Steel River East Battery Energy Storage System

Visual Impact Assessment

Ausgrid Australia

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Glossary and definitions

Term	Definition
AGL	Above Ground Level
AHIMS	Aboriginal Heritage Information Management System
BESS	Battery Energy Storage System
DPHI	NSW Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
km	kilometre
kW	Kilowatt (measure of energy)
kWh	Kilowatt hours
Landscape	Its constituent elements, its character and the way this varies spatially, its geographic extent, its condition, the way the landscape is experienced, and the value attached to it.
VIA	Visual Impact Assessment
LEP	*Local Environmental Plan*
MW	Mega Watt
Magnitude of change	The level of modification that a proposed development has to the existing setting
NEM	National Electricity Market
PCT	Plant Community Type
SEARs	the Secretary's Environmental Assessment Requirements
the Project	The proposed grid-scale battery energy storage system (BESS), along with associated infrastructure, located next to the existing substation in the Steel River Industrial Estate at 1 McIntosh Drive, Mayfield West
SEPP	State Environmental Planning Policy
STSS	sub-transmission switching substation
SSD	State Significant Development
the site	Proposed location for the Project, at 1 McIntosh Drive, Mayfield West
Study Area	The Projects' Study Area includes a 500m buffer from the perimeter of the site, where the Project has the potential to be most visible based on height of components.
SUP	Shared Use Path – for the use of both pedestrians and cyclists
Viewpoint (VP)	Moderate or high sensitivity location from which views to the construction process or components of the project may be possible.
Visual envelope	Or Viewshed - the area visible from a particular viewing location.
Visual amenity	The qualities of a landscape setting that are appreciated and valued by a viewer.
Visual catchment	The area over which an object can be seen within the landscape based on the line of sight.
Visual impact	The result of assessing the sensitivity level of a viewer and the modification level of a development.
Visual sensitivity	The degree to which various user groups would respond to change based on their expectation of a particular experience in a given setting; for example, the expectation of a high level of visual amenity in a national park.
ZTV	Zone of Theoretical Visibility

Executive Summary

Project overview

This Visual Impact Assessment (VIA) for the Steel River East Battery Energy Storage System (the Project) has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project. The Project will be a grid-scale battery energy storage system (BESS) and associated infrastructure (the Project). The Project is located within the existing Steel River Industrial Estate, adjacent to an existing substation at 1 McIntosh Drive, Mayfield West (the site).

The landscape and visual baseline

The VIA Study Area has been defined within a radius of 500 metres from the location of the site. This area captures where the Project will be observable, based upon the height of Project elements (up to 7 m in height), topographical characteristics and intervening elements in the surrounding area.

Relevant planning policies and legislation have been reviewed to understand any specific landscape or visual designations relating to the Study Area. A desktop study has been undertaken to understand the various physical elements that combine to create landscape and visual character.

The Project is subject to the Newcastle Local Environmental Plan (LEP), in land zoned E4 – General Industrial. There are no specific planning designations attributing any significant landscape or visual value within the Study Area. Surrounding land use comprises large infrastructure including an electrical substation, recycling depot, manufacturing, construction and commercial buildings.

Visual assessment findings

There were four public viewpoints (VP) identified within the Study Area that were representative of residential dwellings and road corridors, of differing viewing distance and aspect from the Project. Viewer sensitivity in the Study Area is generally low, due to the nature of industrial zoned land.

The visual modification of the Project is considered low due to adjacent existing larger industrial and electrical infrastructure. The main influence on the magnitude of visual change is caused by the removal of vegetation, and the resulting partial views of the Project elements. The assessment found the following impacts on visual receivers during construction and in the first year of operation:

- **Low visual impacts** experienced by users in close proximity to the Project including, adjacent Shared Use Path (SUP) and people in vehicles on Tourle Street, as assessed in VP1 and VP3 (respectively).
- **Negligible visual impacts** for industrial workers within the industrial estate 250m to the west of the Project (VP3), or for the closest residents located south of Industrial Drive (VP4).

Mitigation

Whilst mitigation is not required given the low visual impacts, design recommendations have been provided. The key beneficial recommendation is to retain tall trees or provide replacement tree planting along the perimeter of the site.

1 Introduction

1.1 Overview

Ausgrid is seeking development consent to construct, operate and maintain a Battery Energy Storage System (BESS) with a capacity of 200 MW at Steel River East (the Project).

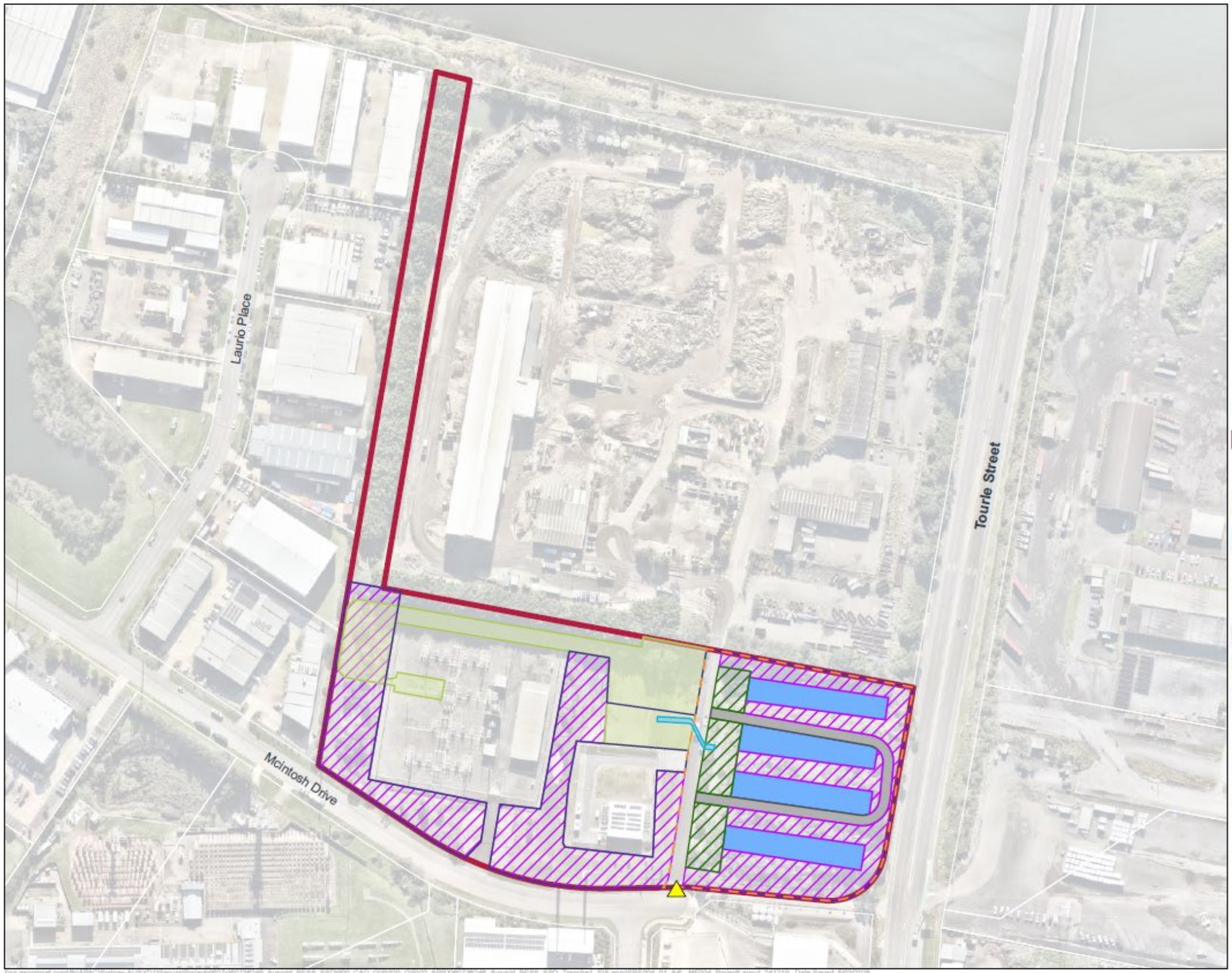
This Visual Impact Assessment (VIA) considers the potential impact of the Project on visual receivers in the local area.

Key features of the Project include:

- Construction, operation, and maintenance of a BESS with a 200 MW maximum power output capacity with 2-hour duration (i.e. 400 MWh)
- Containerised battery units (112 Megapacks) and associated infrastructure, including inverters and 56 medium voltage transformers
- 33 kV underground cable connection from the battery units to Mayfield West zone substation infrastructure
- Combined switch room and control room building
- Eight Ring Main Units (RMU)
- Onsite workshop facility
- Two auxiliary transformers
- Backup diesel generator
- Two spaces for onsite car parking
- Other ancillary infrastructure including fire suppression, stormwater management, 2.4m high boundary security chain wire fencing, lighting and CCTV.

The Project layout is shown in Figure 1-1. The Project is subject to future detailed design and construction methods, staging, quantities and measurements may vary following future design refinement or following award of the construction contract.

This assessment has assessed a worst-case visual scenario so as to provide a conservative assessment of the Project's potential impacts. This allows for flexibility in the design and construction methodology, where Project changes do not increase the visual impact. Note that 'worst-case' in the context of visual impacts refers to construction of all planned components in one stage.



AECOM

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FIGURE 3-1:
INDICATIVE SITE LAYOUT

Legend

- The site
- Project area
- Operational footprint
- Proposed underground 33kV connection
- HV connection infrastructure (area subject to separate approvals process)
- Laydown area
- Ancillary facilities
- BESS infrastructure
- Internal site road
- Site access

Source: Imagery © Nearmap 2024 .

Figure 1-1 Preliminary Project layout

1.2 Purpose of this report

This VIA responds to the Project's Secretary's Environmental Assessment Requirements (SEARs) and supports the application for development consent. The VIA documents the potential impacts of the Project's construction and operation. The scope of the assessment includes:

- Establishing the methodology for assessing potential visual impacts.
- Describing the contextual analysis for the existing environment.
- Qualitative assessment of the potential visual impacts of the Project on surrounding locations and receivers.
- Identify mitigation measures, if required.

1.2.1 Project SEARs

This VIA has been prepared in accordance with the NSW Department of Planning, Housing and Infrastructure (DPHI) SEARs for the Project, as issued on 20 November 2024 (Table 1-1).

Table 1-1 VIA SEARs

SEARs	Where addressed
Visual – including: ■ a detailed assessment of the likely visual impacts of all components of the project on surrounding residences (including approved developments, lodged development applications and dwelling entitlements), and key locations, scenic of significant vistas and road corridors in the public domain; and	**Chapter 6** provides an assessment of likely visual impacts at residences, key locations, or significant vistas.
■ 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).	**Chapter 7** provides recommendations for the mitigation and management of visual impacts

2 Project overview

2.1 Site context

The proposed location of the Project is in the eastern part of Lot 16 DP 270249, to the east of the existing substation. The site address is 1 McIntosh Drive, Mayfield West. The Project is located within the City of Newcastle local government area (LGA), approximately 7 km north-west of Newcastle CBD. See Figure 2-1.

The Project is located on land zoned E4 – General Industrial under the Newcastle LEP.

The Project will be undertaken on property that is owned by Ausgrid. Access to the site will be from a driveway shared with the Leading Edge data centre and a recycling facility owned and operated by Benedict Recycling Pty Ltd.

The site is adjacent to road infrastructure and other industrial properties, with the South Channel Hunter River located 500 m to the north. Industrial developments surrounding the site include a demolition and recycling depot, CSIRO laboratory, logistics office and depot, manufacturing and a childcare facility.

The site is covered by vegetation, with some tall native trees along the eastern boundary.

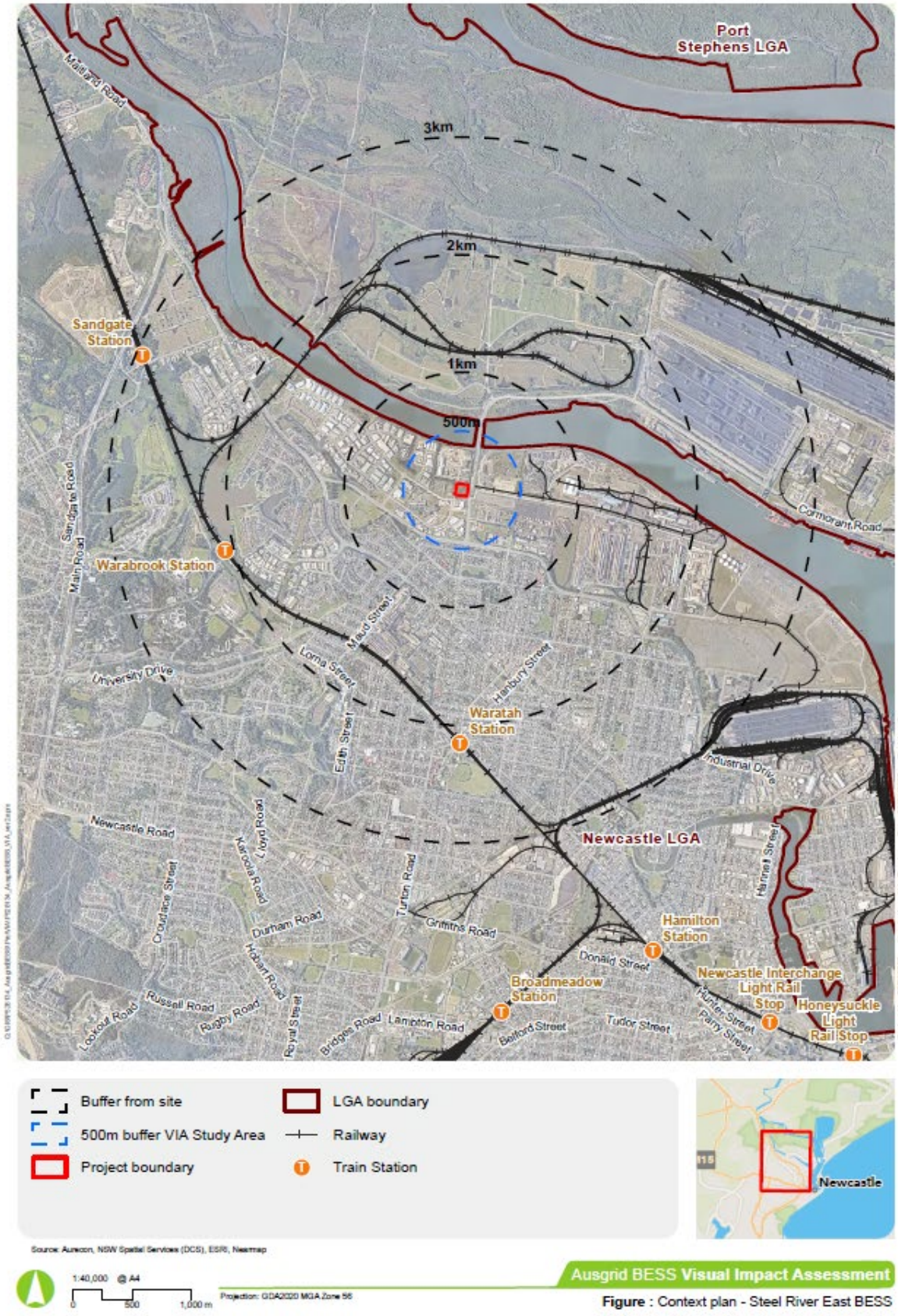

Figure 2-1 site context plan

2.2 Project features

A summary of the key Project features which are considered relevant to the VIA are provided in Table 2-1, along with construction and operational factors in Table 2-2 and Table 2-3. These tables should be read in conjunction with Figure 1-1.

Table 2-1 Key features of the Project

Project	Components	Dimensions
BESS components	■ Construction, operation, and maintenance of a BESS with a 200 MW maximum power output capacity with 2-hour duration (i.e. 400 MWh) (Indicative image shown in Figure 2-2) ■ Containerised battery units (112 Megapacks) and associated infrastructure, including inverters and 56 medium voltage transformers ■ 33 kV underground cable connection from the battery units to Mayfield West zone substation infrastructure	■ Battery units approximately 2.5 m in height above ground level (AGL) and have a footprint of approximately 3.5 m x 7 m. Units arranged in a series of rows.
Ancillary components	■ Combined switch room and control room building ■ Eight Ring Main Units (RMU) ■ Onsite workshop facility ■ Two auxiliary transformers ■ Backup diesel generator ■ Two spaces for onsite car parking ■ Lightning spires (TBC with detailed design)	■ Buildings and lightning spires would be a maximum of 7 m height AGL ■ Water tank would be up to 4 m in height AGL
Grid connection	Connection of the BESS Connection via a 33 kV underground (UG) cable to existing Mayfield West substation infrastructure	Trench or underground bore

Figure 2-2 The final configuration of the Project will be confirmed in the detailed design. The VIA is based on consideration of reasonable worst-case, being the maximum dimensions and/or number of key components.

Figure 2-2 Tesla Megapack units (source: Scoping report, AECOM)

Construction

The Project is anticipated to commence construction in late 2025 and carry on until mid-2027. This is dependent on a number of factors that may change, including environmental issues, weather and staff availability. Table 2-2 outlines the indicative construction activities.

Table 2-2 Construction activities

Indicative Construction	
Construction works	■ Installation of erosion and sediment controls and site fencing ■ Installation and maintenance of environmental controls ■ Development/upgrade of site access and internal access roads ■ Earthworks to form the BESS pad, switchyard area/s, and construction laydown areas ■ Concrete works associated with equipment and building foundations/footings ■ Construction of permanent stormwater drainage network ■ Structural works to support BESS facilities ■ Construction of supporting structures, e.g., temporary site compound, permanent operations building and storage ■ Delivery, installation and electrical fit-out of BESS and transformers ■ Construction of the cable connection between the BESS and substation ■ Fire suppression system including hydrants ■ Installation of a diesel generator for use during operation and in case of emergency ■ Construction equipment will be used including various trucks, earth-moving equipment, generators and light vehicles.
Construction hours	Construction activities would primarily be undertaken during the following hours: ■ 7:00am to 6:00pm Monday to Friday ■ 8:00am to 1:00pm Saturday ■ Sundays only as required due to electrical outage constraints.
Workforce	A peak workforce of up to 100 people during construction (average 50)
Parking	Temporary parking for the construction workforce would either be provided within the existing substation (Ausgrid landholdings) or street parking.

Operation

Operation of the Project would involve the following activities.

Table 2-3 Operational activities

Indicative Anticipated Operating Regime	
Operational activities	■ Recharge and discharge operations of the battery, as required over a 24-hour period, seven days a week. ■ Infrequent maintenance activities which may include any of the following: – Replacement of BESS components – Safety and environmental audits – General ongoing maintenance and housekeeping (average four times per month) including vegetation trimming and general upkeep of facilities.
Operational life expectancy	The Project is intended to have an operational life of up to 50 years. This could lengthen should the BESS be upgraded or replaced following a future planning approval.
Operational workforce	The Project would typically be unstaffed and remotely monitored, with planned and unplanned maintenance visits anticipated on an infrequent basis.

3 Methodology

3.1 Assessment approach

A visual impact assessment (VIA) is the analysis of the potential visual impacts resulting from a proposed development. It involves evaluating the degree of visual change from the existing or baseline environment, as experienced by visual receivers.

The following are the main tasks undertaken to prepare this VIA:

- Identification of visual Study Area from which the Project is likely to be visible based on the height of proposed elements on site and intervening topography.
- Determine the baseline environment against which the Project is assessed against, including permitted land uses, proposed projects, biophysical characteristics and aesthetic value.
- Identification of likely sensitive receivers and viewpoints for assessment.
- Field visit to capture photographs from key viewpoints and ground truth desktop findings.
- Production of 'artist's impression' imagery which indicated the magnitude of visual changes associated with the Project.
- Determination of the significance of visual impacts for each key viewpoint using the Visual Impact Rating Matrix described in Table 3-3 below.
- Outline the mitigation measures to avoid, manage and minimise visual impacts as a result of Project.

3.2 Relevant Guidelines

This report is based on the following industry guidelines:

- Technical Supplement – Landscape and Visual Impact Assessment, Large-Scale Solar Energy Guideline, NSW Department of Planning, Housing and Infrastructure (DPHI, 2022 (the solar guideline)).
- Guideline for Landscape Character and Visual Assessment - Environmental Impact Assessment Practice Note EIA-NO4, Transport for New South Wales, 2020.
- Guidance Note for Landscape and Visual Assessment, Australian Institute of Landscape Architects, June 2018.
- Guidelines for Landscape and Visual Impact Assessment (third edition), Landscape Institute of Environment Management and Assessment (IEMA), 2013.

3.2.1 VIA requirements for BESS projects

Whilst the Project is not proposing installation of solar panels, following consultation with DPHI on other BESS projects, the Project has been assessed in accordance with the general requirements of the solar guideline.

Figure 3-1 outlines the approach of the solar guideline in assessing visual impacts.

The assessment findings outlined in Section 6 illustrate how the assessment concludes at an equivalent to Stage 4 in the below figure.

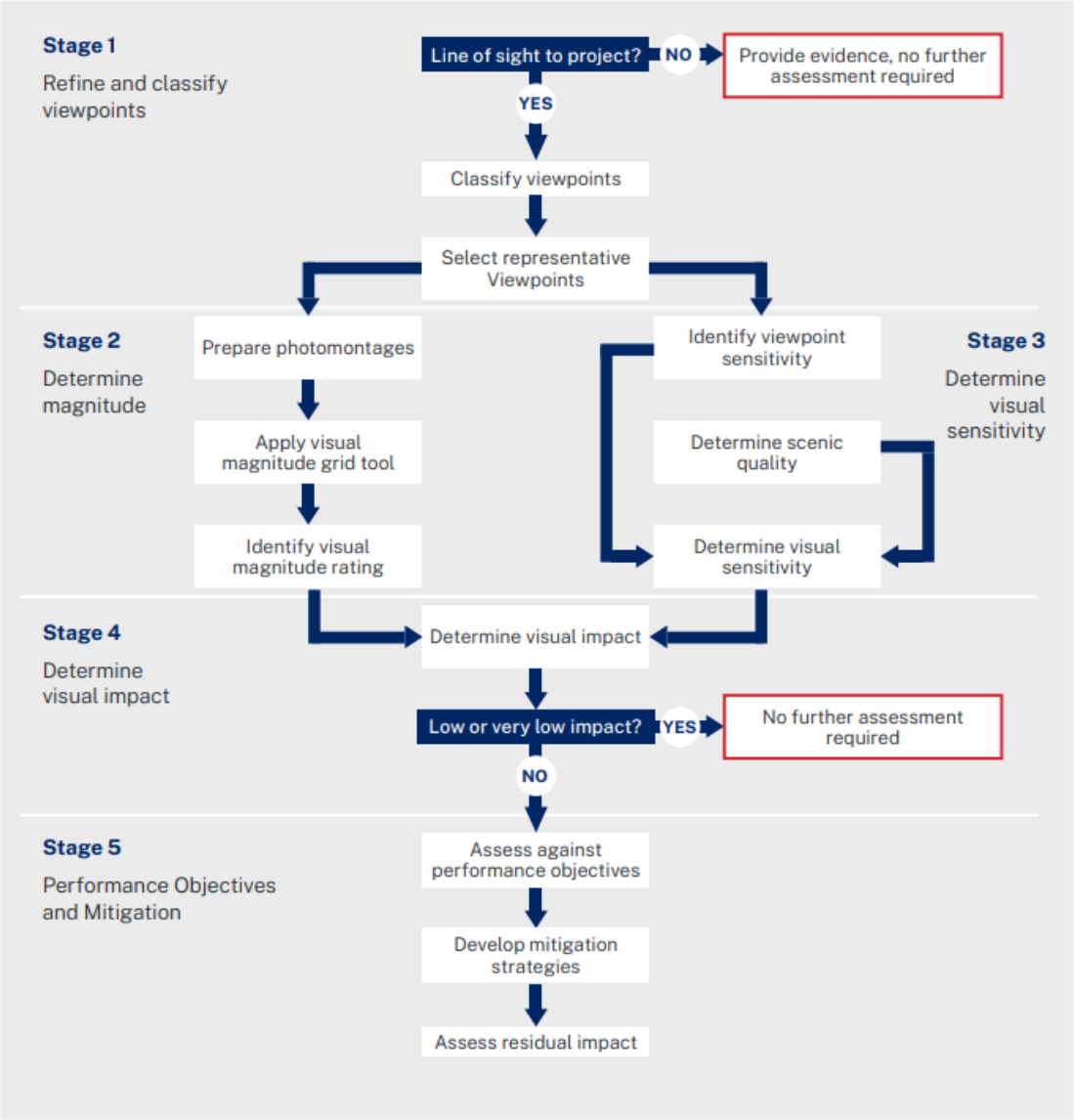

Figure 3-1 Detailed Visual Impact Assessment Process (source: Technical Supplement – Landscape and Visual Impact Assessment, DPHI, 2022)

3.3 Study Area

The Study Area is determined by the distance at which it is considered that Project components will become either indiscernible to the human eye or will occupy a small proportion of the visual field of view that impacts could be considered negligible. This distance is directly related to the scale and height of the Project components and the viewing properties of the typical human eye. This is further explained in Appendix B: Visual Prominence Rationale.

An analysis of the zone of theoretical visibility (ZTV) for the Project was undertaken based on topographical data and the height of key components. Intervening vegetation and built structures are not included in the ZTV mapping. As such the ZTV represents a feasible 'worst case' visual envelope of the Project.

Based on topography alone, the ZTV extends beyond 3 km from the Project (refer Figure 5-1). However in practice, surrounding large industrial buildings and vegetation limit these views in certain directions. During the field visit, views towards the site were investigated and determined to be noticeable within a distance of 500m or less.

For the purposes of this assessment, the Study Area includes a 500-metre radius from the Project area (refer to Figure 2-1**)**. This area includes the closest sensitive receivers within the ZTV and where visual modification is likely to be noticeable.

The key viewpoints captured during the field visit from locations where the site is most visible. This accounts for the screening and filtering effect on views from existing topography, existing vegetation and built form.

3.4 Visual Impact Assessment

The significance of the Project's visual impact has been assessed through consideration of the following components:

- **Viewer sensitivity:** the sensitivity of the viewer to the development / change and distance from the viewpoint. This is discussed further in section 3.4.1 below.
- **Magnitude of change:** how well the development / change contrasts or blends with the surrounding land use based on varying levels of visual prominence. This is discussed further in section 3.4.2 below.

Establishing the level of visual impact involves assigning levels of visual sensitivity and magnitude of change such as high, medium low or very low. A matrix is then used to assign an overall level of significance (see section 0 below).

based on the desktop study, viewpoints have been selected to represent key views of sensitive receivers in the vicinity of the Project. These viewpoints were selected to consider:

- A range of:
  - Receptor types, including public and private domain views.
  - View types, including elevated, panoramic and filtered views.
  - Viewing distances from the Project.
- Valued or protected views in the Study Area.

Some viewpoints proposed during the desktop study were ruled out based on the field visit as intervening vegetation, topography or buildings would fully screen the view of the Project.

3.4.1 Viewer sensitivity

Viewer sensitivity is a measure of how a person would perceive a change to the view. This depends on the nature of the land use in which the viewer is positioned, as well as their expectations of the view from that location. This approach is consistent with the visual management system (*Landscape Aesthetics – A Handbook for Scenery Management*, United States Department of Agriculture& Forest Service, 1995).

Various landscape settings influence the relative importance the viewer places on them. For example, individuals would view changes to the visual setting from their residence more critically than changes to the visual setting in which they travel or work.

As such, levels of viewer sensitivity are based on land use because this largely defines a viewer's expectation of what they would typically expect within a particular setting.

The next critical component to rating the viewer sensitivity is the distance of the Project from the identified land use area. As illustrated in Table 3-1, there are three viewing distances to consider:

- foreground (0 – 500 metres)
- middleground (501 – 2000 metres)
- background (> 2000 metres).

As the distance increases from the land use area, the field of view decreases causing the visibility of Project components to diminish or be absorbed in the landscape setting. Consequently, as distance from the viewer to the Project increases, the level of viewer sensitivity reduces.

Table 3-1 Viewer sensitivity determination matrix[1]

LAND USE (Sensitivity of the viewing location)	DISTANCE FROM THE PROPOSAL				
	FOREGROUND	MIDDLEGROUND			BACKGROUND
	0 – 200 m	201 – 500 m	501 – 1000 m	1001 – 2000 m	> 2000 m
Residential / Accommodation	H	H	H	M	L
Parks and reserves	H	H	H	M	L
Health care facilities	H	H	M	M	L
Educational facilities	H	M	M	L	L
Community facilities	H	M	M	L	L
Shared use paths	M	M	M	L	VL
Commercial	M	M	L	L	VL
Arterial road	L	L	L	VL	VL
Local road	L	L	VL	VL	VL
Industrial areas	VL	VL	VL	VL	VL
	Legend - H = High, M = Medium, L = Low, VL – Very Low				

3.4.2 Magnitude of change

When considering magnitude, all elements of the Project must be considered, including changes to landform, urban structure, vegetation patterns, as well as the nature, scale and density of the Project within the landscape.

Magnitude is dependent on:

- Scale, regarding the loss or addition of features in the view and changes in its composition.
- Degree of contrast or integration based on scale and form, height, colour, and texture.
- Nature of view in relation to the project accounting for angle, distance, and extent.
- Mitigation, accounting for its effectiveness at reducing impacts over time.

Table 3-2 below describes the ratings of magnitude for the purposes of this assessment.

Table 3-2 Viewpoint magnitude ratings[2]

Magnitude	Description
High	The project, or part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or part of it, would form a noticeable feature or element of the view which is readily apparent to the receiver
Low	The project, or part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Very Low	The Project, or part of it, would be perceptible, but the introduction of elements is commensurate with surrounding elements and/or is partially screened.
Negligible	Only a very small part of the project would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view.

[1] Adapted from US Department of Agriculture Forestry Service (1995)
[2] Adapted from US Department of Agriculture Forestry Service (1995), IEMA (2013)

3.4.3 Assigning a level of impact

The significance of the visual is determined by combining the sensitivity with the magnitude, using the visual impact matrix illustrated in Table 3-3.

The consequence of the application of the matrix is that (except where the Project cannot be seen) the Project would have some adverse impact.

Table 3-3 Impact determination matrix (TfNSW, 2020)

		MAGNITUDE			
		HIGH	MODERATE	LOW	NEGLIGIBLE
SENSITIVITY	HIGH	HIGH	HIGH-MODERATE	MODERATE	NEGLIBIBLE
	MODERATE	HIGH-MODERATE	MODERATE	MODERATE-LOW	NEGLIBIBLE
	LOW	MODERATE	MODERATE-LOW	LOW	NEGLIBIBLE
	NEGLIGIBLE	NEGLIBIBLE	NEGLIBIBLE	NEGLIBIBLE	NEGLIBIBLE

3.5 Assumptions and limitations

3.5.1 Key assumptions

This VIA has been developed based on the following assumptions:

- The assessment has been based on the information provided for the Preliminary Design layout (MYE-SKT-0101, 24/10/2024) and assumes that any vegetation within the footprint of the site will be removed. Further changes to the detailed design will not be captured in this assessment.
- Viewpoints on private properties were not considered within this VIA due to land access issues. However with representative viewpoints taken adjacent to private properties have been used as a proxy for these locations.
- Observations made during a field study on 27/11/2024 have been applied to ground truth the baseline analysis. The assessment does not include any changes to the environment that may have occurred since.
- For the purpose of the assessment, an unobstructed viewpoint from a publicly accessible location has been used as a worst-case scenario of potential visual impacts. This is applied to private residential properties parallel to Industrial Drive, where the viewpoint has been captured at the intersection of Tourle Street and Industrial Drive, away from nearby intervening trees.
- Rendered photomontages are indicative of the Project at Day 1 of operation based on the preliminary design layout and do not indicate any potential changes through detailed design or design mitigation measures.

3.5.2 Limitations and uncertainty

The assessment is subject to the following limitations:

- Potential changes resulting from the Project have been defined. However, the significance of these changes requires qualitative (subjective) judgements to be made. Therefore, the conclusions to this assessment combine both objective measurement and subjective professional interpretation.
- The impact assessment is focused on the current land uses and zoning and does not capture planned or provisional changes.

3.6 Photomontages

A photomontage is a technique whereby an image of the Project is produced using an existing photograph, overlayed with a render of proposed Project elements, to provide an indicative visual representation.

The process involves inserting a computer–generated model of the Project into a photograph taken from a geographically referenced viewpoint, using existing landscape elements of a known size, location, and scale to suitably locate the digital elements within the photograph. Existing elements, such as buildings, have been modelled to create a reference point to match in the photos.

The methodology used to produce the photomontages included:

- Undertake site photography including overlapping photo to create a 180-degree panoramic image to depict the existing scene, with the proposed facility to the centre of that image.
    - The location of each viewpoint was recorded on site to accurately depict the location of the photo and match to the 3d digital model of the key design components.
    - Existing site elements were measured to match with the scale of elements within the model.
- Model the facility in 3D max applying known dimensions and material finishes. Render of the model, matching with the photograph.
- Adobe Photoshop was used to produce an ‘artists impressions’ of the Project including addition of people and vegetation.

The photomontages are indicative of the Preliminary Project layout (Figure 1-1) and are subject to detailed design. As such, there may be minor changes which are not captured within the photomontages. It is assumed that minor changes will not have any bearing on the level of visual modification presented by the Project.

Project photomontages

Photomontages were produced for two of the four viewpoints (see Section 6) including:

- VP1 – McIntosh Drive
- VP3 - Tourle Street

The photomontages at day 1 of operation, depict the current design of key elements available at the time of preparing this report, as represented in Appendix A: Visualisations.

4 Regulatory framework

4.1 State Planning Policies

Relevant environmental planning instruments were reviewed to identify landscape and visual values relevant to the Study Area.

The relevant State Environmental Planning Policies (SEPPs) and their application in regard to the VIA are:

- *Transport and Infrastructure, 2021*
  - The proposed land use (electricity generation) is consistent with the existing landscape character and is permissible with consent.
- *Planning Systems, 2021*
  - In accordance with Section 4.12(8) of the EP&A Act, the application is therefore required to be accompanied by an EIS that meets the requirements of Schedule 2 of the EP&A Regulation and any other relevant legislative requirements that relate to the EIS. The findings of this VIA are captured in the EIS.

4.2 Regional Plans

The relevant regional and local key documents reviewed which identified relevant landscape and scenic considerations within the Study Area, include:

- Newcastle Local Environmental Plan (LEP), 2021
  - The Project is located in an industrial zone and is located adjacent to existing electrical infrastructure. There are no landscape and scenic values attributed to this zone.
  - There are no defined landscape or visual characteristics or scenic view corridors identified within the Study Area.

Other local planning frameworks identifying relevant visual considerations include:

- Hunter Regional Plan 2041
  - The Project is located in the Hunter-Central Coast REZ. The co-location of the Project adjacent the existing substation is compatible with the REZ and minimises potential cumulative visual impacts of electrical infrastructure.

4.3 Land Use Zoning

The Project is within the E4 - General Industrial Zone. The area surrounding the Study Area has a variety of land uses including recycling centres and general industrial operations, as well as low density residential suburbs further afield (see Table 4-1 and **Error! Reference source not found.**).

Table 4-1 Land uses in proximity to the Project

Land use zones	Land use features	Relevance to the VIA
E4: General Industrial	Businesses surrounding the Study Area include the existing Ausgrid substation, a data centre, a recycling plant, a concrete supplier, the CSIRO Energy Centre and a number of other businesses	Adjacent site. Low visual sensitivity.
R2: Low Density Residential	Residential area within Mayfield West	High sensitive receivers who are likely to experience views for long periods. Representative viewpoint assessment in Section 5 (430 m south of Project).

Land use zones	Land use features	Relevance to the VIA
SP1: Special Activities	Recycling centres and other industrial operations	Adjacent site. Low visual sensitivity.
SP2: Classified Road	Industrial Drive to the south of the site	No relevance – receivers of low sensitivity with built form screening Project

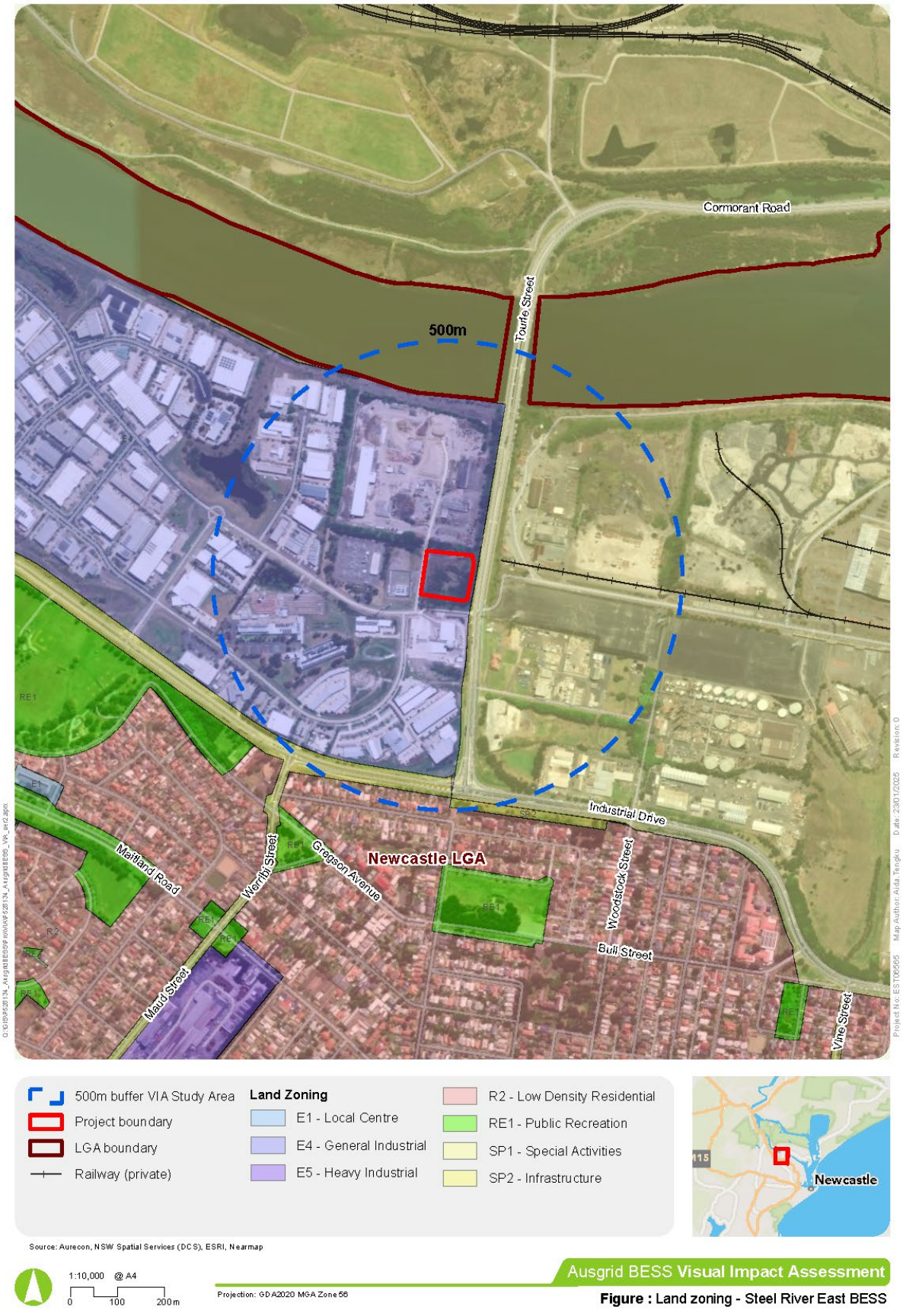

Figure 4-1 Land use zones

5 Existing environment

The Project is located within the City of Newcastle, approximately 7 km northwest of the city centre. The Study Area is predominantly industrial, located adjacent to the South Channel of the Hunter River.

5.1 Land Use

Land use in the surrounding area predominantly consists industrial and commercial use and is zoned 'E4 General Industrial'. Other industrial and commercial businesses on large allotments surround the Study Area include:

- Recycling
- Transportation and haulage
- Metal fabrication
- Manufacturing
- Commercial construction
- Data Centres

Land to the east of Tourle Street, is zoned 'SP1 Special Activities' for use of the Port of Newcastle. Tourle Street has two lanes in each direction, with a cycle lane and a raised central median. It serves as a freight corridor to and from the Port of Newcastle.

There is a SUP immediately to the south of the site which connects an on-road cycle path to the industrial estate. The SUP is not connected to other Newcastle cycleways.

The closest residential area is approximately 400 m to the south within the suburb of Mayfield West.

5.2 Topography, landform and waterways

As shown in Figure 5-2, the Project is at an elevation of approximately 6 m AHD and is relatively flat. It sits slightly higher than Tourle Road to the east. There is a low rise up to 22 m AHD to the southwest of the site which is noticeable on Tourle Road, and which falls along Industrial Drive.

The site is situated within the Ironbark Creek catchment, which is part of the broader the Hunter River catchment. The Hunter River is approximately 5 km east of the Project (Figure 5-2), with the South Channel approximately 1 km north of the site and is the closest named watercourse.

5.3 Vegetation

The ecological assessment undertaken for the Project found the site is highly disturbed by previous industrial uses and is primarily inhabited by introduced weed species. There is some native vegetation present in the southeast portion of the site, including the native tree *Corymbia maculata*.

The site comprises a mix of shrubs and weedy species, with tall native trees to the east boundary. The ecological assessment (Appendix E, Scoping Report) identified one plant community type (PCT) within the site, however no threatened flora species were recorded, nor was there any areas suitable for the establishment of threatened flora species identified in the general area. The vegetation present was not deemed to be commensurate with any threatened ecological communities (TECs).

Vegetation within the Study Area is not prominent due to the large industrial sites, however, there is denser vegetation to site boundaries which are often viewed on the horizon.

There are Saline Wetland areas identified alongside the South Channel of the Hunter River (refer Figure 5-2), however these won't be affected by the Project given the separation (around 1 km).

The mapped PCTs within the Study Area are shown in Figure 5-2 and comprise Saline Wetlands along the South Channel. Riparian Rainforest shown on the map and near to the site, appears to have been built over within the industrial estate. These PCTs are likely to have had greater coverage prior to urban development.

5.4 Cultural Heritage

The Awabakal and Worimi Aboriginal people are acknowledged as the traditional custodians of the land and waters of the Newcastle area.

There are no identified registered Aboriginal sites within the Project Area (Appendix F, Scoping Report), with a high degree of land disturbance due to industrial modification.

European settlement introduced a range of activities including farming, coal mining and industry, which are evident within the Study Area. There is one local heritage item:

- I692 Remnant Garden - 2 and 4 Murray Dwyer Circuit, Mayfield West

This site has been built on by Qualtest Laboratory and with the exception of a tall tree (Araucaria ssp.), little remains of the Remnant Garden. The Project therefore will not have any direct impact on this site.

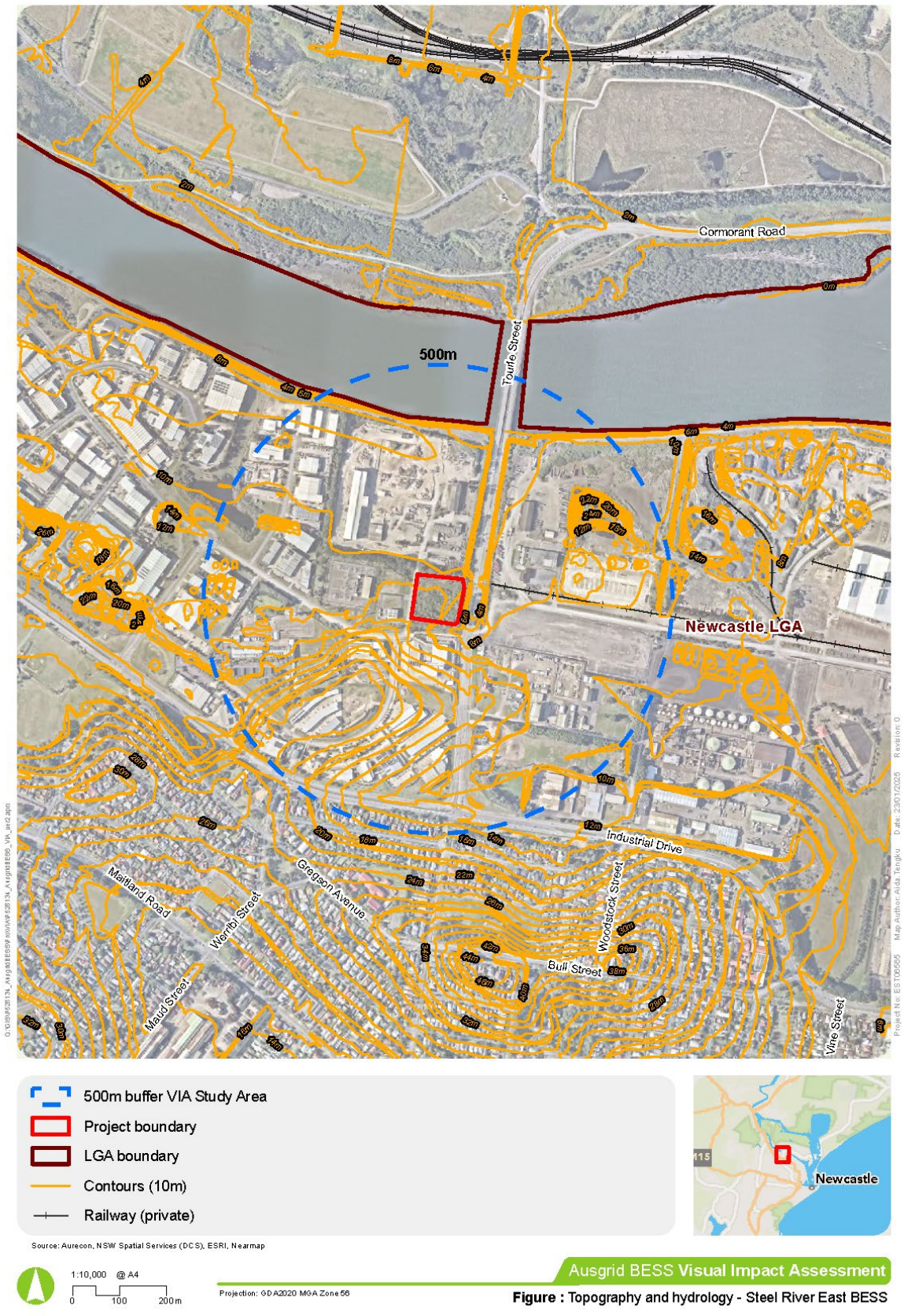

Figure 5-1 Topography and Hydrology with the Study Area

Figure 5-2 Plant Community Types within the Study Area

5.5 Visual context

The Project sits within a heavily industrialised area, with prominent visual features including transmission towers, powerlines, and other industrial facilities. These include the existing Ausgrid substation, the Hymix Steel River Plant and the Benedict Recycling facility.

The most prominent views of the site are from McIntosh Drive and the SUP to south (**Error! Reference source not found.**), while views from Tourle Street to the east are mostly obstructed by existing vegetation (**Error! Reference source not found.**). Although buildings, topography, and vegetation hinder visibility towards the site, taller high-voltage power lines that converge at the adjacent substation can be partially seen from a distance.

The closest residential dwellings are approximately 400 m south of the site. The dwellings in this area (Figure 5-7**Error! Reference source not found.**) range between one to two storeys with landscaped perimeters that contribute to the low-density residential character of the area. These properties are located on Industrial Drive (**Error! Reference source not found.Error! Reference source not found.**), which creates a distinct separation from the commercial and industrial areas to the north. The dwellings along the east side of Groongal Street following into Simpsons Cresent have tall vegetation which screens views to the north towards the site (**Error! Reference source not found.Error! Reference source not found.**).

The Ausgrid substation is not visible from the residential area due to intervening buildings and vegetation, and a slight elevation in grade towards the north (Figure 5-8). Overall, the visual environment near to the Ausgrid Mayfield West substation, has little visual amenity and a high degree of modification.

Figure 5-3 Views looking east towards the site from McIntosh Drive

Figure 5-4 Views looking west towards the sitefrom Tourle Street

Figure 5-5 Residential dwellings along Industrial Drive looking south-east

Figure 5-6 Vegetation providing screening along Industrial Drive looking south-east

Figure 5-7 Residential dwellings on Groongal Street looking north-east

Figure 5-8 Views looking north towards the site from Tourle Street / Industrial Drive

6 Potential visual impacts

In accordance with the DPHI guidelines identified in Section **Error! Reference source not found.**, viewpoints with a potential line of sight have been identified and assessed in the following section.

A viewpoint assessment has been undertaken representative of public and private viewpoints.

The assessment of potential visual impacts as a result of the Project have been considered during construction and at year 1 of operation.

6.1 Identification of representative viewpoints

Viewpoint selection is based on identified publicly accessible significant viewpoints, receivers with a high sensitivity (such as residents), and locations within the mapped zone of theoretical visibility (ZTV) (or visibility envelope) with a high extent of visibility.

There were no locations identified within the Study Area that are designated or significant viewpoints for the community.

The ZTV (refer Figure 6-1) indicates that the visibility of the Project extends beyond 3 km, based on the relatively flat topography. However, the field visit determined that that site is only visible within a much closer proximity due to intervening buildings, vegetation and low rises.

A total of four representative viewpoints were selected for the Project. The locations are all publicly accessible and differ in viewing distance and aspect. These viewpoints are deemed to be representative of the particular nearby visual receivers (Table 6-1 and Figure 6-1).

Table 6-1 Representative viewpoints

Viewpoint	Location	Visual receivers
VP1	McIntosh Drive – 70 m west of Project	SUP users / Industrial workers
VP2	McIntosh Drive – 250 m west of Project	Industrial workers
VP3	Tourle Street – 150 m southeast of Project	People in vehicles
VP4	Industrial Drive/ Tourle Street – 430 m south of Project	Residents to the south of the Project

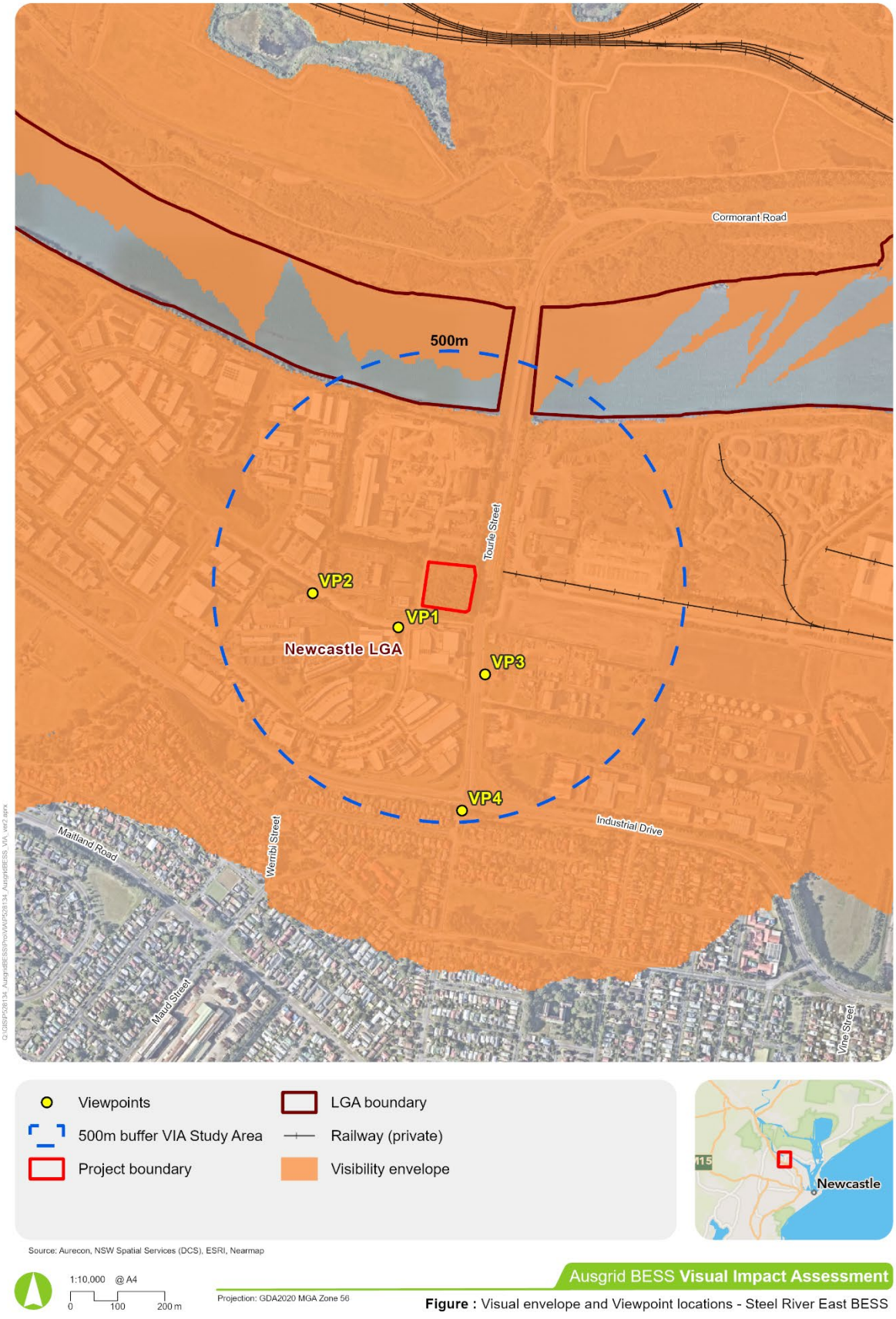

Figure 6-1 Zone of theoretical visibility and viewpoint locations

VIEWPOINT 1

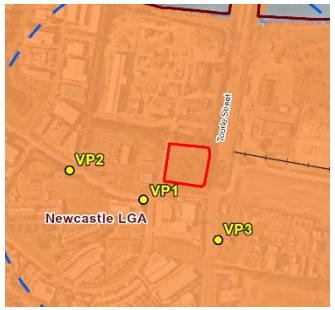

Figure 6-2 VP1: McIntosh Drive looking east towards the Project

Viewing location	From the corner of McIntosh Drive and Murray Dwyer Circuit, looking northeast to east, towards the site.
Visual receivers	The viewpoint is representative of industrial workers that work in this area and users of the SUP, which are also likely workers accessing the industrial estate.
Existing setting	The foreground comprises McIntosh Drive with grassed nature strips and pedestrian paths. Driveways provide access to business sites and depots, often frequented by trucks. The SUP connects McIntosh Drive and Murray Dwyer Circuit with Tourle St. Transmission infrastructure connects into the substation further left of the viewpoint frame. The Project area, to the centre of the viewpoint, comprises mostly understorey vegetation, with tall native trees to its boundary closest to Tourle St.

Viewing context	Dynamic - viewed temporarily by receivers	**Viewing angle**	Perpendicular – to the front of the viewpoint
Land use	Industrial	**Viewing distance**	Foreground (approx. 70 m from site)
Visual Sensitivity Level	Low – representative of view from SUP within an industrial estate		

Visual modification	**SENSITIVITY**	**MAGNITUDE OF CHANGE**	**VISUAL IMPACT**
Construction	Low	During construction, removal of existing vegetation will be noticeable in foreground views. The increase in vehicles and laydown areas will result in a low magnitude of change, noting the consistency of these activities to the existing surrounding industrial uses.	Low
Year 1 of operation		During operation the BESS megapacks will be visible behind security fencing. These components are less prominent than neighbouring built elements due to their lower height. Retained vegetation will be visible in the background. Project infrastructure is commensurate with adjacent electrical infrastructure and industrial use, resulting in a low magnitude of change. See Figure 0-2 for a photomontage of the Project at year 1 of operation.	Low

VIEWPOINT 02

Figure 6-3 VP2 McIntosh Drive, looking north-east towards the Project

Viewing location	From McIntosh Drive, looking east towards the Project. The viewpoint location is within the ZTV, indicating the Project is visible based on height of elements and topographic conditions.
Visual receivers	The viewpoint is representative of industrial workers and people in vehicles along McIntosh Drive.
Existing setting	This is in an industrial estate with the foreground comprising the existing Ausgrid substation, powerlines and some low-medium planting surrounding the substation. The substation's control room building and a neighbouring building are located between the viewpoint and the site, screening through-views. Wide grassed nature strips are along the street with buildings typically set back and fenced boundaries visible. The topography rises in the foreground, screening background views.

Viewing context	Dynamic – viewed temporarily by motorists	**Viewing angle**	Perpendicular – to the front of the viewpoint
Land use	Industrial	**Viewing distance**	Foreground (approx. 250 m from closest Project component)

Visual Sensitivity Level	**Low** – workers and commuters within an industrial area		
	SENSITIVITY	**MAGNITUDE OF CHANGE**	**VISUAL IMPACT**
Construction	Low	The site is not visible from this viewpoint, screened by the substation, buildings and hill rise. Construction works will be barely visible, including removal of trees within the site which are not visible from this viewpoint. There is a Negligible magnitude of change.	Negligible
Year 1 of operation		The Project once built would be located behind the existing Mayfield West zone substation in the background, as well as intervening vegetation. There is no view of the Project at day 1 of operation, therefore a Negligible magnitude of change is experienced by industrial workers.	Negligible

VIEWPOINT 03

Figure 6-4 VP3 Tourle Street, looking northwest towards the Project

Viewing location	From Tourle Street, looking northwest towards the Project.
Visual receivers	The viewpoint is representative of the view experienced by motorists.
Existing setting	This is in a highly modified industrial setting nearby the South Channel Hunter River. People in vehicles travelling north towards the Tourle Street Bridge are travelling to the wharf and industrial facilities on Kooragang Island. The foreground comprises a busy 2-lane road in each direction, with a cycle lane and a raised central median. Street lights and powerlines are at regular intervals; and HV transmission lines cross the road in the foreground with the tower to the right of the viewpoint. A concrete production facility (Hymix Steel River Plant) is to the far left of the viewpoint and Benedict Recycling facility is located on the far right of VP3. The proposed site is in the centre of the viewpoint, comprising dense middleground vegetation with tall trees to its east boundary closest to the road.

Viewing context	Dynamic - viewed temporarily by motorists	**Viewing angle**	Parallel – viewed in peripheral vision
Land use	Transport - Road	**Viewing distance**	Foreground (approx. 150m from closest Project component)
Visual Sensitivity Level	**Low – workers and commuters within an industrial area**		

	SENSITIVITY	MAGNITUDE OF CHANGE	VISUAL IMPACT
Construction	Low	During construction, removal of existing vegetation will be noticeable in foreground views, experienced temporarily by people in vehicles. The construction works and vehicles will be a low magnitude of change, and of little contrast to the surrounding industrial uses.	Low
Year 1 of operation		Once built, BESS packs will be visible behind security fencing, with some of the vegetation retained to the street frontage. The Project components are of lower height and less prominent than neighbouring built elements. Retained vegetation will be visible in the background. The magnitude of change is low at day 1 of operation. See **Error! Not a valid result for table.** of the Project at year 1 of operation.	Low

VIEWPOINT 04

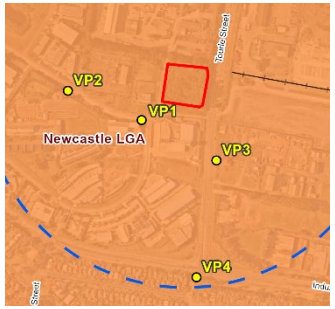

Figure 6-5 VP4 Industrial Drive, looking north towards the Project

Viewing location	From Industrial Drive, looking north towards the Project.		
Visual receivers	The viewpoint is representative of residents located on Groongal Street and Simpson Court, parallel to Industrial Drive and behind viewpoint. The residential houses which this viewpoint represents, are located on a low rise and do not have views of the site due to intervening high fencing, street trees within Industrial Drive road reserve and the hill crest seen on Tourle Street.		
Existing setting	The foreground of VP1 comprises the busy road intersection of Industrial Drive and Tourle Street, comprising traffic signals, road signage, street lighting and power poles. There are commercial buildings within the industrial area to the left, and tall trees screening an empty industrial lot to the left of the viewpoint. In the background, the Hymix Steel River Plant silos can be seen, along with existing trees, to the immediate foreground of the site.		
Viewing context	Static – residents potentially experience views for longer periods	**Viewing angle**	Perpendicular – Project visible to front of viewpoint
Land use	Residential	**Viewing distance**	Foreground (approx. 430m from closest Project component)
Visual Sensitivity Level	Moderate – residential dwellings		

	SENSITIVITY	MAGNITUDE OF CHANGE	VISUAL IMPACT
Construction	Moderate	The site is not visible from this viewpoint, screened by intervening buildings, street trees and crest of hill. The trees to the east of the site are visible in the background and removal of these would be barely noticeable from dwellings with partial screening, resulting in a Negligible magnitude of change. Negligible – no view of site	Negligible
Year 1 of operation		The Project components would not be visible below the crest of the hill. There is a Negligible magnitude of change.	Negligible

6.1.1 Summary of findings

There are limited views from adjoining land uses towards the Project, due to intervening topography, built form and vegetation. The relevant visual receivers for the Project are people in vehicles on Tourle Road, workers and/or visitors to adjacent industrial businesses; and workers using the SUP to access adjacent industrial businesses.

The scale of Project components including ancillary structures, from 2.5 m to 7 m in height (refer Section 2), are smaller than the existing surrounding buildings, the depot infrastructure and the Ausgrid substation.

Table 6-2 provides a summary of the visual impact assessment at construction and year 1 of operation. Decommissioning impacts will be commensurate with construction impacts.

Table 6-2 Summary of visual impacts

Viewpoint no.	Description	Sensitivity	Magnitude	Construction impacts	Year 1 Operation impacts
Viewpoint 01 (VP1)	SUP users on McIntosh Drive – 70 m west of Project	Low	Low	Low	Low
Viewpoint 02 (VP2)	Industrial workers on McIntosh Drive – 250 m west of Project	Low	Negligible	Negligible	Negligible
Viewpoint 03 (VP3)	People in vehicles on Tourle Street – 150 m southeast of Project	Low	Low	Low	Low
Viewpoint 04 (VP4)	Representative of residents on Groongal Street and Simpson Court, parallel to Industrial Drive – 430 m south of Project	Moderate	Negligible	Negligible	Negligible

7 Management of impacts

7.1 Recommendations

The following recommendations are included as a guide to assist the development of the detailed design of the Project and during construction management. These are not intended as compulsory mitigation measures due to the absence of significant adverse impacts, however, would contribute to minimise adverse visual impacts.

In accordance with the SEARs, a Landscape plan is to be produced prior to construction including vegetation removal, planting areas and planting list. The below landscape recommendations are to be captured in the landscape plan.

Site design

- Minimise the removal of existing vegetation along the site boundaries where possible.
- Provide a native planting buffer along the east and south boundaries (facing the SUP and Tourle Street) to provide screening effect.

Construction impact guiding principles

- Limit the area of disturbance during construction where possible.
- All areas disturbed by construction and not required for operation of the Project are to be rehabilitated, to soften appearance of the Project and provide permeable surface.
- Storage areas and associated construction support equipment are to be located in cleared or otherwise disturbed areas away from public interfaces, where possible.

Operational phase guiding principles

- Site lighting is to be designed to minimise glare issues and light spillage into adjacent areas and should be generally consistent with the requirements of Australian Standard 4282-1997 *Control of the obtrusive effects of outdoor lighting*.
- Where bespoke equipment or buildings are selected(e.g. control room) materials, colour and finishes should mitigate appearance of bulky structures and minimise glare through use of matt or low-sheen finishes. It is noted that all other equipment will be as per the manufacturer's default colour specifications.

8 Conclusion

The Project is located within a highly modified area where the existing visual character is dominated by large buildings, construction depots, the electrical substation, and other industrial and road infrastructure.

There are a limited number of sensitive receivers identified within the VIA Study Area, with main visual receivers of the site including people passing by in vehicles on Tourle Street, and workers or visitors to the surrounding industrial businesses. The closest residents (high visual receivers) are located approximately 400 m to the south, with intervening buildings screening views of the Project area.

Four viewpoints were assessed that were representative of the visual receivers, resulting in low to negligible visual impacts during construction and at year 1 of operation as a result of the Project, including:

- **Low visual impacts**: SUP users on McIntosh Drive (VP1) and motorists on Tourle Street (VP3)
- **Negligible visual impacts**: Industrial workers on McIntosh Drive (VP2) and the closest residents located on Groongal Street and Simpson Court, parallel to Industrial Drive (VP4)

The removal of trees and understorey vegetation within the site will be the most noticeable change, particularly for foreground views from the east (Tourle Street). The loss of this vegetation is an adverse impact to the visual amenity of the area, which has limited landscape amenity due to the industrial land use.

Recommended design and mitigation measures provide an opportunity to minimise adverse visual impacts. Whilst the area is highly industrialised, there is opportunity to soften the appearance of new infrastructure, through retention of tall trees or replacement tree planting to the perimeter of the site.

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Appendix A: Visualisations

The following photomontages are indicative of selected viewpoints based on the Preliminary Design layout. Refer to Section 3.6 Photomontages for a description of the methodology.

Figure 0-1 Viewpoint 1: Existing view

Figure 0-2 Viewpoint 1: Indicative view of Project at year 1

Figure 0-3 Viewpoint 3: Existing view

Figure 0-4 Viewpoint 3: Indicative view of Project at year 1

Appendix B: Visual Prominence Rationale

The visual prominence of a development can be determined by understanding the extent to which an object is part of a viewer's static field of view.

The measurement of the field of view is based upon the parameters of human vision outlined below. These provide a basis for assessing and interpreting the visual prominence of a development by comparing the extent to which the development will intrude into the central field of vision (both horizontally and vertically).

These horizontal and vertical fields of view are also interlinked to the viewing distance from the development. The methodology is based on the reduction of the visibility of a development in the distance as the field of view reduces (i.e. the increase in distance between a given viewpoint and the development).

Horizontal line of sight

It is generally accepted that the central field of vision for the human eye covers a horizontal angle of approximately 50 degrees to 60 degrees. Within this angle, both eyes observe an object simultaneously creating a degree of overlap, which is the central field of view (refer to Figure A.1). Within the central field of vision, the viewed image is sharp, colours are separately defined and depth perception occurs.

The visual prominence of a development will vary according to the proportion a development occupies the central field of vision.

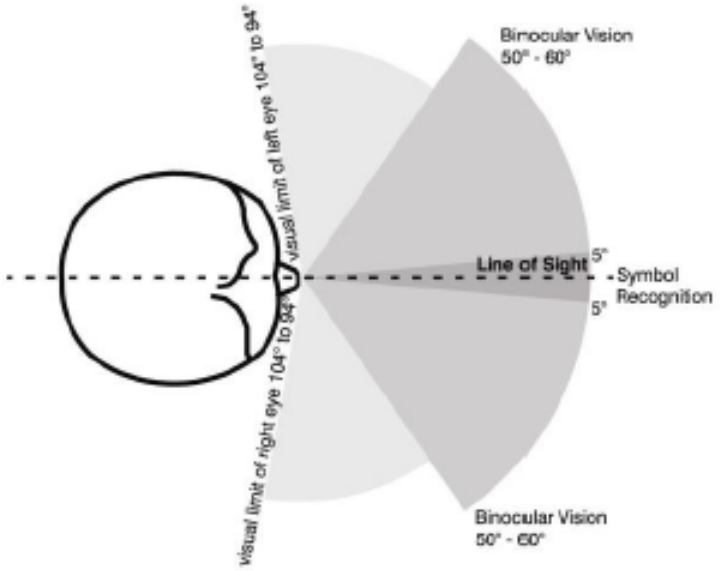

Figure A.1 Horizontal line of sight

Table A.1 outlines the potential visual prominence of a development, dependant upon on how much of the horizontal central field of vision that it occupies.

Degrees of Field of View occupied	Potential visual prominence – horizontal field of view
Less than 5°	**Insignificant - Low visual prominence** The development would not be highly visible in the view, unless it contrasts strongly with the background.
5° – 30°	**Potentially Noticeable – Moderate visual prominence** The development may be noticeable. The degree that it intrudes on the view would be dependent on how well it integrates with the landscape setting.
Greater than 30°	**Potentially Dominant - High visual prominence** The development would be highly noticeable.

Table A.1 Potential visual prominence based on degrees of horizontal field of view occupied

Vertical line of sight

As for the horizontal line of sight, there is also a vertical central field of view. If we assume that the horizon is 0° then the eye clearly defines colour, field of view and has image sharpness for an angle of approximately 25° upwards and 30° downwards. However, in reality, the typical line of sight for a standing person at ground level is approximately 10° below the horizon line (Refer to Figure A.2).

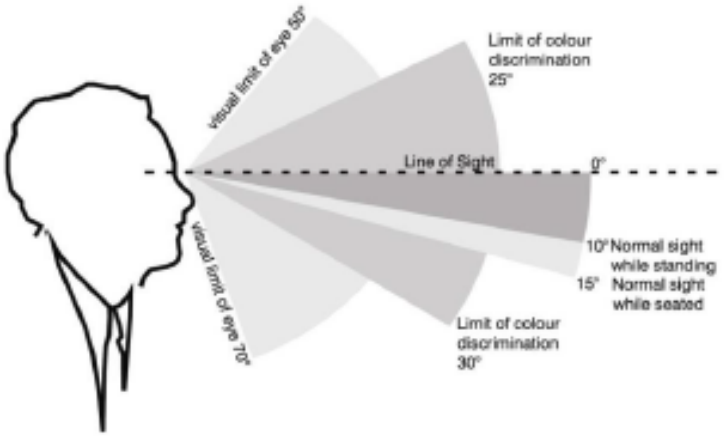

Figure A.2 Vertical line of sight

Objects that occupy a small proportion of the vertical field of view (less than 5^0) are visible but not dominant, particularly when they occur within landscapes that have been modified by human activity.

Table A.2 demonstrates the potential visual prominence of a development, dependant upon on how much of the vertical central field of vision that it occupies.

Degrees of Field of View occupied	Potential visual prominence – vertical field of view
Less than 0.5°	**Insignificant - Low visual prominence** A small thin line in the landscape and is no longer an easily recognisable element.
0.5° – 2.5°	**Potentially Noticeable - Moderate visual prominence** The development may be noticeable. The degree that it intrudes on the view would increase as distance reduces and be dependent on how well it integrates with the landscape setting.
Greater than 2.5°	**Potentially Dominant - High visual prominence** The development would be highly noticeable, although the degree of visual intrusion would depend on the landscape setting and the width / thickness of the object.

Table A.2 Potential visual prominence based on degrees of vertical field of view occupied

Visual prominence in relation to distance and field of view

These horizontal and vertical fields of view are also interlinked to the viewing distance from the development. The viewing distances, foreground, middleground and background, (refer to Table A.3) have been established based on previous field studies undertaken by Aurecon. The distances also relate to the distances for the land use types in the viewer sensitivity assessment methodology.

Distance from a viewer	Potential visual prominence
> 2.0km (background)	**Insignificant** The visibility of the development would progressively diminish over greater distances of 2km with no visibility beyond 5km due to atmospheric conditions.
Between 0.5km & 2.0km (middleground)	**Potentially Noticeable** The development would be noticeable, reducing with distance. The degree that it intrudes on the view would be dependent on topography and the vegetation within the landscape setting and how well it integrates with the surrounding land-uses.
< 0.5km (foreground)	**Potentially Dominant** The development would be highly noticeable, although the degree of visual intrusion would depend on the landscape setting (where not screened by vegetation or buildings) and the width / thickness of the object.

Table A.3 Potential visual prominence based on distance from a viewer

Figure A.3 illustratively demonstrates how the viewshed of a horizontal object is determined by its height and not so much by its width based on the viewing distance from a development. As a viewer moves further away from a horizontal object the width may still be apparent, however the vertical dimension reduces to insignificance.

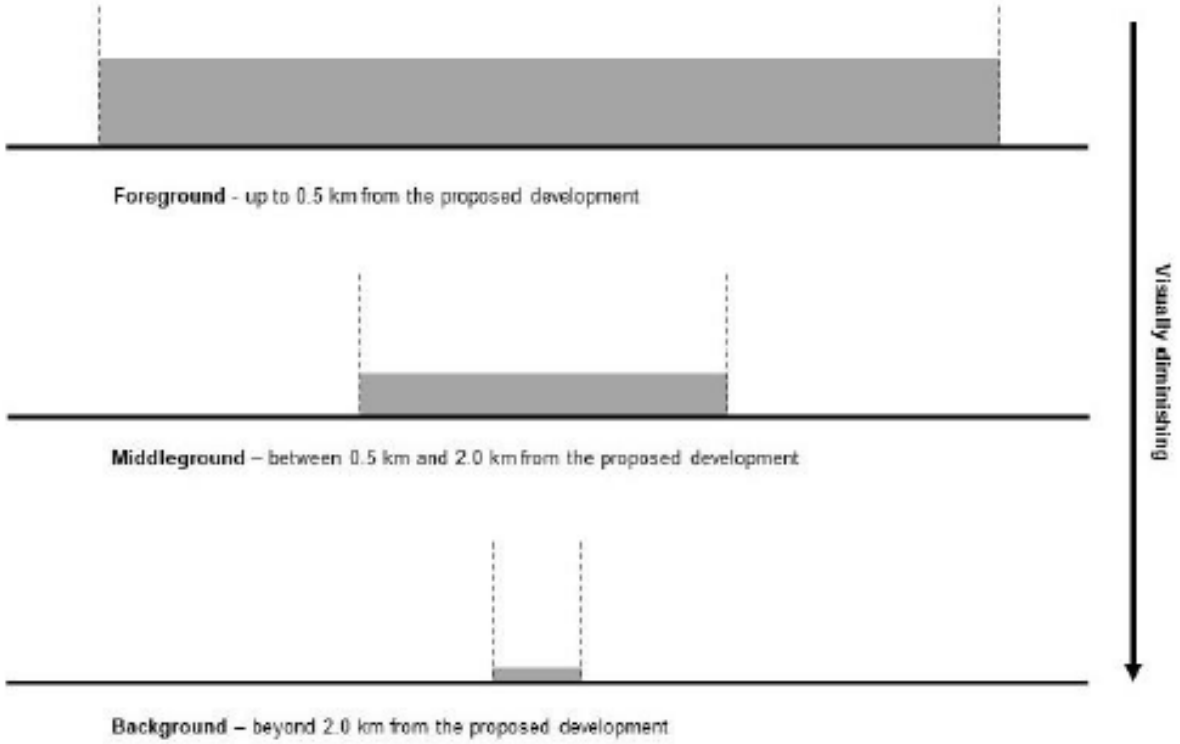

Figure A.3 The reduction in visibility of the horizontal line of sight based on increase in distance from a viewpoint

The same approach can be applied to the vertical field of view. As a viewer moves further away from a vertical object the height may still be apparent, however the vertical dimension reduces to insignificance (refer to Figure A.4).

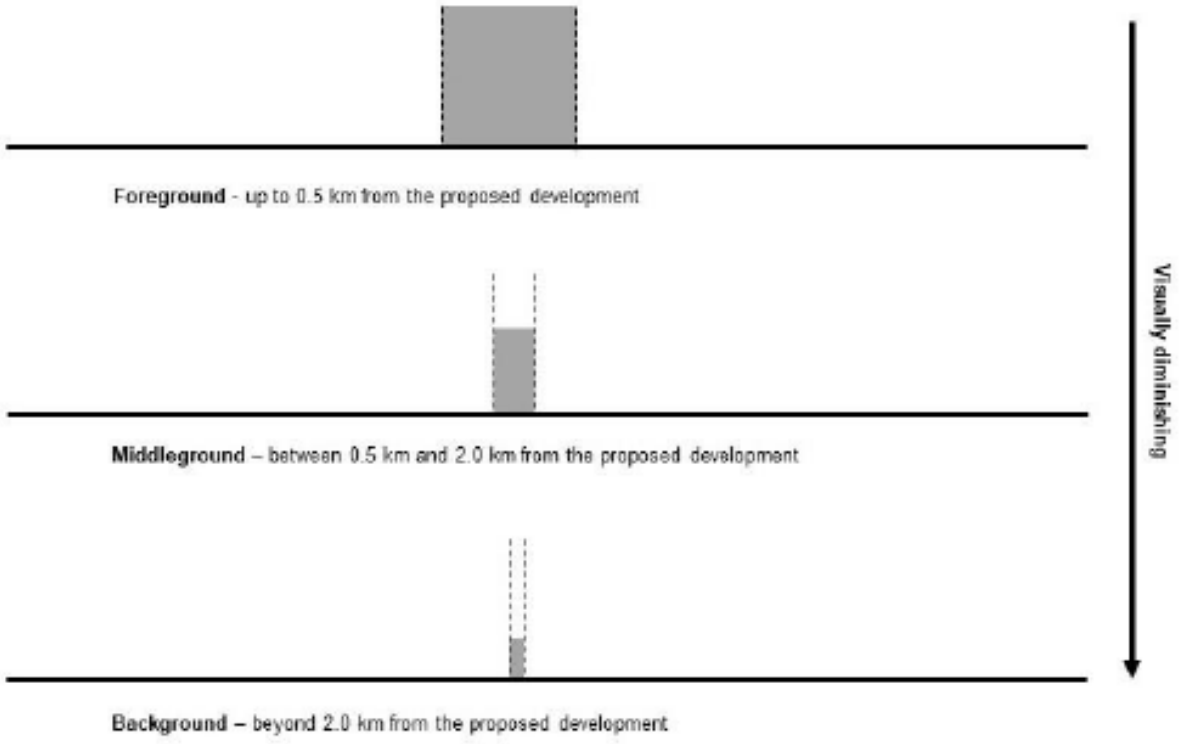

Figure A.4 The reduction in visibility of the vertical line of sight based on increase in distance from a viewpoint

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