysis from these locations included:

- Selecting observer locations within the digital terrain model;
- Applying 2 m view height to represent eye level; and
- Analysis of what can be seen with intervening vegetation included.

The results of this analysis are illustrated in **Figure 4-3**.

Based on the analysis the following conclusions are drawn in relation to potential visibility of transmission structures (and can be inferred as also being applicable to the BESS compound that sits lower in the landscape):

- Tops of transmission structures may be visible from west and south west of the Project area;
- Intervening vegetation provides significant screening such that limited vantage points are available; and
- Views affected by the addition of the transmission structures already feature existing transmission structures, the EPS turbine hall and tower structures.



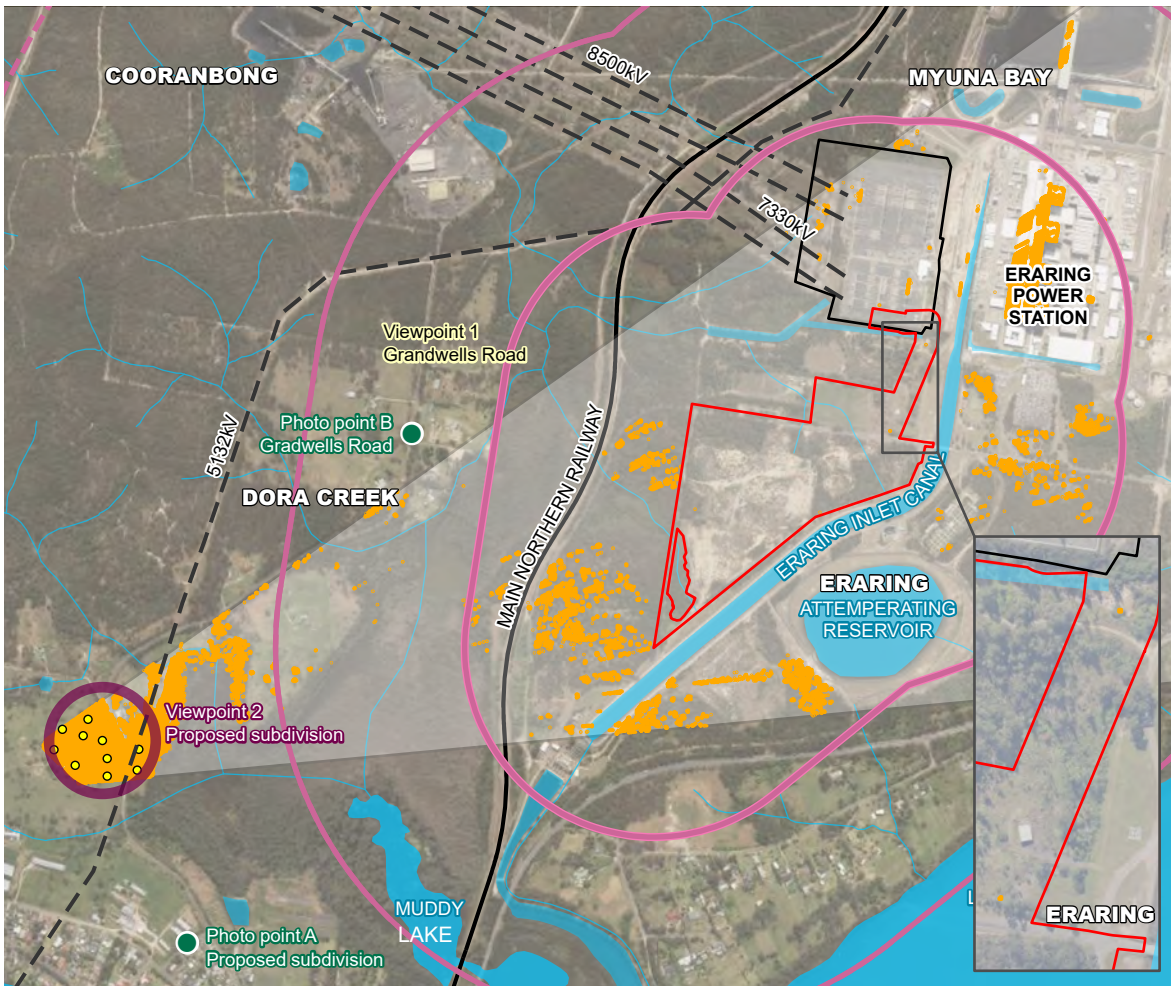


Figure 4-3 Views of BESS compound, switchyard and transmission towers

4.5 Viewpoint Analysis

4.5.1 Viewpoint 1: Indicative near neighbour viewpoint

Description

This viewpoint looks east from the Gradwells Road reserve across a residential property landholding towards the Project area (refer to **Photo 3-4**). The road reserve features mature trees that filter views east towards EPS. This viewpoint illustrates both the view from Gradwells Road and the adjacent residential property which is set at a slightly lower elevation than the road. East of the property, dense vegetation heavily filters views beyond with further visual containment provided by a low, heavily vegetated ridgeline. The EPS turbine hall and tower structures are local landmarks and are visible against the skyline approximately 1 km to the east with views filtered by intervening trees.

Sensitivity

The sensitivity of the view is High due to the viewpoint being representative of the adjacent residential receptor where occupants are likely to contemplate, spend long periods of time and focus on views. Viewers in this location include residents and road users afforded existing, rural views that feature EPS as a local landmark on the skyline. The local landscape is not recognised for particular characteristics or quality and road users would have short-term exposure to/appreciation of long or panoramic views which would likely be screened or heavily filtered by landform and vegetation.

Magnitude

The magnitude of change would be negligible within this view. The visible changes would likely be minimal from this location given the approximate 1 km distance over which they would be seen, the visual screening provided by the existing landform and vegetation surrounding the Project area and the dense vegetation and low ridgeline immediately east of the property. The composition and character of the existing view would remain substantially unaltered following the proposed changes as the addition of two transmission structures within the view would be seen within the context of the existing, visually dominant, EPS structures. The BESS compound and TransGrid switchyard would not be visible from the viewpoint due to the dense woodland within the Origin landholding west of the Project area. The tower structures would be partially visible above the treeline as relatively lightweight structures when viewed as adjacent to the EPS turbine hall and tower structures which currently form focal points within the view. Due to the nature of the proposed changes, their partial screening by intervening vegetation and the distance over which they would be viewed the changes would not be remarkable within the view.

Summary

The impact of the Project on Viewpoint 1 has been assessed as negligible.

4.5.2 Viewpoint 2: Indicative proposed subdivision viewpoint

Description

This viewpoint looks northeast from private land on Gradwells Rd in the direction of Muddy Lake, towards the Project area and EPS which is visible on the skyline. The viewpoint location is illustrative of potential future views from the Gradwells Road subdivision where the landform generally slopes downwards towards Muddy Lake across gently rolling terrain. Views towards EPS are heavily filtered by intervening vegetation within the Origin landholding, dense stands of woodland southwest of Muddy Lake and a vegetative strip alongside Gradwells Road. Views from the western extents of the subdivision are generally from a higher elevation and feature more intervening nearfield vegetation. Views from the eastern extents of the subdivision are from lower in the landscape and feature more open views (illustrated in **Photo 3-3**).

Sensitivity

The sensitivity of the view is High due to the viewpoint being representative of views experienced by residential properties, where occupants are likely to contemplate, spend long periods of time and focus on views. Viewers in this location include residents and road users afforded existing, rural views that feature EPS as a local landmark on the skyline, at a distance of approximately 2 km. Whilst Muddy Lake is a local feature in the landscape, the wider locality is not recognised for particular characteristics or quality and road users would have short-term exposure to/appreciation of long or panoramic views which would likely be screened or heavily filtered by landform and vegetation.

Magnitude

The magnitude of change is negligible within this view. The visible changes would likely be minimal from this location given the visual screening provided by the existing, dense vegetation surrounding the Project.

The composition and character of the existing view would remain substantially unaltered following the proposed changes as the addition of two transmission structures within the view would be seen within the context of the existing, visually dominant, EPS structures. The BESS compound and TransGrid switchyard would not be visible from the viewpoint due to the dense woodland within the Origin landholding west of the Project area. The tower structures would be partially visible above the treeline as relatively lightweight structures when viewed as adjacent to the EPS turbine hall and tower structures which currently form focal points within the view. Due to the nature of the proposed changes, their partial screening by intervening vegetation and the distance over which they would be viewed the changes would not be remarkable within the view.

Summary

The impact of the Project on Viewpoint 2 has been assessed as negligible.

4.6 Visual Impact Assessment Summary

The assessment reveals the visibility of the Project as being relatively limited from publicly accessible areas within the locality as a result of visual screening provided by existing vegetation within the Origin landholding.

Two viewpoints were selected for assessment from the area surrounding the Project. Both viewpoints would experience negligible impacts due to the distance over which the change would be viewed, the presence of intervening vegetation and the presence of existing adjacent/ surrounding power-related built form/ infrastructure within the view.

Distant views towards the EPS from recreational users of Lake Macquarie or from the mountain range to the west would experience negligible impacts due to the distance over which they would be seen. Views would include the existing EPS infrastructure, TransGrid transmission lines and pockets of developed land and while BESS technology is new, its appearance in far field views would be typical of low-rise urban development, greenhouses or rural farms buildings that exist near Dora Creek.

A summary of the visual impact assessment is provided in **Table 4-2**.

Mitigation strategies relating to the Project are described in **Section 5**.

Table 4-2 Summary of visual impact assessment

Viewpoint	Sensitivity	Magnitude	Impact Rating
Viewpoint 1	High	Negligible	Negligible
Viewpoint 2	High	Negligible	Negligible

4.7 Changing land use context

It is noted that the Project would be operational beyond the end of life of the EPS and occur within a changing land use context. At this stage a future land use for the EPS has not been confirmed however the current land use zoning and applicable strategic plans as described in **Section 3.2** envisage the ongoing use of the Origin landholding for energy generation purposes.

The BESS infrastructure is generally low-lying, containerised infrastructure established in a formalised layout. Such a layout is unlikely to be detrimental from a visual perspective for likely future land uses of the Project area. In the event that more visually sensitive land uses are proposed the low-lying nature of the infrastructure can be readily screened with mitigation planting.

5. Mitigation Measures

Origin will seek to minimise disturbance associated with the Project, for example by retaining existing mature vegetation and limiting areas of disturbance where possible in order to limit the overall environmental impact of the Project. This would have the effect of also mitigating any visual impacts of the Project.

5.1 Draft landscape management plan

The SEARs require the preparation of a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners. The following recommendations form the draft landscape management plan for the Project and would be incorporated into the construction and operational environmental management documentation as required in response to detailed design and conditions of approval:

- Retention and enhancement of existing landscape features (areas of scrub, individual trees) will be considered where feasible and not conflicting with bushfire management requirements;
- Limit the area of disturbance during construction where possible;
- Colour of proposed structures and built form will be considered in a suitable muted palette to visually integrate the Project within the landscape where possible noting that battery enclosures may need to be white for thermal regulation and longevity requirements;
- BESS compound and TransGrid switchyard night lighting will be oriented inwards and downwards to minimise light spill;
- Transmission structure lighting will be limited to the extent necessary for safety and aeronautical purposes (if required); and
- The use of reflective surfaces will be minimised to avoid drawing attention to the site within views due to reflective glare.

No perimeter planting is considered warranted based on the existing mature vegetation surrounding the Project area which would render additional planting redundant. On the basis that the visual impact assessment has not identified landowners likely to be significantly affected by visual impacts from the BESS compound, there would be no benefit from perimeter planting, therefore no consultation with landholders relating specifically to visual impact has been undertaken.

Community members will have the opportunity to submit feedback including in relation to visual impacts as part of the EIS exhibition process. Origin also has a dedicated email address and a contact number to ensure community members can provide feedback and raise any issues they may have. Origin has a dedicated community complaints procedure to manage all complaints and concerns from the community. The most common feedback methods are outlined in **Table 5-1**.

Table 5-1: Origin consultation contact details

Feedback method	Details
Dedicated 1800 number	A 1800 number is available for all stakeholders to lodge enquiries and complaints. 1800 677 315
Email	A dedicated email address for Origin Development Projects enables stakeholders to provide feedback or ask questions. Powerdevelopmentprojects@originenergy.com.au