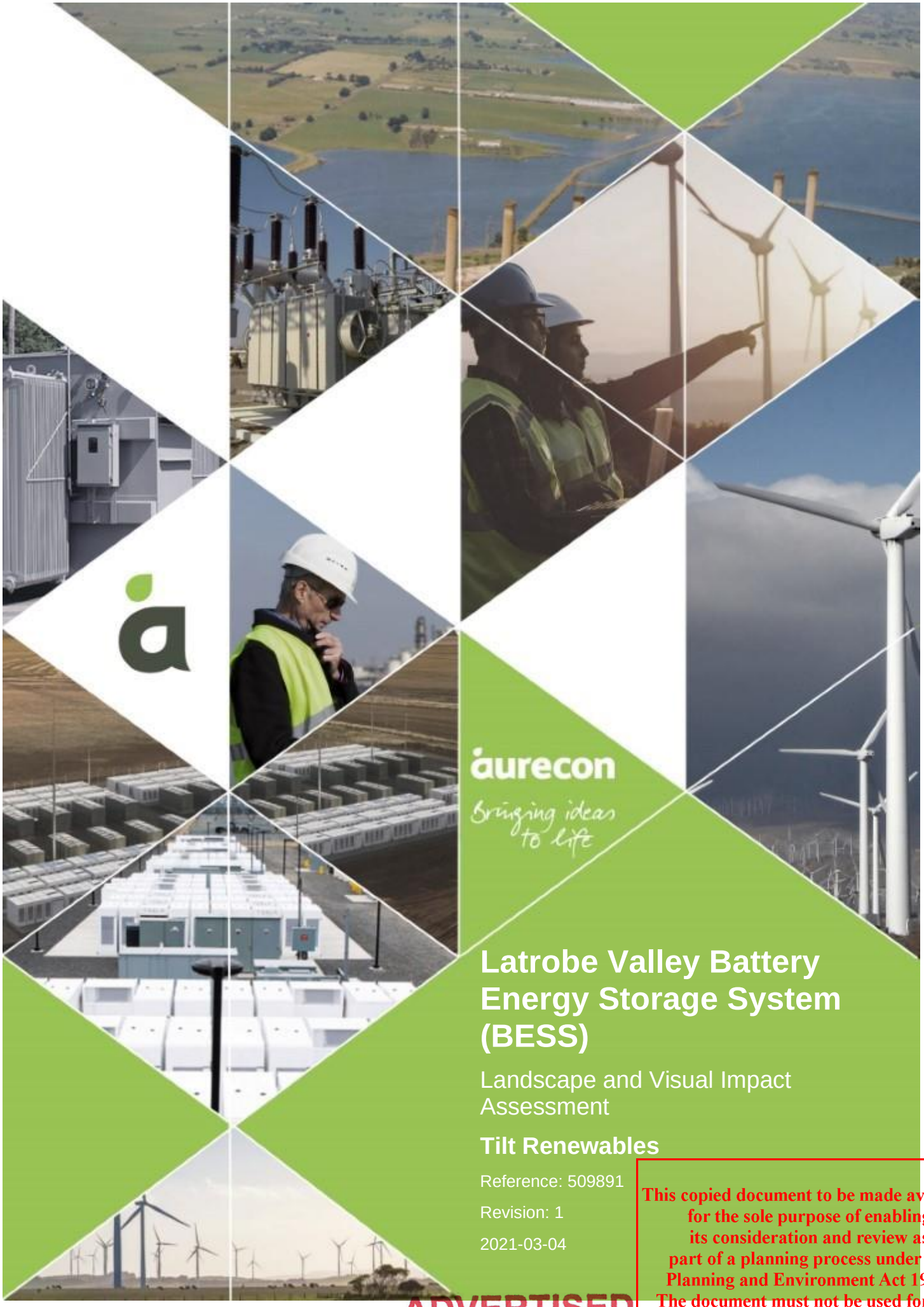

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Bringing ideas to life

Latrobe Valley Battery Energy Storage System (BESS)

Landscape and Visual Impact Assessment

Tilt Renewables

Reference: 509891

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Abbreviations

Term	Definition
BESS	Battery Energy Storage System
CHMP	Cultural Heritage Management Plan
ESO	Environmental Significance Overlay
Foreground	The area that immediately surrounds the Project up to a distance of 0.5 kilometres.
HO	Heritage Overlay
Km	kilometre
LVIA	Landscape and visual impact assessment: The assessment of the impacts of the proposal on landscape and visual values.
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.
LCT	Landscape Character Types
LPPF	Local planning policy framework: Local planning policies are tools used to implement the objectives and strategies of the Municipal Strategic Statement.
M	metre
MWTS	Morwell Terminal Station
Study Area	The area designated relevant for assessment of the Project, determined by viewshed analysis
the Project	Latrobe Valley BESS
The Site	Proposed location for the Project
Viewpoint	Moderate or high sensitivity location from which views to the construction process or components of the Project may be possible.
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.

Executive summary

Project overview

The purpose of the Landscape and Visual Impact Assessment (LVIA) is to support an application for a Planning Permit to the Minister for Planning.

The Project proposes two battery energy storage sites (BESS) – north and south, located between the existing Morwell Terminal Station (MWTS) and the Morwell Energy Brix Power Station. The Site is within the Industrial 1 Zone(IN1Z). The Project comprises of electrical infrastructure and battery storage units, which are similar to existing components within the Study Area. The most noticeable elements of the Project include the scale of the connection works within the MWTS at a height of 16m, within the existing MWTS and commensurate with existing infrastructure.

The landscape and visual baseline

This assessment examines the existing landscape and visual conditions of the Study Area (both physical and statutory) to establish a baseline against which potential impacts of the Project can be assessed.

The LVIA Study Area has been defined within a radius of two kilometres from the location of the proposed Site. This area captures where the Latrobe Valley BESS will be observable, based upon the 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, as well as a desktop study and field work to understand the various physical elements that combine to create landscape and visual character.

The Project is located in the City of Latrobe. There are no specific planning designations attributing any specific landscape or visual value within the Study Area.

The baseline assessment identified a total of three distinct Landscape Character Types (LCTs) within the Study Area, including:

- LCT 1: Energy and industrial infrastructure
- LCT 2: Rural landscape
- LCT 3: Residential (within Morwell township)

These LCTs have been determined to have a high ability to absorb the change as proposed by the Project.

There were six representative public viewpoints identified within the Study Area that were determined to be assessed which include the following:

- Viewpoint 01 (VP1): Hazelwood Drive, 1.15km northwest of the Project. Viewpoint is representative of that experienced by workers and education centre visitors.
- Viewpoint 02 (VP2): Monash Way, approximately 500m north of the Project and the existing Morwell Terminal Station site. Viewpoint is representative of that experienced by arterial road users.
- Viewpoint 03 (VP3): Monash Way, approximately 400m south of the Project and the existing Morwell Terminal Station site. Viewpoint is representative of that experienced by arterial road users.
- Viewpoint 04 (VP4): Tramway Road, 1.4km east of the Project. Viewpoint is representative of that experienced by local road users.
- Viewpoint 05 (VP5): The end of Mulga Road, 2.6km east of the Project. Viewpoint is representative of that experienced by nearby private residents.
- Viewpoint 06 (VP6): Firmins Lane, near a garden supplies depot, 2.8km north west of the Project. Representative of industrial/commercial workers and travellers.

Landscape and visual assessment findings

For the assessment of landscape and visual impacts, the Latrobe Valley BESS civil works site layout concept design (rev 0, 14-12-2020) produced by Aurecon has been used.

The level of visual modification due to the Project is a combination of the degree of change and the ability of the landscape setting to absorb the change. The prominence and level of intrusion of the development within a landscape setting is a key determinant of the level of visual modification.

The landscape characters identified within the Study Area have been assessed to have the ability to absorb change, as proposed by the Project, given the high level of modification already experienced.

The visual impacts of the Project resulted in Very Low impacts for all assessed viewpoints. This is derived from there being no sensitive receivers in close proximity to the Project and located in a setting that is highly modified. VP5 is the only sensitive receiver, representative of a private residential property, with the Project being barely discernible in the background of the field of view. The Project is expected to be most visible by motorists travelling along Monash Way, with the views of key components not in contrast to the MWTS in the foreground view.

Mitigation

To assist the detailed design process, recommendations have been provided for mitigation and management measures to reduce potential visual impacts as a result of the Project during construction and operation.

Mitigation measures are based on minimising the level of intrusion that the Project has on its existing landscape setting and is subject to further detailed design, operational and safety requirements. The mitigation measures for the Project include minimising disturbance to existing vegetation in and around the Site, planting low-level vegetation where possible to soften views, and using materials and colours on structures to blend into the existing environment where possible.

1 Introduction

1.1 Project background

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Tilt Renewables (the Proponent) to prepare a Landscape and Visual Impact Assessment (LVIA). The purpose of the LVIA is to support an application for a Planning Permit, for the proposed Latrobe Valley Battery Energy Storage System (BESS) at Morwell, Victoria (the Project), to the Minister for Planning.

The Proponent is proposing to install a BESS in Morwell to help maintain reliable and affordable energy supply for Victoria. The intention is to combine the operation of the Latrobe Valley BESS with renewable energy generation to support Victoria's transition away from reliance on fossil fuels.

This LVIA report will assist in identifying any impacts to the existing landscape character and visual amenity as a result of the Project and whether further approvals or assessments are required. This assessment provides identification of any key risk areas of the Project and provides recommendations for mitigating adverse impacts of proposed infrastructure.

1.2 Scope of proposed works

It is understood the main infrastructure for the proposed Latrobe Valley BESS will be located in the western portion of the Study Area, with connection potentially required in the existing AusNet portion of the Site.

The Project will involve construction and operation of up to two separate BESS sites (Northern BESS and Southern BESS) simultaneously or as a phased Project with an indicative output of 203 MW / 812 MWh, optimising the energy storage capacity of the site.

Key Plant of the BESS includes Battery Pack Containers, installation of up to two 66 kV transformers (one per BESS Site), 33 kV transformers and 3.5 MW inverters. Ancillary infrastructure includes construction of an Operations and Maintenance (O&M) Buildings (that includes storage and site office), access track connecting the BESS Sites to the PineGrow Intersection at Monash Way and permanent site carparking.

The Project further involves connection upgrade works within the MWTS and installation of up to two 66 kV transformers, connecting to the BESS Sites via an underground connection. Installation of up to two 66 kV transformers will either be within the BESS sites or within the MWTS. The development footprint covers 3.95 hectares in the northern and southern BESS sites.

The proposed works will include:

- Installation of the BESS;
- Ancillary infrastructure;
- Development of access track; and
- Connection upgrade with the MWTS.

1.3 Location

The Project is located in Morwell, approximately 149 kilometres east of Melbourne in the Latrobe Valley area of Gippsland. The Project is situated at 240 Monash Way, Morwell, adjacent to the existing Morwell terminal station (MWTS). The location of the Project is presented within the Site Context Plan Figure 1.1.

The BESS site is currently vacant land within the Industrial 1 Zone as outlined in the Latrobe Planning Scheme. The proposed Latrobe Valley BESS infrastructure will be located in the western portion of the Study Area, with connection required into the existing AusNet MWTS. Monash Way is an arterial road identified in the Latrobe Planning Scheme as a Road Zone, Category 1.

The Site is situated within the Victorian Eastern Plains as part of the prior stream plains geomorphological unit. The Project area also runs adjacent to a waterway (Bennett's Creek) on its western border.

Figure 1.1 Site context plan (Site shown in red outline)

1.4 Study Objectives

The objectives of the LVIA were to:

- Understand the natural and built landscape, and visual attributes and characteristics in the vicinity of the Project, including their relationship to use patterns and history.
- Identify areas of sensitivity to landscape and visual change associated with the Project.
- Identify opportunities to improve and enhance the visual environment from a precinct perspective and for the Project's components.
- Assess the landscape and visual impacts associated with the Project.
- Satisfy regulatory requirements under the Planning and Environment Act 1987.

1.5 Structure of the report

The structure of the report is outlined below.

- Section 1 – introduces the report.
- Section 2 – describes the methodology for the assessment.
- Section 3 – identifies relevant landscape and visual policy and legislation pertinent to the proposal.
- Section 4 – describes the existing site conditions and landscape setting.
- Section 5 – describes the proposal's features and operation.
- Section 6 – identifies the landscape character types within the Study Area.
- Section 7 – assesses the potential visual impacts of the proposal.
- Section 8 – summarises the assessment findings.
- Section 9 – provides guidelines for mitigating potential impacts.

2 Methodology

2.1 Approach to the assessment

The Project is located in land zoned industrial (IN1Z) adjacent to the existing MWTS and the Morwell Power Station, is not seeking a planning scheme amendment to change land use. As such, determination of the prominence of the proposed development within a landscape setting is treated as being of a lower relevance to assess the visual impact than the sensitivity or perception of a viewer.

The report's key focus therefore is on the visual sensitivity being the tolerance of the viewer and the landscape setting to change as a result of the proposed development. The visual impact of the Proposal is determined by evaluating the degree of its visual fit in the context of the visual sensitivity of the surrounding land uses (based on the land use zones of the applicable planning scheme).

2.2 Study Area

A viewshed is defined as the surface area visible from a given viewing location. As the distance increases from any proposed development, the field of view decreases causing the visibility of components to diminish. Appendix A defines this diminishing visual prominence rationale.

The extent of the Site's potentially visible surface area from a given viewing location was identified during a desktop study using topographical data. The Study Area for the purposes of this assessment includes the Project extents (the Site) and a conservative viewshed analysis of a two kilometre radius from the Site boundary.

The potential viewpoints were then validated from imagery taken during a field visit to account for potential screening and filtering effect on views from topography, existing vegetation and built form.

2.3 The study method

There are limited specifications for the assessment of landscape and visual impacts specific to Australia. Therefore, the below guidelines have been used as a basis for the methodology for this assessment.

- The Guidance for Landscape and Visual Impact Assessment (GLVIA), Third Edition (2013), prepared by Landscape Institute and Institute of Environmental Management & Assessment (IEMA, UK);
- Guideline for Landscape Character and Visual Impact Assessment (August 2020), Transport for New South Wales; and
- Guidance Note for Landscape and Visual Assessment (June 2018), Australian Institute of Landscape Architects (Queensland chapter).

Figure 2.1 illustrates the key steps for the methodology of the assessment.

The level of visual impact resulting from the Project has been assessed against the following components:

- Visual sensitivity made up of the following:
  - Viewer sensitivity: the sensitivity of the viewer to the development/change and distance from the viewpoint; and
  - Landscape sensitivity: the ability of the landscape setting to absorb the development/change.
- Scale of modification: how well the development/change contrasts or blends with the surrounding land use based on varying levels of visual prominence.

Establishing the level of visual impact involves assigning levels of visual sensitivity and modification such as high, medium, low or very low. A determination matrix is then used to assign an overall level of visual impact.

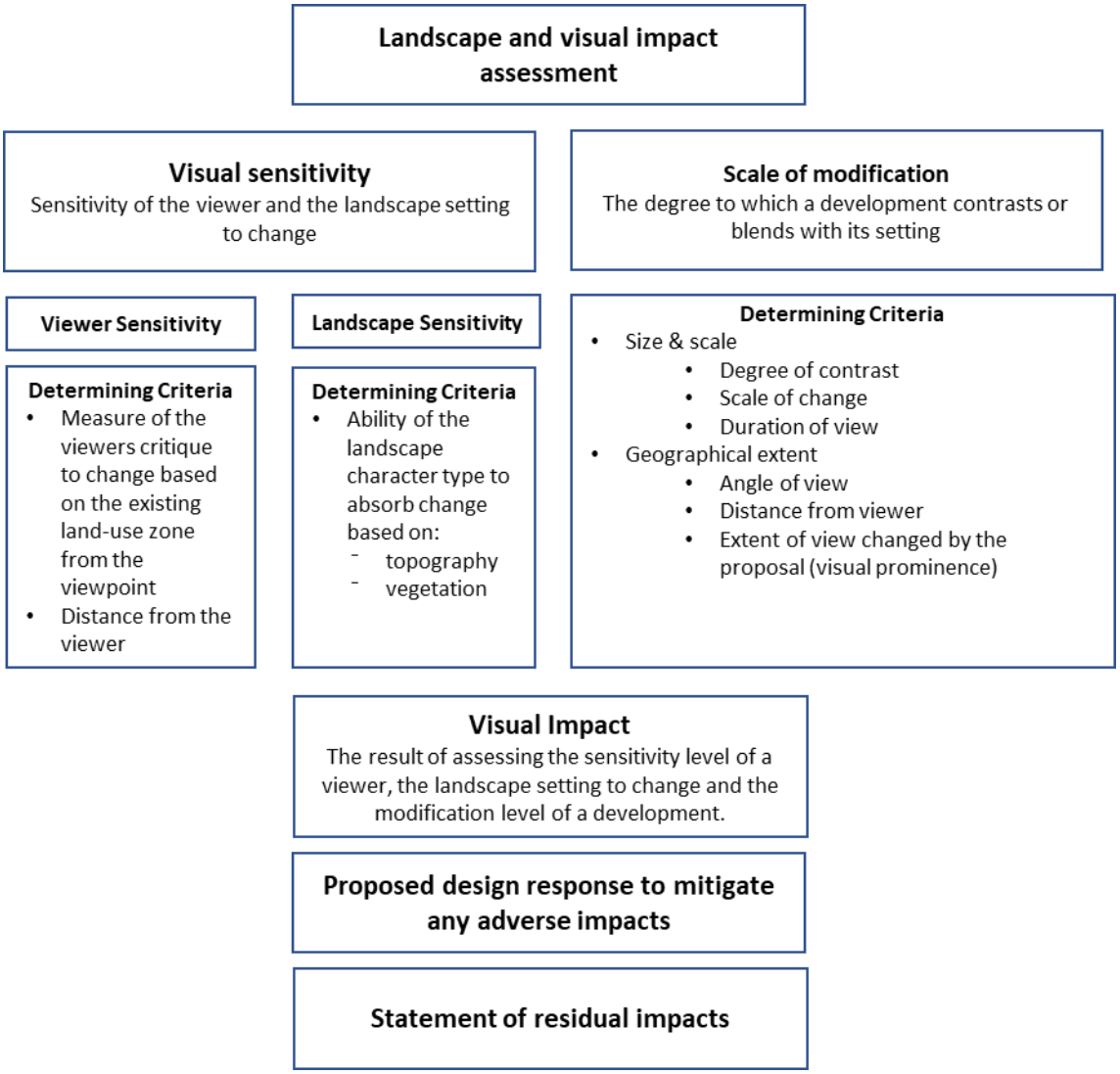

Figure 2.1 LVIA study method

2.4 Visual sensitivity

Visual sensitivity is composed of two parts: viewer sensitivity and landscape sensitivity.

2.4.1 Viewer sensitivity

Viewer sensitivity is a measure of how critically a change to the existing landscape setting would be regarded based on the use of the area and distance from where it is viewed.

Various landscape settings have differing indexes to the relative importance the viewer places on them. For example, individuals would view changes to the visual setting of 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. This approach is consistent with the visual management system (*Landscape Aesthetics – A Handbook for Scenery Management*, United States Department of Agriculture& Forest Service, 1995).

The viewer sensitivity levels relating to existing land use zones within the study area are outlined in Table 2.1.

The next critical component to rating the viewer sensitivity is the distance of the Proposal from the identified land use area. As illustrated in Table 2.1, there are three viewing distances to consider:

- Foreground (0 – 500 metres);

- Middleground (501 – 2000 metres); and
- Background (> 2000 metres).

As outlined in Appendix A, as the distance increases from the land use area the field of view decreases causing the visibility of the proposal 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 2.1 Viewer sensitivity determination matrix

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					

Landscape Sensitivity

To understand the sensitivity of a landscape and its ability to absorb change, landscape character types (LCTs) need to be identified and defined. Identifying the LCTs of an area provides the basis for understanding the features that are important, and how different types of development would sit within a particular landscape.

LCTs are defined based on physical characteristics such as:

- topography;
- vegetation;
- drainage patterns;
- geology; and
- land use patterns.

Once the LCTs are defined, an assessment of how well these landscape types are able to accommodate or absorb change such as a development is undertaken.

The key factors considered in determining a LCTs absorptive capability are:

- topographic variation;
- presence of and patterning of vegetation and density; and
- human modification such as presence of built from and/or extensive clearly resulting in a highly altered landscape.

In areas of elevated topography with no or lowland vegetation, open, unobstructed views towards a proposed development is highly likely. The ability for the setting to absorb the development and/or screen views using

vegetation for example would be hard to achieve. Consequently, the ability to absorb the development in this scenario would be very low.

In areas where there are bands of dense vegetation in the surrounding landscape or the presence of built form that inhibit views towards the proposed development, the setting would have a greater capacity to absorb change compared to a cleared, expansive landscape or no structures.

Areas that contain signs of human modification such as farming land and industrial areas are typically not considered as high-quality landscape settings compared to natural landscapes such as mountain ranges. As such, the higher level of human modification the greater capacity the landscape has to absorbing change.

The absorptive capability levels relating to landscape sensitivity are outlined in Table 2.2.

Table 2.2 Landscape absorptive capability level

Landscape absorptive capability level	Description
Very Low	The extent of alteration would result in the landscape losing significant natural landscape features, its character and/or sense of place. Open, expansive and bare landscapes. Elevated, bare and/or groundcover vegetation. The viewer is highly sensitive to changes in their immediate surroundings such as residents or 'natural' areas such as National Parks.
Low	The extent of alteration would result in the landscape partially losing some natural or designed landscape features, its character and/or sense of place. Open, expansive and moderately vegetated landscapes including canopy trees. Elevated and vegetation landscape including canopy trees. The viewer is moderately sensitive to changes in their immediate surroundings such as users of regional and local reserves.
Moderate	Modified landscapes with an abundance of built form and limited natural characteristics. Built-up landscapes typically interspersed with canopy trees. The viewer is aware of the change but not overly sensitive to changes in their immediate surroundings such as users of commercial areas.
High	Highly modified and/or degraded landscapes with limited to no natural characteristics. Undulating or elevated topography with dense tree cover. The viewer is not critical/sensitive to changes in their immediate surroundings such as industrial areas.

2.5 Assigning a level of visual sensitivity

The visual sensitivity is a result of combining the viewer sensitivity level with the landscape absorptive capability level using the visual sensitivity determination matrix illustrated in Table 2.3.

Table 2.3 Visual sensitivity determination matrix

Viewer sensitivity level

Landscape absorptive capability level	**H**	**M**	**L**	**VL**
VL	H	H	M	L
L	H	M	L	VL
M	M	L	L	VL
H	L	VL	VL	VL

VL = Very low
L = Low
M = Moderate
H = High

Level of visual sensitivity

2.5.1 Visual modification

Visual modification is not easily predicted objectively, and interpretation and professional judgment is applied. A clear picture of the modification is determined from a combination of the degree of change to the view due to the Project including the extent of the area over which changes would be visible, the period of exposure to the view and reversibility.

The assessment of visual modification is based on the Proposal design outlined in Section 5.

The assessment of visual modification does not include an evaluation of the merit of the aesthetic quality of the design. It is recognised that that assessment of aesthetic quality is highly subjective, therefore an assumption has been made that the changes are adverse. Table 2.4 outlines the four categories of modification used for determining the degree of visual modification potentially resulting from the Project.

The key considerations in determining the level of visual modification as outlined in Table 2.4 include:

- Size and scale;
  - The scale of the change in the view with respect to the loss or addition of features in the view, and changes to the composition including the proportion of the view occupied by the Project components;
  - The degree of contrast or integration of the Project components in the landscape setting with the existing or remaining elements including form, mass, line, height, colour, texture and materiality; and
  - The nature of the view towards the Project components in terms of duration of the view.
- Geographical extent;
  - The angle of the view in relation to sensitive land use;
  - The distance of the viewpoint from the Project component(s); and
  - The extent of the area over which the changes would be visible.

Table 2.4 Criteria for determining the visual modification level

MODIFICATION LEVEL	DESCRIPTION
High	The proposal is highly visible and intrusive in regard to the size, scale and geographical extent, and would disrupt views currently experienced from sensitive land use areas and/or strongly contrasts with the existing landscape setting which has limited capacity for change.
Moderate	The proposal partially intrudes in regard to the size, scale and geographical extent or somewhat obstructs current views from sensitive land use areas and/or a noticeable compositional change to the existing landscape setting in which there is moderate capacity for change.
Low	The proposal is barely perceptible resulting in minor deterioration to the view currently experienced from sensitive land use areas; and/or results in a small change to the existing landscape setting in which change is possible without harm.
Very low	There is minimal compositional contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the proposal and the environment in which it sits. In this situation, the proposal may be noticeable, but does not markedly contrast with the existing landscape setting.
Not apparent	There are no views of the proposal components and as such, there is no impact.

2.5.2 Assigning a level of impact

The visual impact therefore is a result of combining the visual sensitivity level with the degree of visual modification using the visual impact determination matrix illustrated in Table 2.5.

The consequence of the application of the matrix is that (except where the Project cannot be seen) the Project would have some adverse impact, whether low, moderate or high, depending on the level of visual modification and viewer sensitivity from the location at which the Project can be viewed.

Table 2.5 Impact determination matrix

Visual Sensitivity

Degree of modification*

	H	M	L	VL
H	H	H	M	L
M	H	M	L	VL
L	M	L	L	VL
VL	L	VL	VL	VL

*Adverse, Neutral or Beneficial

VL – Very low
L = Low
M = Moderate
H = High
Level of Visual impact*

2.5.3 Consideration of night lighting impacts

There is little guidance locally on the assessment of night time visual impact. Therefore, the methodology applied to this report is drawn from the United Kingdom. The Institute of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light (2020) includes four categories or zones with which to describe the lit situation of the landscape. These environmental zones are supported by design guidance for the reduction of light pollution which can then inform proposed mitigation techniques (refer to Appendix B).

A full night time visual assessment has not been undertaken, however this report has included a broad assessment of likely impacts. This assessment includes identification of existing lighting levels within the Study Area (referencing the ILE environmental zones), identification of the likely sources of lighting associated with the Project and consideration of likely lighting impacts.

2.5.4 Residual impacts

The residual impact assessment level has considered the existing view in comparison to the view ten years after commencement of operations. Maturation of the landscape plantings that have been included in the design would filter or inhibit views at some locations, potentially reducing the visual impact of the Project over time. These are discussed in the viewpoint assessments in section 7.

2.6 Limitation and assumptions

2.6.1 Limitations

There are the following limitations associated with this assessment:

- There are limited specifications for the assessment of landscape and visual impacts specific to Australia. Therefore, the below guidelines have been used as a basis for the methodology for this assessment.
  - The Guidance for Landscape and Visual Impact Assessment (GLVIA), Third Edition (2013), prepared by Landscape Institute and Institute of Environmental Management & Assessment (IEMA, UK);
  - Guideline for Landscape Character and Visual Impact Assessment (August 2020), Transport for New South Wales; and
  - Guidance Note for Landscape and Visual Assessment (June 2018), Australian Institute of Landscape Architects (Queensland chapter).
- The LVIA process aims to be objective and, as such, seeks to describe any changes factually. Potential changes resulting from the Proposal 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. This assessment has attempted to be objective, however it is recognised that visual assessment can be highly subjective, and individuals are likely to associate different visual experiences to the Study Area;

- This LVIA is based on Latrobe Valley BESS civil works site layout concept design (rev 0, 14-12-2020) produced by Aurecon.
- The impact assessment is focused on the current land uses and zoning.
- Access to sensitive viewpoints on private land, such as residences or accommodation, were not undertaken for this LVIA. However, impacts from these locations were considered in the assessment.
- Methodology, program and timing of the construction works are currently indicative and dependent upon planning approvals. Consequently, construction impacts have not been assessed in this report. However, it would be acceptable to predict that there would be impacts during construction and would be similar degree of visual impact to the operational phase assessment findings.

2.6.2 Assumptions

This report has been developed based on the following assumptions:

- Desktop investigations and a field study were undertaken to inform the findings of this report.
- No stakeholder consultation or engagement on environmental matters has occurred.
- The preliminary environmental assessments were undertaken based on the Project investigation area mapped in each specialist assessment. Any additional Project area has not been considered by these reports and therefore has not been considered in this report.
- The landscape and visual assessment is based on the Project Description as outlined in Section 1.2. As the design of the Project is not yet finalised, our advice provides a point in time reference that is subject to change.
- The methodology adopted for this landscape and visual impact assessment assumes that if the works would not be seen, there is no impact.
- 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.

3 Legislation and Policy

Legislation, policies and guidelines that have been reviewed and that are applicable to this impact assessment are outlined below.

3.1 State legislation

Victorian legislation contains several Acts that are relevant to the Latrobe Valley BESS Project, including:

Table 3.1 State legislation

Legislation/Policy reference	Brief description legislation, salient parts and intent	How legislation/policy is relevant to the study
Heritage Act 2017	Heritage registered elements can be selected for their design or aesthetic characteristics. Whilst there is no specific protection of views of heritage elements within the Act, it is worth considering the heritage registered element as an importance cultural aspect which helps influence the landscape character.	The heritage registered Morwell Power Station and Briquette Factory (H2377) is an example of Victoria's industrial heritage. It is situated immediately west and northwest of the Project area.

3.2 Municipal planning schemes

The *Planning and Environment Act 1987* (PE Act) provides the framework for land-use and development in Victoria. Planning schemes prepared under the provisions of the Act apply to each municipal area in Victoria.

The Project is located in an area subject to the provisions of the Latrobe Planning Scheme. The relevant planning schemes control the use and development of land and are structured to include:

- State Planning Policy Framework;
- Local Planning Policy Framework;
- Municipal Strategic Statement;
- Local Planning Policy;
- Zones and overlays;
- Particular and general provisions; and
- Definitions and incorporated documents.

State Planning Policy Framework
The State Planning Policy Framework (SPPF) provides a context for spatial planning and decision making in Victoria. Table 3.1 is a summary of the key documents assessed:

Table 3.2 State Planning Policy Framework documents

Legislation/Policy reference	Brief description legislation, salient parts and intent	How legislation/policy is relevant to the study
Latrobe PS Ordinance	**15.01-6S Design for rural areas** • Ensure that the siting, scale and appearance of development protects and enhances rural character. • Protect the visual amenity of valued rural landscapes and character areas along township approaches and sensitive tourist routes by ensuring new development is sympathetically located. • Site and design development to minimise visual impacts on surrounding natural scenery and landscape features including ridgelines, hill tops, waterways, lakes and wetlands.	Proposed site is within existing industrial zone with farming zone near. Proposed use is compatible to the SPPF.

3.2.1 Local Planning Policy Framework (LPPF)

Table 3.2 is a summary of the key documents assessed.

Table 3.3 Relevant local planning policies

Legislation/Policy reference	Brief description legislation, salient parts and intent	How legislation/policy is relevant to the study
Municipal Strategic Statement and Local Planning Policy	The Latrobe MSS includes policy direction that reflects the diverse land uses and development intensity in the municipality. **Clause 21.04 Environmental risks:** encourages new energy opportunities in order to avoid and minimise environmental risks. **Clause 21.07 Economic development:** supports the creation of new and alternative energy related jobs and investments within the municipality. It seeks to make use of existing energy infrastructure and distribution networks.	Proposed land use is compatible with the LPPF

3.2.2 Zones and overlays

Zones

The Project is within the Industrial 1 Zone. The area surrounding the Site has a variety of land uses including residential, recreation and public open space, community facilities, industrial sites and utilities as shown in Table 3.4 and mapped in Figure 3.1 Land use zones .

Table 3.4 Land uses

PLANNING ZONES	Land Use Features
IN1Z: INDUSTRIAL 1 ZONE	Project site and adjacent Morwell Terminal Station (east) and Pinegro green waste site (south). To the east of Monash Way, this includes areas of the electrical transmission easement.
IN2Z: INDUSTRIAL 2 ZONE	Industrial area east of Monash Way including Morwell waste transfer (Tip) and Omnia Specialities (soil and fertilizer manufacture)
RDZ1: ROAD ZONE	Monash Way, access to the Project site
FZ1: FARMING ZONE	Area to the south and east of Monash Way
NRZ4: NEIGHBOURHOOD RESIDENTIAL ZONE	South-east side of Morwell township, north of Princes Drive (RDZ1) and Princes Freeway (PUZ4).
SUZ1: SPECIAL USE ZONE	Land area to west and south of Project site, part of the Hazelwood Power Station
PUZ1: PUBLIC USE ZONE 1	Hazelwood Pondage and wetlands located south of Monash Way
PPRZ: PUBLIC PARK AND RECREATION ZONE	Tree-reserve and local park south-east side of Morwell township, north of Princes Drive (RDZ1)

Overlays

The Study Area falls within the Gippsland Plain bioregion, the West Gippsland Catchment Management Authority (CMA) area and the Latrobe Local Government Area (LGA).

While no environmental significance overlays occur over the Study Area, portions of the Site are affected by the Land Subject to Inundation Overlay (LSIO), Flooding Overlay (FO) and the Site is within a designated bushfire prone area.

The Study Area is covered by a Bushfire Prone Area (BPA). There are no implications regarding the designation of the Site for the Project under Clause 13.02-1S of the Latrobe Planning Scheme.

Refer to overlays listed in Table 3.5 and mapped in Figure 3.2.

Table 3.5 Planning overlays

PLANNING CODE	Components
LSI0: LAND SUBJECT TO INUNDATION OVERLAY	Specified portions of the Study Area, particularly in the north
FO: FLOODWAY OVERLAY	Along the western boundary of the Site, area associated with Bennetts Creek and further east of the Site along Waterhole Creek

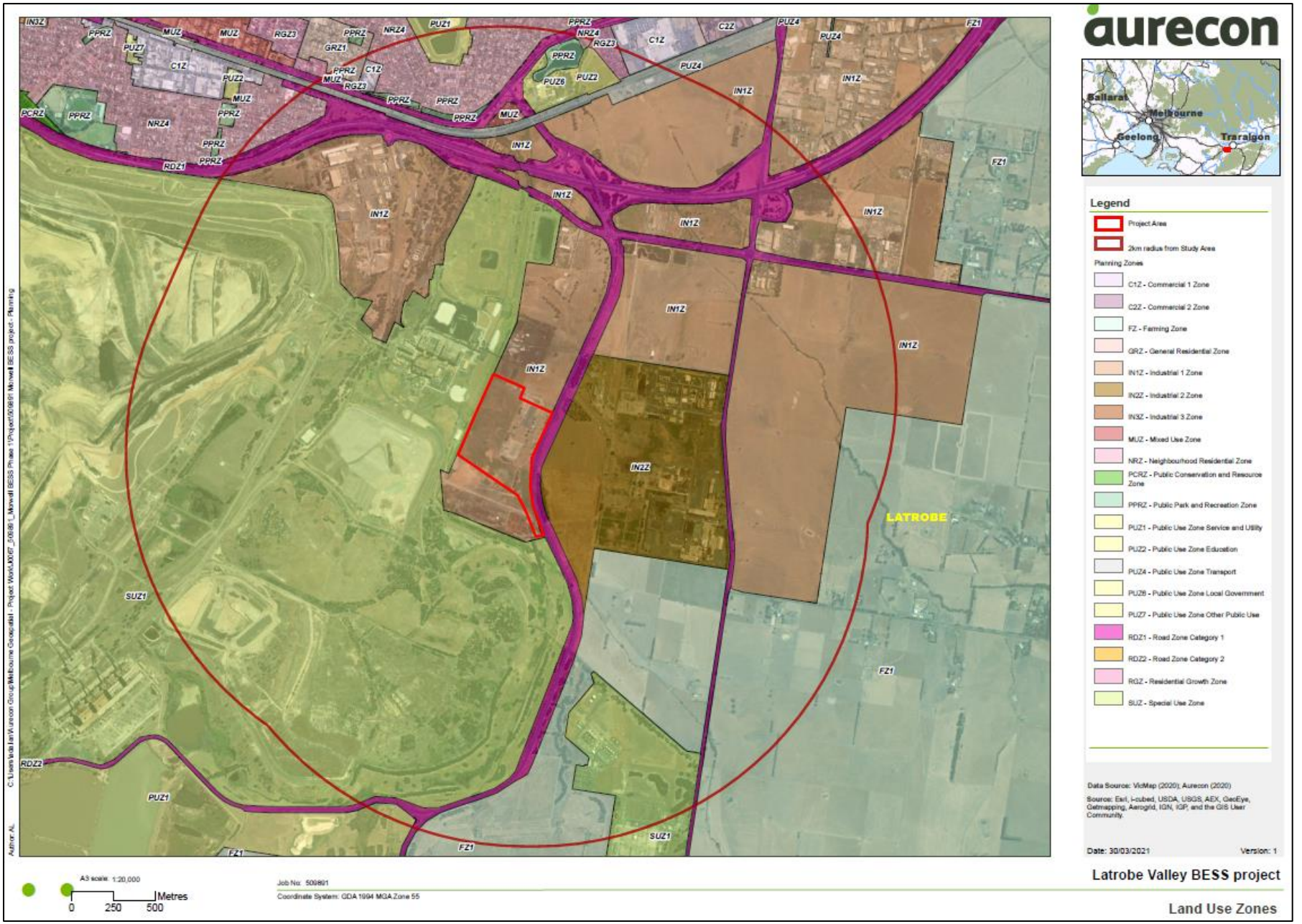

Figure 3.1 Land use zones within Study Area

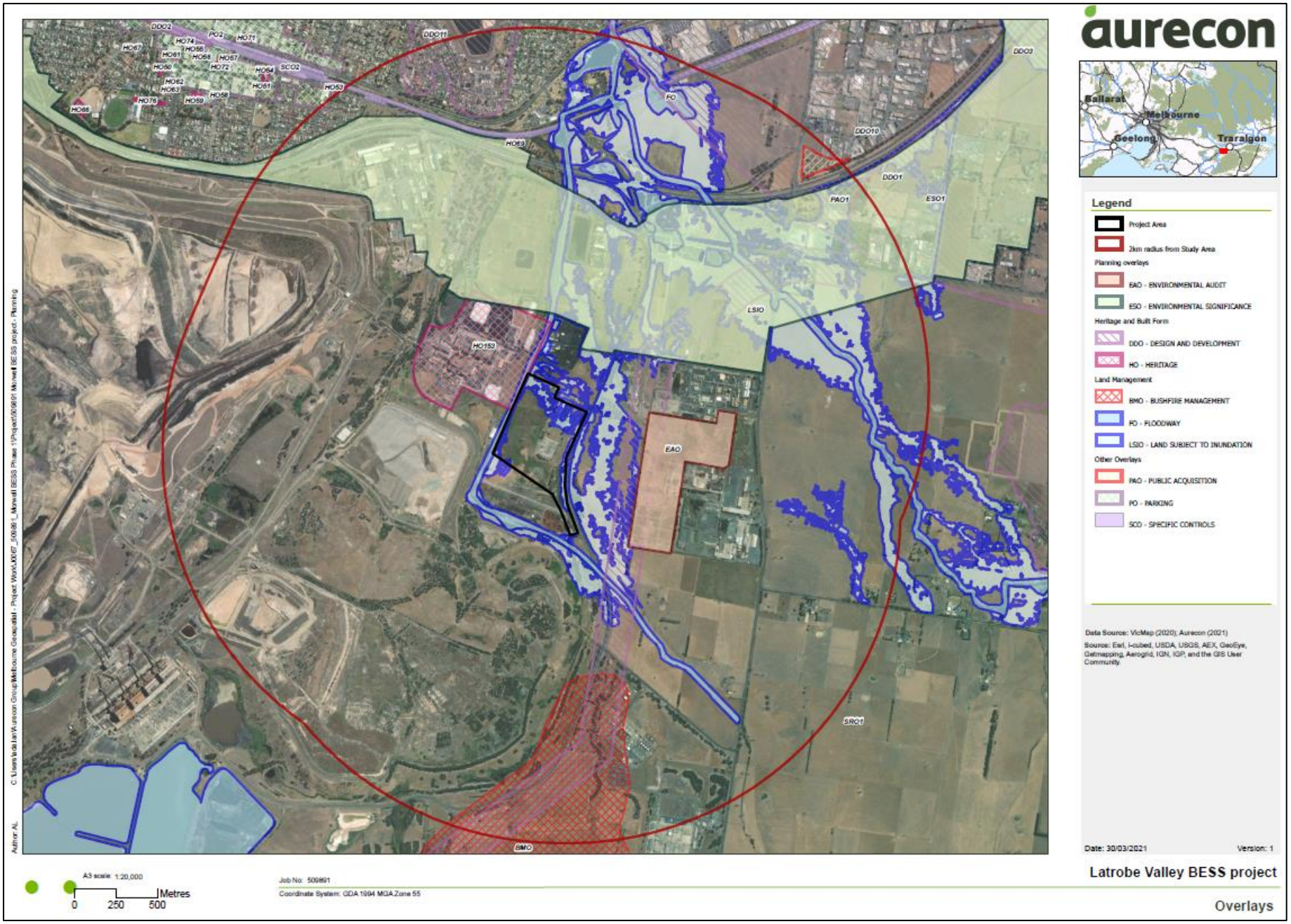

Figure 3.2 Planning overlays within Study Area

4 Site context and appraisal

4.1 Site context

The Project is located approximately 500m east of the Morwell Power Station, decommissioned in 2014 and approximately three kilometres north east of the Hazelwood Power Station site decommissioned in March 2017.

The Site is located within the Latrobe City Council catchment and within the Latrobe Valley. This area contains three large open cut brown mines (Hazelwood, Yallourn and Loy Yang) and associated power stations. The area also comprises a large forestry industry.

4.1.1 Overview

The following section provides a brief description of the existing conditions, associated land uses and key landscape features surrounding the Site.

Land Use

Land use in the surrounding area predominantly consists of agricultural land, industrial land and land used for power generation. The Site is currently vacant industrial land.

The land directly adjacent to the Site is vacant land which is part of the Morwell Power Station land area. The nearby Morwell Power Station and Hazelwood Power Station (refer to Figure 4.1) and open-cut mine occupy land to the west of the Site. The power station was a brown coal-fired thermal power station and was decommissioned in 2014. It was previously used to supply electricity to the retail market as well as produce briquettes in the adjacent Energy Brix briquette works. The power station and mine have ceased operation and are now in a closure, demolition and rehabilitation phase. Hazelwood Pondage to the south of the Site (refer to Figure 4.2) was formed and used as part of the power station operations. The pondage is often used as a recreational lake along its western shores and for boating activities.

Land use directly surrounding the remainder of the Site is industrial land, including PineGro Green Waste to the south, Morwell Transfer Station to the northeast and vacant land zoned Industrial 2 on the eastern side of Monash Way.

Land further southeast of the Site is within the Farming Zone. There are rural residential dwellings scattered within the Farming Zone the nearest being approximately 1.6km from the Site. The closest residential land use is located approximately 2 km to the north in the Morwell township.

Monash Way is an arterial road to the M1 freeway, which allows access to major nearby Victorian ports for any imported equipment (Melbourne and Geelong).

Figure 4.1 Hazelwood power station (image: N.Lamb 2012)

Figure 4.2 Hazelwood pondage (image: N.Lamb 2012)

Topography, landform and waterways

There are a number of waterways and landforms within the Study Area that are highly modified as the result of diversions around and reclamation of the Morwell open-cut coal mine.

Being within a valley (Latrobe Valley), there are a number of natural waterways with the largest being the Latrobe River, north of Yallourn. There are also a number of smaller tributaries winding through undulating land. To the west of the Site is Eel Hole Creek diversion (refer to Figure 4.4) and Bennetts Creek (refer to Figure 4.6).

To the south of the Site, lies the Hazelwood overburden mound (Figure 4.3). This was created from overburden (including interseam, ash and debris materials) from mining activity and shaped to form a natural-appearing hill, with minimal soil placed to allow vegetation to grow.

The Site is surrounded by undulating topography with background views to rising foothills as seen in Figure 4.5.

Figure 4.3 Revegetated overburden mound, south of the Site (image: R. Smithers 2020)

Figure 4.4 Eel Hole Creek diversion – altered waterway to the west of the Site (image: N.Lamb 2012)

Figure 4.5 Undulating landscape with background foothills (image: R. Smithers 2020)

Figure 4.6 Bennetts Creek – area of darker ephemeral grasses (image: Google street view)

Vegetation

The Study Area has been subject to a high level of past disturbance and does not have any significant native vegetation. A group of vegetation is located within the Site along the eastern boundary. Refer to the Desktop Ecological Risks Assessment - Revision 1, Aurecon, 14.9.2020 for the impacts to flora and fauna. A small amount of mature native vegetation is present within the MWTS, to the southeast of the Site.

The Phase 1 Desktop Ecological Risks Assessment details the extent and type of vegetation within the Project site. It states, '*The desktop assessment determined that the Study Area has been subject to a high level of past disturbance and is unlikely to support extensive areas of remnant native vegetation or significant habitat for native fauna*'. There is planted vegetation and a few patches of remnant native vegetation within the Site as listed in Table 4.1.

Table 4.1 Vegetation types and conservation status

Conservation status	EVC / Conservation reserve	Location
n/a	Aquatic habitat	Patches scattered to centre, north and east
Least concern	EVC 821 - Tall Marsh	Small patch in the north of the site
Endangered	EVC 647 - Plains Sedgy Wetland	West side of site
Endangered	EVC 151 – Plains Grassy Forest	South side of site near Monash Way
Endangered	EVC 55 – Plain Grassy Woodland	Narrow strip to west perimeter

In the surrounding area, there are EPBC Act listed Strzelecki Gum and Gippsland Red Gum Grassy Woodland species.

Cultural Heritage

A summary of findings from the Heritage Due Diligence Assessment (July 2020), includes the following.

- A search of the Victorian Aboriginal Heritage Register (VAHR) revealed that there are no Aboriginal places within the Project area.
- The Project area intersects with one area of cultural heritage sensitivity (CHS) being land within 200 m of Bennett's Creek.
- There is one VHR listed heritage place, Morwell Power Station and Briquette Factory (H2377) as seen in Figure 4.7, situated immediately west and northwest of the Project area. The Heritage Overlay (HO) associated with this heritage place (HO153) abuts the Project area in the west.

There are heritage places located within close proximity of the Morwell township, approximately 2.5 km north-west of the Project area, as detailed in Table 4.2. Many of the heritage sites below are associated with the Hazelwood power station, open-cut coal mine and associated development.

Table 4.2 Historic heritage register search results

Register	Listing	Site ID	Proximity to Project area
VHR / Local Planning Scheme	Morwell Power Station and Briquette Factory	H2377 / HO153	Outside of the Project area, the heritage curtilage abuts the western extent of the Project area.
VHR	No 21 Dredger	H2130	Outside of the Project area, approximately 1.4 km northwest (refer to Figure 4.8).
VHI	Tramway Road 1	H8121-0022	Outside of the Project area, approximately 2 km northeast.
Local Planning Scheme	Washingtonia Palms	HO69	Outside of the Project area (off Princes Drive, Morwell), approximately 1.5 km north.

Figure 4.7 VHR H2377 Briquette factories with chimneys
(View west from Site, photograph by A. Carr, 29 July 2020)

Figure 4.8 VHR H2130 No. 21 Bucket dredger
(image: VHD National Trust Database)

5 Project Description

5.1 Overview

The Proponent is seeking planning permit from the Minister for Planning to install a Battery Energy Storage System (BESS) located in Morwell, Victoria (the Project).

The Latrobe Valley BESS site is proposed to be located adjacent to the Morwell Terminal Station (MWTS), approximately 2km south from the nearby town of Morwell and approximately 140km from Melbourne (both Central Business Districts respectively).

The Project land is located approximately 500m east of the Morwell Power Station, decommissioned in 2014 and approximately three kilometres north east of the Hazelwood Power Station site decommissioned in March 2017 (refer to Figure 5.1). The proposed site layout plan is shown in Figure 5.3 Indicative site layout.

The Project will involve construction and operation of up to two separate BESS sites (Northern BESS and Southern BESS) simultaneously or as a phased Project with an indicative output of 203 MW / 812MWh, optimising the energy storage capacity of the Site.

The Project scope of works requiring approval includes the installation of up to two 66kV transformers (one per BESS Site), 33kV transformers, 3.5MW inverters, battery pack units, ancillary infrastructure comprising Operations and Maintenance (O&M) Buildings, permanent site carparking and an access track connecting the BESS Sites to the PineGro Intersection at Monash Way.

The Project further involves connection upgrade works within the MWTS and installation of up to two 66 kV transformers, connecting to the BESS Sites via an underground connection. The installation of up to two 66 kV transformers will either be within the northern and southern BESS site or within the MWTS.

Construction is estimated to extend over an 18 month period, with an operation life of approximately 25 years.

Figure 5.1 Latrobe Valley BESS site is proposed to be located between the Morwell Terminal Station (foreground) and the Morwell Power Station (background)

5.2 Project components

The key Project components relevant to landscape and visual include:

- Temporary construction compound and lay down areas for northern and southern BESS Sites
- Northern BESS operational area, O&M building and car parking;
- Southern BESS operational area, O&M building and car parking;
- MWTS connection upgrade works; and
- Access track.

Table 5.1outlines the key Project components of the Proposal.

Table 5.1 Indicative Project components

Component	Description	Indicative scale (w x l x h)
O&M storage building	Operations facility including site office, control room, warehousing, workshop and personnel facilities with car parking	8 x12 x 4.5m
Northern BESS 105 MW / 420 MWh	Battery Pack Containers, coloured white steel	1.83 x 21.88 x 2.6m
	30 X 3.5 MW inverters, coloured white steel	9.3 x 2.62 x 2.6m
	15 X 33 kV transformers, coloured white/green steel	2.82 x 2.96 x 2.9m
	1 x 66 kV transformer, , coloured white/green steel	14.8 x 11.1 x 8m
Southern BESS 98MW / 392 MWh	Battery Pack Containers, coloured white steel	1.83 x 21.88 x 2.6m
	28 X 3.5 MW inverters, coloured white steel	9.3 x 2.62 x 2.6m
	14 X 33 kV transformers, coloured white/green steel	2.82 x 2.96 x 2.9m
	1 x 66 kV transformer, , coloured white/green steel	14.8 x 11.1 x 8m
MWTS upgrade works	2 x 66kV transformers	16m height
	33kV cable trench connecting into the BESS Sites	underground
	Temporary loading areas	
	Road widening within the MWTS to allow delivery and installation of the 66kV transformers	
	Proposed swale to connect into existing swale	
	Lopping/trimming of the remnant scattered tree in the southern boundary of the MWTS to facilitate delivery of the 66kV transformer.	
Other	Business identification signage at the entry	
	Lighting, security, and safety fencing	
	Site parking, internal access roads and drainage	

Figure 5.2 below provides indicative illustrations of battery storage units, inverter and MV transformer station. This application is supported by a concept plan, which identifies the maximum footprint of the proposal. This will provide flexibility in accommodating minor design and layout changes.

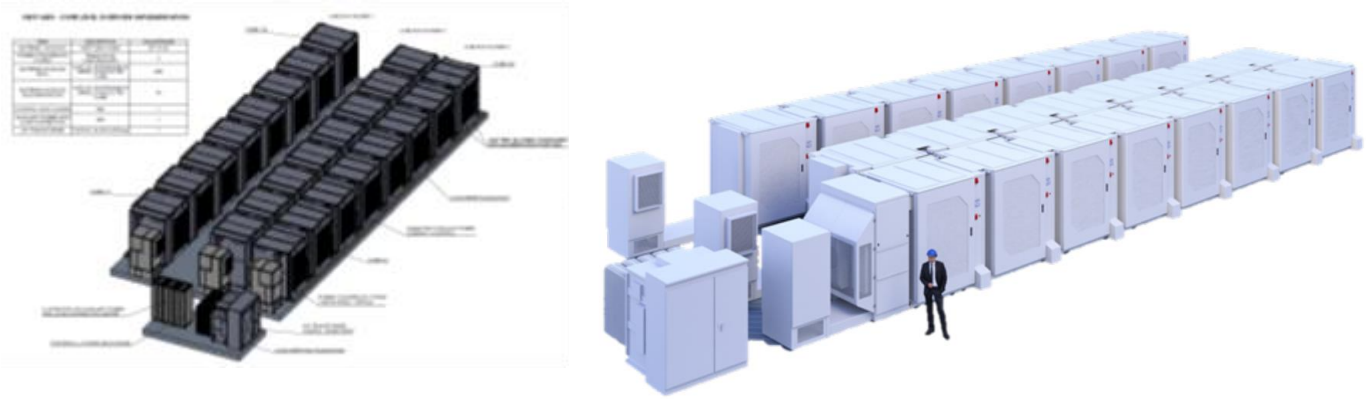

Figure 5.2 Example of battery storage units, inverter and transformer station

5.3 Construction

Methodology, program and timing of the construction works are currently indicative and dependent upon planning approvals. Consequently, construction impacts have not been assessed in this report.

It is anticipated that the construction activities will take place over an approximately 18 month timeframe in which the following will occur:

- Site establishment and civil works:
  - Site clearing, fencing and establishment of laydown area;
  - General earthworks, storage and removal of spoil (including the treatment of contaminated soil, where required); and
  - Site benching, access roads and drainage.
- BESS installation and other works:
  - Construction of batteries, inverters and associated infrastructure;
  - Construction of transmission connection; and
  - Testing and commissioning.
- Site access for construction and operation is proposed to occur via the Monash Way (C456).

Figure 5.3 Indicative site layout plan

6 Landscape Character

6.1 Landscape Character Types

Landscape Character Types (LCT) help to identify unifying aspects of the landscape and distinguish why one landscape is visually distinct from another. The character zones have been determined through a desktop assessment and confirmed through a site visit. Each character type identified is based on the consideration of the following attributes:

- landscape value, i.e. landscape designated for their scenic or landscape importance or valued recreational function;
- landscape elements that contribute to defining character, i.e. residential, commercial and landform;
- landscape character attributes, including scale, grain, perceptual characteristics such as connection to natural landscape, industrial nature of the area;
- observed land uses and current and future land use zones outlined in strategic planning documents and Local Environmental Plans; and
- topography and vegetation.

The LCTs identified within the Study Area are shown in Figure 6.1 and include LCT 1 – Energy infrastructure and industrial, LCT 2 – Rural landscape and LCT 3 – Residential, as described in the following sections. Roads are assumed to take on the character of adjacent LCTs.

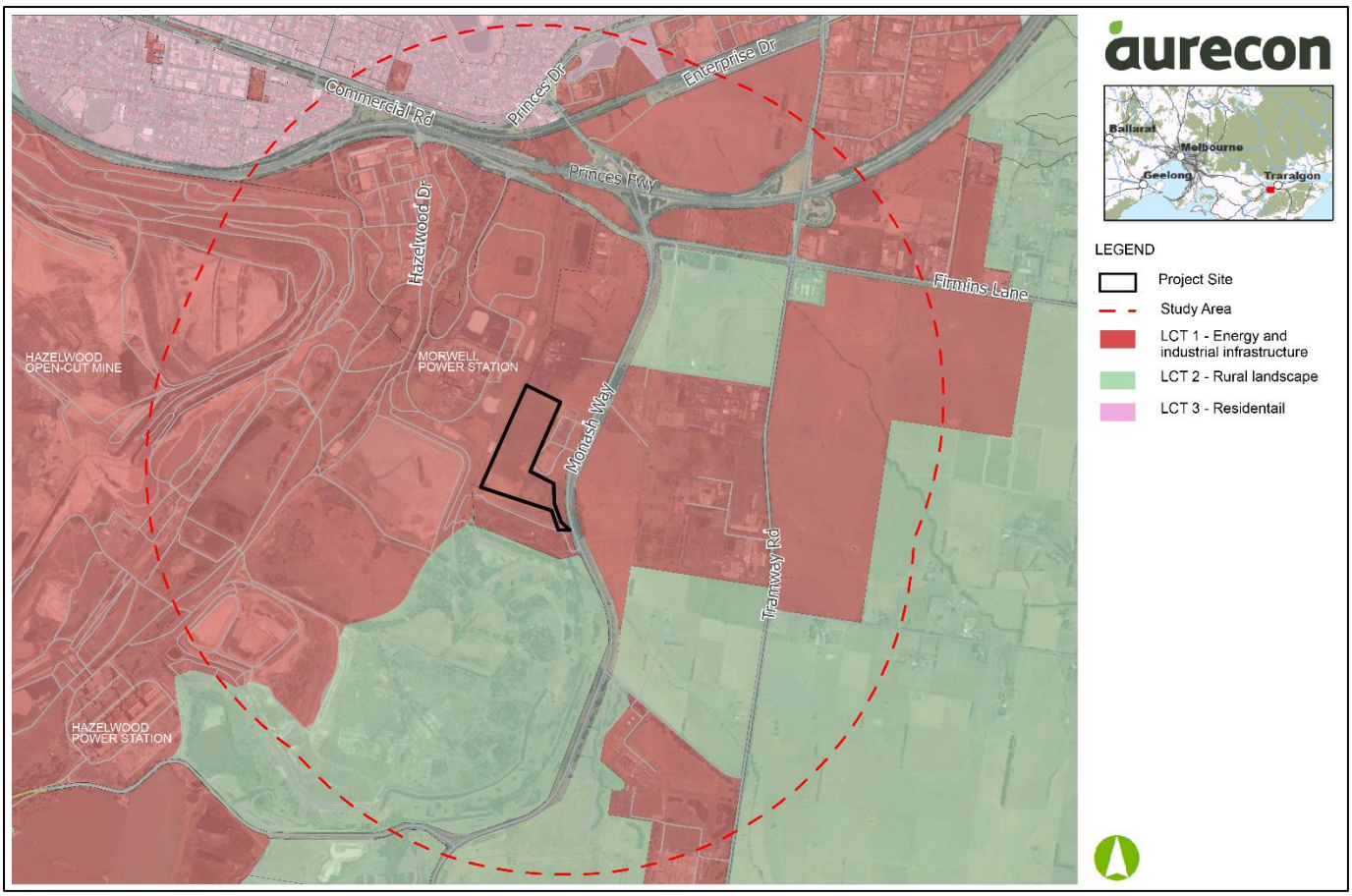

Figure 6.1 Landscape Character Types within Study Area

6.1.1 LCT 1: Energy and industrial infrastructure

The Study Area lies within LCT 1 which is dominated by energy infrastructure and industrial elements. These heavy industrial operations have extensively modified the landscape through earthworks and built structures as shown in Figure 6.2 to Figure 6.7.

The energy infrastructure originates from the Hazelwood Power Station, to the southwest of the Site and the Morwell Power Station to the west. These were supported by the large Hazelwood open-cut coal mine. Both of the power stations, open-cut mine and the Morwell briquette factory are now closed, with the scale and extent of buildings and the open-cut mine remaining to be defining elements within the landscape.

The electrical infrastructure including substations, transmission towers and powerlines are frequent and clearly evident within the Study Area.

The industrial sites within the Study Area consist of waste tip sites (PineGro Green waste and Morwell Transfer Station), processing of local forestry, engineering firms and landscape supplies. These are typically large compounds with large sheds and processing areas.

Key characteristics:

- Extended views of tall transmission towers and frequent powerlines;
- Substations containing a fenced area of concentrated electrical conduits and small buildings/sheds;
- Large power station buildings with tall stacks, large sheds and equipment;
- Large heavy industrial factories i.e. Morwell briquette works (closed) and Omni Specialities fertilizer; and
- Large compounds including numerous large sheds for manufacture, construction and processing.

Figure 6.2 LCT 1: Morwell Terminal Station (MWTS)

Figure 6.3 LCT 1: Large transmission towers

Figure 6.4 Morwell Energy Brix Power Station

Figure 6.5 Omnia Specialties industrial site

Figure 6.6 Hazelwood open-cut mine
(image: Latrobe Valley Express, Dec-2017)

Figure 6.7 PineGro Green waste site

6.1.2 LCT 2: Rural landscape

LCT 2 is a rural landscape that surrounds the Study Area comprising an undulating topography and valley plains. There are large paddocks used for sheep and cattle grazing. Supporting farm infrastructure includes fencing, sheds and machinery (refer Figure 6.8). There are residential dwellings spotted around the area.

To the south of the side of the Site is a small man-made hill. This is the Hazelwood mining overburden mound which has been shaped and planted (grasses and native trees) to blend in with the surrounding landscape.

The rural landscape is traversed by numerous waterways, including Bennetts Creek traversing to the west and south of the Site, Waterhole Creek further to the east; various wetlands including Firmis Lane Wetlands (north of Site) and small ponds. Bennetts Creek has been diverted around mining and power station operations, although the low flowing creek has been naturalised through ephemeral vegetation.

The rural landscape within the Study Area is influenced by powerlines and transmission towers which traverse fields and hilltops.

Monash Way a two laned road, traverses through the Study Area which comprises of both LCT 1 and LCT 2.

Key characteristics:

- scattered residential dwellings and ancillary farm buildings at low densities;
- vegetation occurs throughout the area sporadically in agricultural paddocks, along riparian corridors and as windrows. Species are both native and exotic, with windrows mostly made up of dense planting of pine and macrocarpa species;
- the landscape often appears as a patchwork of different colours and textures, dependent upon the nature of the farming occurring within any given area and the time of year; and
- small streams, creeks and wetlands traverse the landscape.


Figure 6.8 LCT 2: Rural landscape including hay-baling, stock fencing and large pastures

6.1.3 LCT 3: Residential

The residential area is within the township of Morwell, approximately 1.6 km north of the Site and north of the Princes Freeway. The area is south of Buckley Hill Reservoir and consists of mostly single-storey houses on curvilinear streets. There is a vegetation buffer alongside the road reserves of Princes Freeway and Princes Drive (refer to Figure 6.10) which limits outward views (refer to Figure 6.9), despite being elevated above the Site.

Figure 6.9 LCT 3: Houses and a motel south of Princes Drive

Figure 6.10 LCT 3: Residential street north of Princes Drive

6.2 Absorptive capability of the Landscape Character Type

The ability of the landscape types to absorb changes has been assessed and is outlined in Table 6.1.

Table 6.1 LCT absorptive capability

Landscape Type	Ability to absorb change	Comments
LCT 1: Energy and industrial infrastructure	High	The scale and type of existing industrial infrastructure has a large influence within the Study Area and provides capacity to absorb further changes.
LCT 2: Rural landscape	Moderate	The rural landscape is modified, containing and surrounded by bulky elements that lessen the sensitivity and provide capacity to absorb further changes.
LCT3: Residential	Very Low	Changes to views immediately adjacent to residential receptors are often more critically received. As such, it is assumed that the viewer is highly sensitive to changes in their immediate surroundings.

7 Visual Appraisal

7.1 Visibility of the Proposal

The assessment of the visual impact has been based on the sensitivity of the view and the degree of modification or changes to the view as part of the proposal at the operational phase. The following section outlines the impact assessment on the visual components at operation of the Project and the residual impacts that remain following the implementation of mitigation measures.

7.1.1 Detailed assessment of representative viewpoints

A total of six representative viewpoints were identified for the Project based on the design, viewing distance and aspect. The locations of the assessed viewpoints are shown in Figure 7.1.

There were no viewpoints within the Study Area that are designated or assessed as significant viewpoints.

The details on the individual viewpoints including photographs of existing conditions can be found in the subsequent section.

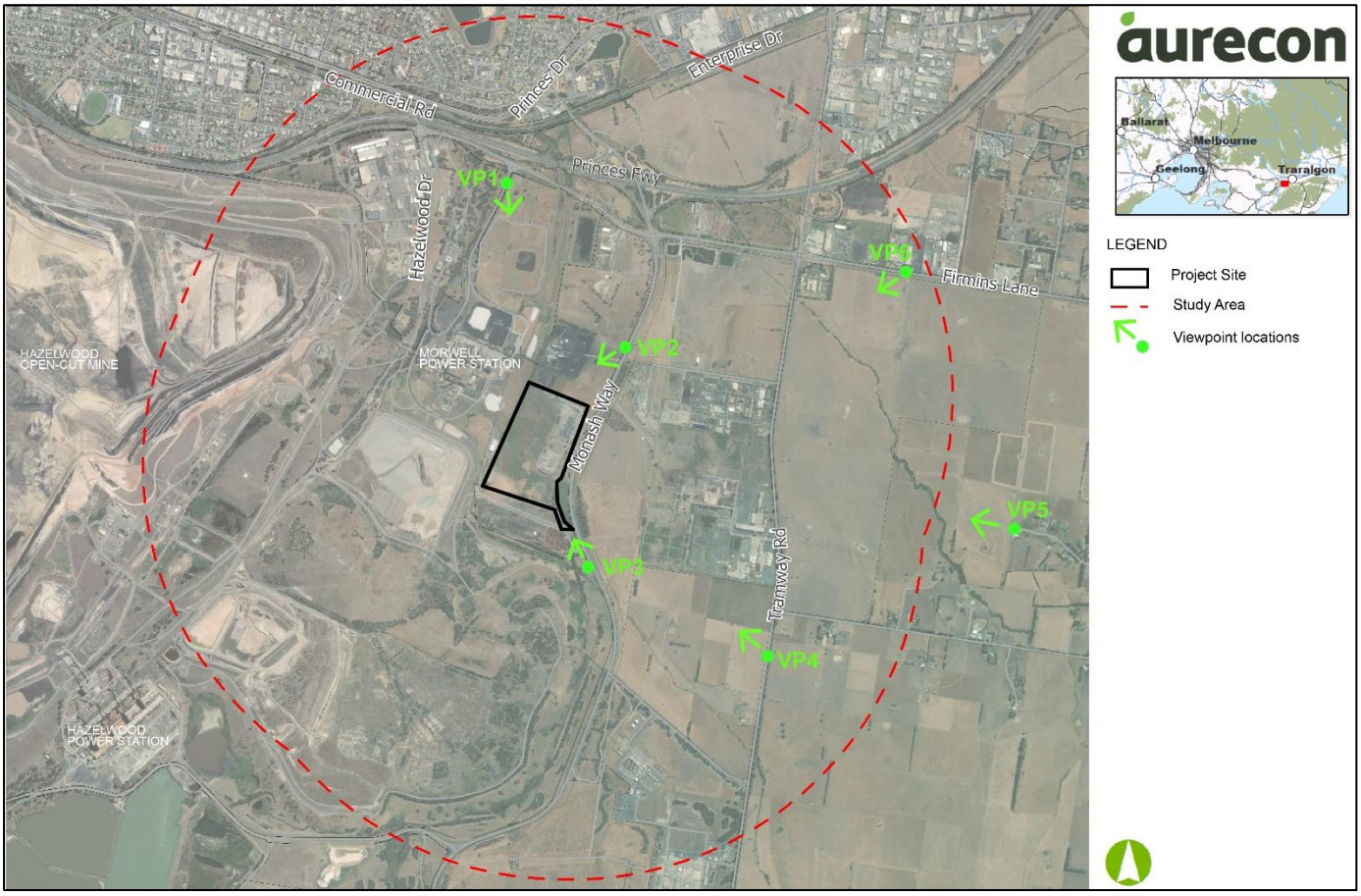

Figure 7.1 Viewpoint assessment locations

VIEWPOINT 01

Viewing location	From Hazelwood Drive, looking southeast towards the Project. Refer to Figure 7.2.		
Existing setting	Hazelwood Drive is used by workers accessing the many industrial sites and visitors to the PowerWorks Energy Education Centre – an educational-tourist centre. The foreground view looks out onto farmland which is zoned Special Use (SUZ1), as the land is part of the Morwell power plant. The view comprises of undulating open grassed area, with some stock grazing. There are groups of trees located in the midground. Powerlines and transmission towers are seen in the same vicinity of these trees, along with buildings and the coal conveyor of the Morwell Energy Brix Power Station (far right). The white tanks from Omnia Specialties are visible above the mid-ground tree line. The MWTS is partially visible, though is screened by intervening vegetation. The Strzelecki Ranges are visible in the background. The range contains mostly native vegetation, however there are a number of pine plantations visible which provide a patchwork in the viewpoint through harvesting.		
Viewing context	Duration of view dynamic (moving view)	Viewing angle: perpendicular	

Visual Sensitivity Level	**VERY LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Local road	Landscape Type	LCT 2 Rural landscape
Viewing distance (m)	Middleground (approx. 1.15 km from closest Project component)		
Viewer sensitivity level	**Very Low**	Absorptive ability	**Moderate**
Visual Modification Level	**VERY LOW**		
Viewpoint discussion	Some taller components of the Project are expected to be visible from this viewpoint above existing trees, however they are unlikely to be discernible from the MWTS existing energy and electrical infrastructure. Intervening vegetation will remain screening the Site. The Project would result in a barely perceptible visual change resulting in a minor deterioration to the view for the road users, workers and visitors.		
Operational Visual Impact	**VERY LOW**		
	Consequently, the very low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for road users and workers along Hazelwood Drive.		
Residual Visual Impact	**VERY LOW**		
	No mitigation is proposed in this location. Consequently, the residual impact on views for users would be very low adverse.		

Figure 7.2 **Viewpoint 01: existing view from Hazelwood Drive, looking southeast towards the Project (yellow line indicative of the Project location)**

VIEWPOINT 02

Viewing location	From Monash Way, looking south towards the Project and the existing Morwell Terminal Station site. Refer to Figure 7.3.		
Existing setting	Monash Way connects Morwell (north) to the townships of Churchill (south) and further connecting to the Strzelecki Highway. To either side of the road the land is zoned industrial (IN1Z) at this viewpoint location. The viewpoint is dominated by electrical infrastructure. The Morwell Terminal Station (MWTS) is clearly visible, comprising of numerous powerlines and wires leading into the station and a higher density of conduits and low sheds within a fenced compound. There are a few trees which do not screen the MWTS. The hill in the background is the Hazelwood overburden mound which has been revegetated and integrates with the surrounding views of farmland. Tall transmission towers are visible to the far left.		
Viewing context	Duration of view dynamic (moving view)	Viewing angle: perpendicular	

Visual Sensitivity Level	**VERY LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Arterial road	Landscape Type	LCT 1 Energy and industrial infrastructure
Viewing distance (m)	Foreground (approx. 500 metres from closest Project component)		
Viewer sensitivity level	**Low**	Absorptive ability	**High**
Visual Modification Level	**VERY LOW**		
Viewpoint discussion	The Project is expected to be visible from this viewpoint, located behind the existing MWTS, which is visible within the foreground. Battery storage units will be visible, although these are expected to be commensurate to existing MWTS sheds within the viewpoint, resulting in a higher density of electrical/built components. The Project would be a noticeable visual change for a short duration, resulting in a minor deterioration to the view for road users.		
Operational Visual Impact	**VERY LOW**		
	Consequently, the very low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for road users along Monash Way.		
Residual Visual Impact	**VERY LOW**		
	The placement of low to medium sized vegetation to screen Project components, would help partially screen bulkier battery storage units, subject to offset requirements. The residual impact on views for users would remain to be very low adverse.		

Figure 7.3 **Viewpoint 02: Existing view from Monash Way, north of the Project (yellow line indicative of the Project location)**

VIEWPOINT 03

Viewing location	From Monash Way, looking north towards the Project and the existing MWTS site. Refer to Figure 7.4.		
Existing setting	Monash Way connects Morwell (north) to the townships of Churchill (south) and further connecting to the Strzelecki Highway. To the right-side of the road, there is a narrow strip zoned as industrial (IN1Z), with farmland (FMZ) beyond. The Hazelwood revegetation overburden is located to the left of the road and is zoned Special Use (SUZ1), though visually integrates with surrounding farmland. The viewpoint comprises of wide grassed road reserves, with scattered vegetation and powerlines to the side of the road. The office building for the PineGro Green Waste site is visible on the left, and part of the Morwell Power Station and chimneys. The MWTS is visible in the centre of the view, comprising of conduits and low sheds within a fenced compound. Views of the MWTS are not dominant, with trees behind visible though wiring.		
Viewing context	Duration of view dynamic (moving view)	Viewing angle: perpendicular	

Visual Sensitivity Level	**VERY LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Arterial road	Landscape Type	LCT 1 Energy and industrial infrastructure
Viewing distance (m)	Foreground (approx. 400 metres from closest Project component)		
Viewer sensitivity level	**Low**	Absorptive ability	**High**
Visual Modification Level	**VERY LOW**		
Viewpoint discussion	The Project is expected to be barely perceptible from this viewpoint, located behind the existing MWTS visible within the foreground and will be screen by existing vegetation. The proposed components are not expected to contrast to the MWTS, resulting in a higher density of electrical components and storage units from this viewpoint. The access track into the Site from Monash Way will be aligned with the existing access drive into PineGro, visible from this viewpoint and apparent only through proposed new signage. The Project would be a barely noticeable visual change resulting in a minor deterioration to the view for road users.		
Operational Visual Impact	**VERY LOW** Consequently, the very low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for road users along Monash Way.		
Residual Visual Impact	**VERY LOW** No mitigation is proposed in this location. Consequently, the residual impact on views for users would be very low adverse.		

Figure 7.4 **Viewpoint 03: Existing view from Monash Way, south of the Project (yellow line indicative of the Project location)**

VIEWPOINT 04

Viewing location	From Tramway Road, looking west towards the Project site and the Morwell Power Station. Refer to Figure 7.5.		
Existing setting	Tramway Road is a two-laned road that accesses a number of industrial sites and farmland. Farmland is zoned either side of the road, with industrial zoning (IN1Z) near this viewpoint location. The foreground view looks out onto farmland, comprising of an open grassed area, with hay bales and a farm shed to the left of the view. There are groups of trees located in the midground, along with powerlines. The Morwell Power Station and chimneys are distinctive elements to the right of the view. Transmission towers are visible to the background, traversing the revegetated Hazelwood overburden mound.		
Viewing context	Duration of view: dynamic (moving view)	Viewing angle: perpendicular	

Visual Sensitivity Level	**VERY LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Local road	Landscape Type	LCT 2 Rural landscape
Viewing distance (m)	Background (approx. 1.4 km from closest Project component)		
Viewer sensitivity level	**Very low**	Absorptive ability	**Moderate**
Visual Modification Level	**VERY LOW**		
Viewpoint discussion	The Project will be located to the front of the Morwell Power Station to the right of the viewpoint, and behind the existing MWTS. The existing trees which are positioned along Monash Way will be retained and continue to screen bulkier elements such the O&M storage building and battery storage units. These components are likely to be partially visible although not contrasting greatly to MWTS components. Proposed transmission towers up to 16m tall, are likely to be visible however there are already many powerlines and transmission towers within the surrounding landscape setting, that the two proposed will be commensurate with the existing visual conditions.		
Operational Visual Impact	**VERY LOW** The very low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for road users along Tramway Road.		
Residual Visual Impact	**VERY LOW** No mitigation is proposed in this location. Consequently, the residual impact on views for users would be very low adverse.		

Figure 7.5 Viewpoint 04: Existing view from Tramway Road south (yellow line indicative of the Project location)

VIEWPOINT 05

Viewing location	From the end of Mulga Road, looking west towards the Project and the Morwell Power Station. Refer to Figure 7.6.		
Existing setting	The viewpoint is representative of views experienced by nearby residents on Mulga Road. The area is zoned Farmland. There are wide open views of the surrounding area from this viewpoint. The foreground view looks out onto farmland, comprising of an open grassed area, with hay bales and farm fencing. There are scattered trees located in the middleground, with large energy and industrial infrastructure located just beyond. The distinctive large structures include the Morwell Energy Brix Power Station and chimney, to the left, Omnia Specialities to the right and transmission towers. The MWTS is visible in the midground from the left to the chimneys, though is not a prominent element due to distance, intervening vegetation and the dominance of the larger energy and industrial components within the landscape. The Strzlecki Ranges are visible in the background.		
Viewing context	Duration of view static (fixed view)	Viewing angle: perpendicular	

Visual Sensitivity Level	**LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Residential	Landscape Type	LCT 2 Rural landscape
Viewing distance (m)	Background (approx. 2.6 km from closest Project component)		
Viewer sensitivity level	**Low**	Absorptive ability	**Moderate**

Visual Modification Level	**VERY LOW**
Viewpoint discussion	The Project will be located to the front and left of the Morwell Power Station within this viewpoint, and behind the existing MWTS. The existing trees which are positioned along Monash Way will be retained and continue to screen bulkier elements such the O&M storage building and battery storage units. Key Project components will be barely perceptible in the field of view at this distance. Proposed transmission towers up to 16m tall, are likely to be visible however there are already many powerlines and transmission towers within the surrounding landscape setting, that the two proposed will be commensurate with the existing visual conditions. The Project, where visible, does not contrast to the existing conditions.
Operational Visual Impact	**VERY LOW** The low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for private residents from this viewpoint.
Residual Visual Impact	**VERY LOW** No mitigation is proposed in this location. Consequently, the residual impact on views for users would be very low adverse.

Figure 7.6 **Viewpoint 05: Existing view from Mulga Road, near residential property (yellow line indicative of the Project location)**

VIEWPOINT 06

Viewing location	From Firmins Lane, near a garden supplies depot, looking southwest towards the Project. Refer to Figure 7.7.		
Existing setting	Firmins Lane is a two-laned road that connects Morwell (to the west) to Hazelwood North. There are wide open views from this viewpoint, with farm paddocks in the foreground. The view is representative of a low number of workers accessing industrial sites on Firmins Lane and travellers between Morwell and Hazelwood North. In the midground, energy and industrial infrastructure are discernible elements. These include Omnia Specialities to the left, Morwell Power Station and chimney to the right, and transmission towers. There are scattered trees located in the middleground, which do not screen the large buildings of the Morwell Power Station or Omnia Specialities. A hill range is visible in the background.		
Viewing context	Duration of view: dynamic (moving view)	Viewing angle: parallel	

Visual Sensitivity Level	**VERY LOW**		
Viewer sensitivity		**Landscape sensitivity**	
Land use	Industrial	Landscape Type	LCT 1 Energy and industrial infrastructure
Viewing distance (m)	Background (approx. 2.8 km from closest Project component)		
Viewer sensitivity level	**Very low**	Absorptive ability	**High**
Visual Modification Level	**VERY LOW**		
Viewpoint discussion	The Project will be located to the left of the Morwell Power Station within this viewpoint. The existing trees which are positioned along Monash Way will be retained and continue to screen bulkier elements such the O&M storage building and battery storage units, although at this distance they are expected to be barely perceptible in the field of view. Proposed transmission towers up to 16m tall, are likely to be visible however there are already many powerlines and transmission towers within the surrounding landscape setting, that the two proposed will be commensurate with the existing visual conditions. The distance of this viewpoint from the Project will have the effect of proposed elements appearing smaller, being barely perceptible from this viewpoint blending in with other similar components and bulkier structures.		
Operational Visual Impact	**VERY LOW** The very low level of visual sensitivity combined with the very low degree of modification, would result in a very low adverse visual impact at operation for workers at industrial/commercial sites at Firmis Lane.		
Residual Visual Impact	**VERY LOW** Mitigation in the form of vegetation screening will not be visible from this location, therefore the residual impact on views for users would remain at very low adverse.		

Figure 7.7 Viewpoint 06: Existing view from Firmins Lane (C475) Garden Supplies (yellow line indicative of the Project location)

7.2 Summary of findings

The following section provides a summary of the landscape and visual impact assessment at operation and the resulting residual impacts.

Table 7.1 Summary of visual impacts

Viewpoint no.	Description	Operational impacts	Residual impacts
Viewpoint 01 (VP1)	Hazelwood Drive, 1.15km northwest of the Project site. Viewpoint is representative of that experienced by workers and education centre visitors.	Very Low	Very Low
Viewpoint 02 (VP2)	Monash Way, approximately 500m north of the Project site and the existing Morwell Terminal Station site. Viewpoint is representative of that experienced by arterial road users.	Very Low	Very Low
Viewpoint 03 (VP3)	Monash Way, approximately 400m south of the Project site and the existing Morwell Terminal Station site. Viewpoint is representative of that experienced by arterial road users.	Very Low	Very Low
Viewpoint 04 (VP4)	Tramway Road, 1.4km east of the Project site. Viewpoint is representative of that experienced by local road users.	Very Low	Very Low
Viewpoint 05 (VP5)	The end of Mulga Road, 2.6km east of the Project site. Viewpoint is representative of that experienced by nearby private residents.	Very Low	Very Low
Viewpoint 06 (VP6)	Firmins Lane, near a garden supplies depot, 2.8km north west of the Project site. Representative of industrial/commercial workers and travellers.	Very Low	Very Low

8 Conclusion

The Project is an industrial site set on land zoned industrial, adjacent the existing Morwell Terminal Station and near to the Morwell Power Station. There are no designated views or sites of environmental significance within the Study Area up to two kilometres from the proposed site, anticipated to have landscape or visual impacts as a result of the Project.

Project components including battery storage units and connection works within the MWTS are likely to be visible at least partially from all six of the assessed viewpoints, with the visual modification assessed as very low. Proposed components do not intrude in regard to the size, scale and geographical extent to the those within the Morwell Power Station site which comprises of larger and bulkier structures than those proposed. Battery storage units and connection works within the MWTS do not contrast with existing electrical infrastructure.

The two BESS sites (north and south) are within close proximity to each other and are likely to be viewed as one site.

The landscape character types within the Study Area are either industrial or rural, with the residential LCT not having direct views of the Project. LCT 1 – Energy and industrial infrastructure, is highly modified with infrastructure at a large scale and spread over a vast area and thus results in a high absorptive capacity. LCT 2 – Rural landscape is influenced by the scale of LCT 1 components, being traversed by electrical towers and large structures which are prominent elements in this landscape setting. The Project components proposed are of a much smaller scale and are not expected to contrast with the existing setting.

There has been no landscape mitigation design proposed for the existing concept design. The Project is most visible from Monash Way at Viewpoint 2. Due to the existing MWTS adjacent the Project Site, the view will have higher density of electrical/built components, resulting in a minor deterioration to the view for road users. There is the potential for low to medium sized roadside landscaping, located along Monash Way, to assist in softening the views towards the Project site. Other assessed viewpoints have existing intervening vegetation with low-level visual impacts.

9 Mitigation

The purpose of mitigation is to avoid, reduce or where possible remedy or offset any significant adverse effects on the environment arising from the proposed development. This chapter provides recommendations for mitigation and management measures to reduce potential visual impacts as a result of the Project during construction and operation. It is intended as a guideline to assist in the design development of the Project.

9.1 Construction phase mitigation

At the time of this report, construction elements have not been designed, therefore the below is a high-level approach based on construction access and construction compounds.

9.1.1 Built form

- Ancillary facilities are to be developed to minimise visual impacts for adjacent receptors.
- Storage areas and associated works are to be located in cleared or otherwise disturbed areas away from the Monash Way interface.
- Where feasible and reasonable, the elements within construction sites would be located to minimise visual impact, for example materials and machinery would not be visible above temporary screens.
- Site hoardings, if required, will be in neutral colours and designs in proximity to open space to help blend them into surrounding environment. These are to be erected as early as possible within the site establishment phase to provide visual screening.
- Site lighting is to be designed to minimise glare issues and light spillage into adjacent areas and generally consistent with the requirements of Australian Standard 4282-1997 Control of the obtrusive effects of outdoor lighting.
- Fencing quality should be commensurate with existing transparent security fencing surrounding the MWTS.

9.1.2 Vegetation and landscape

- Existing trees adjacent to the works will be retained and protected where possible to screen construction support sites, minimising clearing where possible.
- Where possible, trees will be trimmed rather than removed. Works would be carried out by a qualified arborist.
- All areas disturbed by construction and not required for operation of the Project are to be restored to existing condition, unless otherwise agreed with the landowner.

9.2 Operational phase mitigation

The principle consideration in mitigating potential landscape and visual impacts by the Project is through site selection. The Site was selected as providing the most suitable location for the BESS given its rural locality, separation from residential localities and proximity to the existing MWTS. It is also noteworthy that the site is in close proximity to other significant energy and industrial infrastructure including the Morwell Power Station, Hazelwood Power Station and the Omnia Specialities site.

9.2.1 Built form

- Architectural materials - cladding, materials and colour used to mitigate appearance of bulky structures. ‘Environmental Green’ adopted for structures visible beneath the horizon, to blend with existing background vegetation.
- Offsite/roadside screening – a row of small to medium sized trees placed typically to a property boundary, to soften direct views of the Project from sensitive receivers, subject to negotiation with private residents/ landowners.

- Earthworks – use of landform to integrate the facility components into the surrounding landscape, including planted embankments for additional visual screening. This is subject to operational requirements and fire hazard offsets.
- Ensure any replacement planting is protected and not impacted by operational activities, fauna species or other activities. Undertake regular inspections and maintenance of vegetation plantings and rehabilitation.
- Inspection and maintenance of security lighting direction to ensure it is directed to the worksite and away from neighbouring land uses.
- Signage to place on existing or proposed fencing, located away from Monash Way to limit visual distraction of drivers. Where possible, group any new signage with existing signage to limit visual clutter.

Appendix A: Visual Prominence Rationale

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.

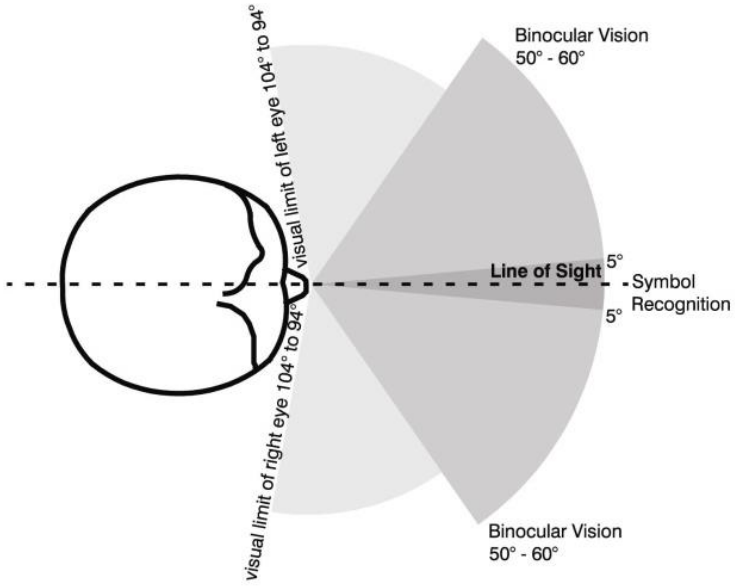

Figure A.1 Horizontal line of sight

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 5º	**Insignificant - Low visual prominence** The development would not be highly visible in the view, unless it contrasts strongly with the background.
5º – 30º	**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 30º	**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 0º then the eye clearly defines colour, field of view and has image sharpness for an angle of approximately 25º upwards and 30º downwards. However, in reality, the typical line of sight for a standing person at ground level is approximately 10º below the horizon line (Refer to Figure A.2).

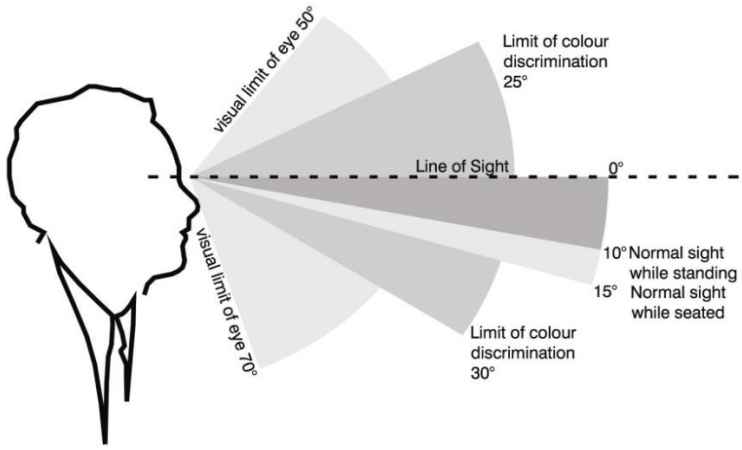

Figure A.2 Vertical line of sight

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 0.5º	**Insignificant - Low visual prominence** A small thin line in the landscape and is no longer an easily recognisable element.
0.5º – 2.5º	**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 2.5º	**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.

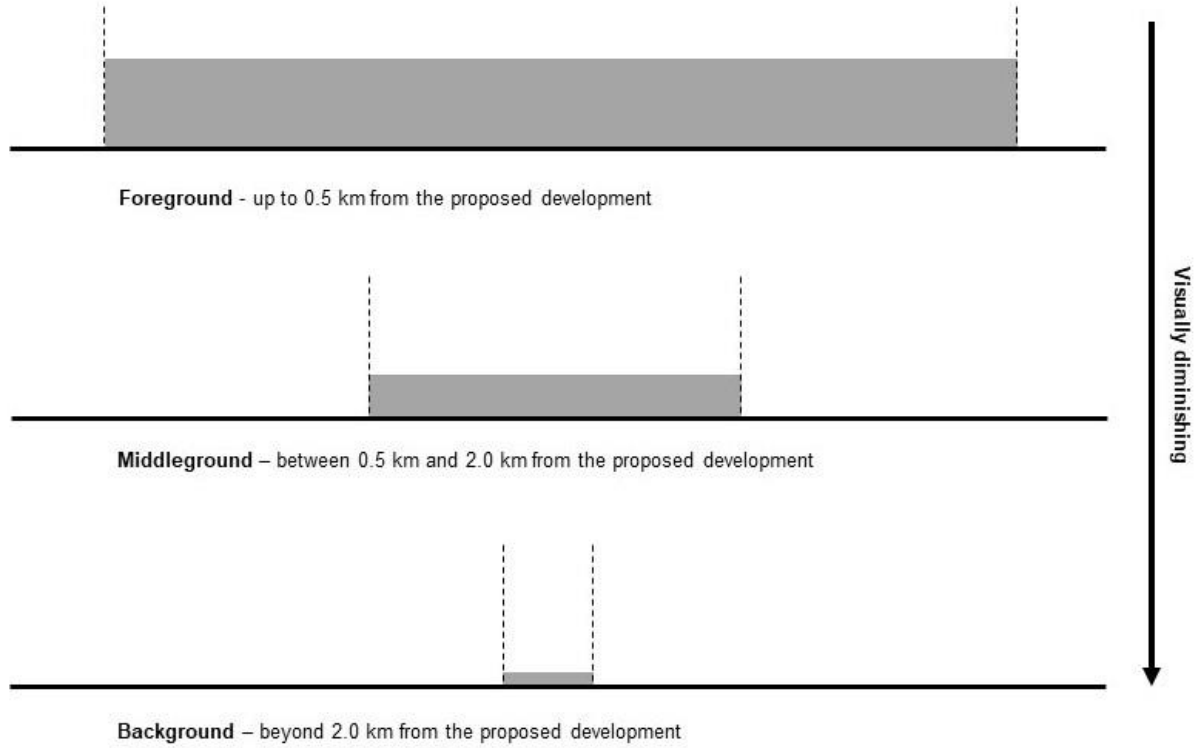

Figure A.3 The reduction in visibility of the horizontal line of sight based on increase in distance from a viewpoint

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).

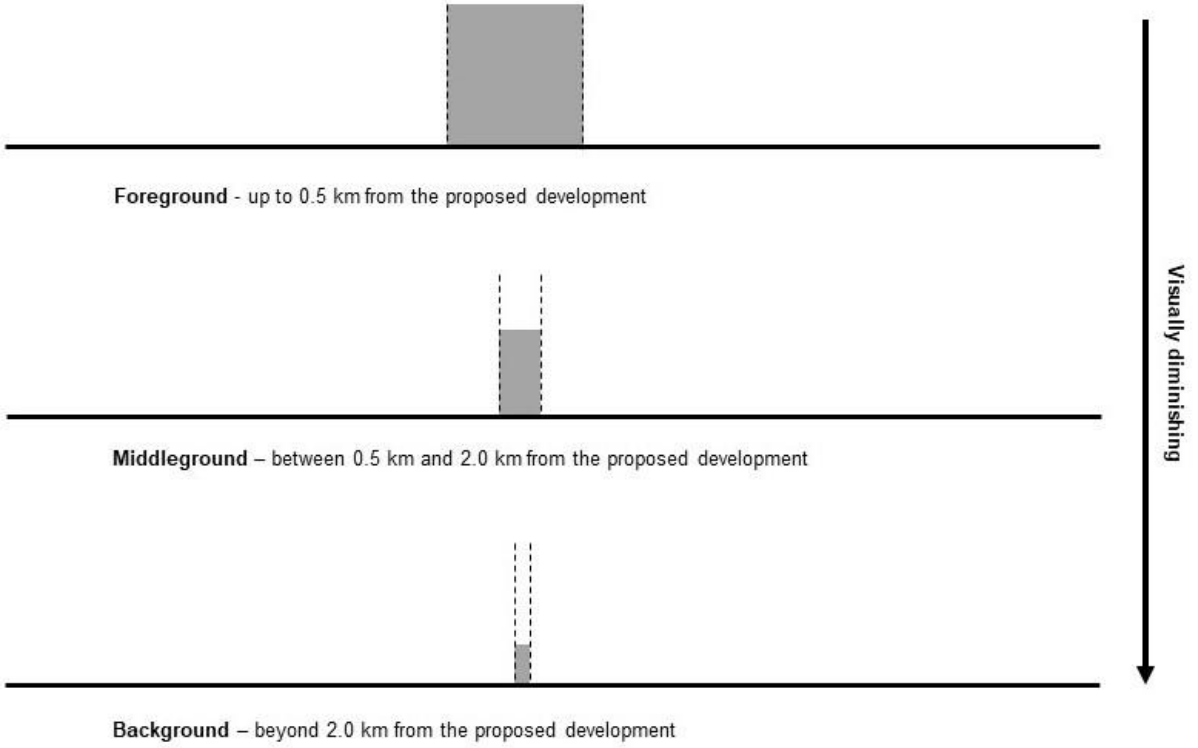

Figure A.4 The reduction in visibility of the vertical line of sight based on increase in distance from a viewpoint

Appendix B:
Guidance Notes for the reduction of Obtrusive Light

Guidance Note 01/20

Guidance notes for the reduction of obtrusive light

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This guidance note has been revised to reflect the changes in international guidance regarding obtrusive light as detailed in CIE 150:2017 *Guide on the limitation of the effects of obtrusive light from outdoor lighting installations*.[1] It also considers industry comment regarding the assessment and definition of obtrusive lighting.

Good lighting practice is the provision of the right light, at the right time, in the right place, controlled by the right system.

Humanity's invention of artificial light and its application in the external environment has done much to safeguard and enhance our night-time environment but, if not properly controlled, *obtrusive light* (sometimes referred to as light pollution) can present serious physiological and ecological problems.

Obtrusive light – whether it keeps you awake through a bedroom window, impedes your view of the night sky or advisedly affects the performance of an adjacent lighting installation – is a form of pollution, which may also be a nuisance in law and which can be substantially mitigated without detriment to the lighting requirements of the task.

Sky glow, the brightening of the night sky, *glare* the uncomfortable brightness of a light source when viewed against a darker background, *light spill* the spilling of light beyond the boundary of the area being lit and *light intrusion* ("nuisance")[2] are all forms of obtrusive light which may cause nuisance to others, or adversely affect fauna and flora as well as waste money and energy.

Considerations to be made

Think before you light. Is it necessary? What effect could it have on others? Has it the potential to cause a nuisance? How can you mitigate and manage any potential adverse effects from your lighting installation?

There are published standards and guidance for most lighting tasks, adherence to which will help mitigate obtrusive lighting aspects. Organisations from which full details of these standards can be obtained are given later in this Guidance Note.

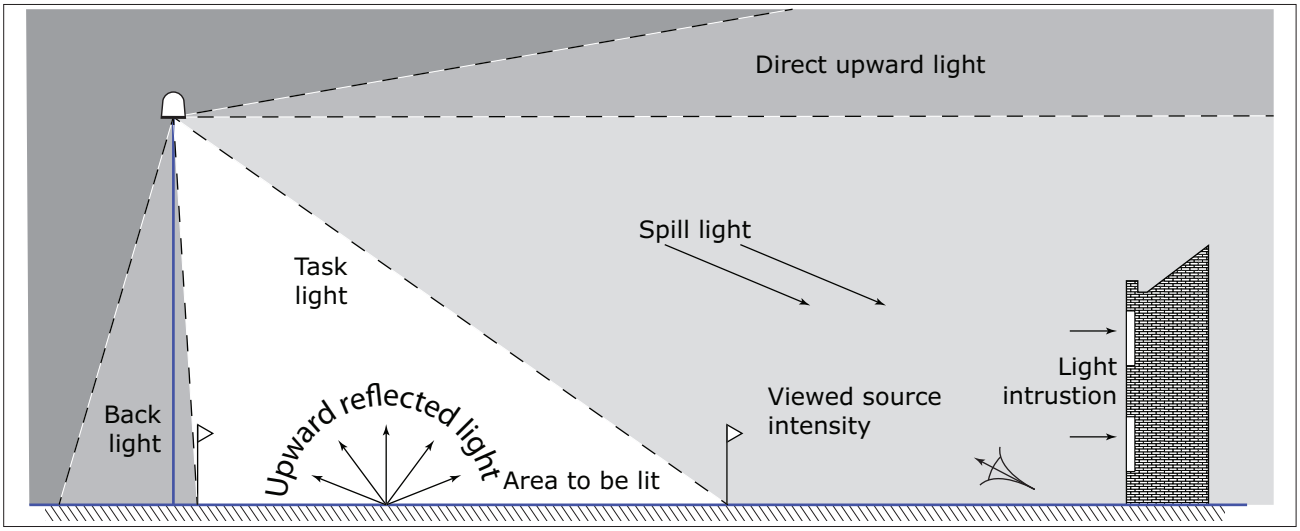


Figure 1: Types of intrusive light

1 The copyright of the data detailed within this guide belongs to CIE, email ciecb@cie.co.at
This document should be used in conjunction with CIE 150:2017 and CIE 126:1997 and not as a replacement for the procedures contained therein.
These documents can be obtained from https://www.techstreet.com/cie/pages/home and members of a National Committee of the CIE can purchase them with a discount of 66.7%.

2 The term light trespass is sometimes used, but trespass is to physically encroach on land and light can't do that, so the term nuisance should always be used.

For the purpose of this Guidance Note the following two Commission Internationale De L'Eclairage (CIE) documents are specifically referenced; they provide guidance to the mitigation of obtrusive light from exterior lighting installations:

- CIE 150:2017 Guide on the limitation of the effects of obtrusive light from outdoor lighting installations;
- CIE 126-1997 Guidelines for minimizing sky glow

When considering any lighting installation these two documents should be referenced.

Whilst this Guidance Note specifically considers the effects from external lighting installations, the considerations within it can be relevant when considering modern office blocks and shop fronts where the main external facing structure is transparent and light from within the buildings could become a source of illumination to the exterior environment.

"Good Design Equals Good Lighting"

It cannot be stressed sufficiently that employing a competent lighting designer with proven experience in the lighting application being considered will provide a suitable lighting installation where all obtrusive lighting aspects are mitigated[3].

Any lighting scheme consists of three basic elements: a light source, a luminaire (incorporating the optical control system) and a method of installation/mounting.

Light sources (lamps/LEDs)

Remember that the light source output in lumens is not the same as the wattage and that it is the former that is important in combating the problems of obtrusive light.

Most night-time visual tasks are only dependent on light radiated within the visual spectrum. It is therefore not necessary for light sources to emit either ultra-violet or infra-red radiation unless specifically required to do so. The majority of light sources used in external lighting do not contain these wavelengths or where they are present their spectral power is very low.

Research indicates that light from the blue end of the spectrum could have important adverse effects on fauna and flora. The lighting designer should consider the blue light spectral power of the light source and try to balance the needs of the task to be lit with any impact on fauna and flora within the environment.

Luminaires

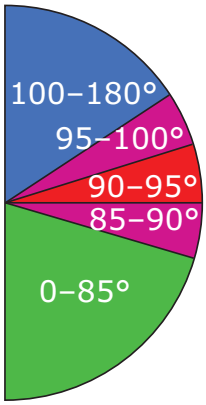
The choice of luminaire with the right optical distribution at the right mounting height is critical to minimising light spill and obtrusive light effects while providing the right lighting performance on the task area.

Sky glow is the general diffuse sheen that is visible in the direction of large cities, airports, and industrial complexes. It occurs from both natural and artificial light sources and does not depend exclusively on the lighting design. It also depends on the atmospheric conditions (humidity, aerosols, clouds, haze, atmospheric pollution, etc). Light propagating into the atmosphere either directly from upward directed or incompletely shielded sources, or after reflection from the ground or other surfaces, is partially scattered back towards observers on the ground; the impact being shown in Table 1.

It is therefore important to consider the luminaire, its light distribution, how it is installed, and how it is set up.

For most general sports and area lighting installations the use of luminaires with asymmetric optics designed so that the front glazing is kept at or near parallel to

3 Competency can be determined through membership of a professional lighting body supported by the appropriate qualifications and experience in the application of lighting required.



Indicative diagram

Table 1: The effect on the ability to view the night sky at various angles

Angle of light emitted (degrees)	Sky glow effect	Glare effect
100 – 180	Local	Little
95 – 100	Significant	Some
90 – 95	High	High
85 – 90	Significant	High
0 – 85	Minimal	Some

the surface being lit should, if correctly aimed, ensure minimum obtrusive light.

Appendices 1 and 2 in this Guidance Note give more details of how to choose luminaires, and if necessary modify them through the use of louvres and shields.

Installation

In most cases it will be beneficial to use as high a mounting height as possible, giving due regard to the daytime appearance of the installation.

It should be noted that a lower mounting height is perhaps not better as can be seen from Figures 2a and 2b from CIE 150. A lower mounting height can create a higher level of light spill and require additional lighting points.

Keep glare to a minimum by ensuring that the main beam angle of all luminaires directed towards any potential observer is no greater than 70°. Higher mounting

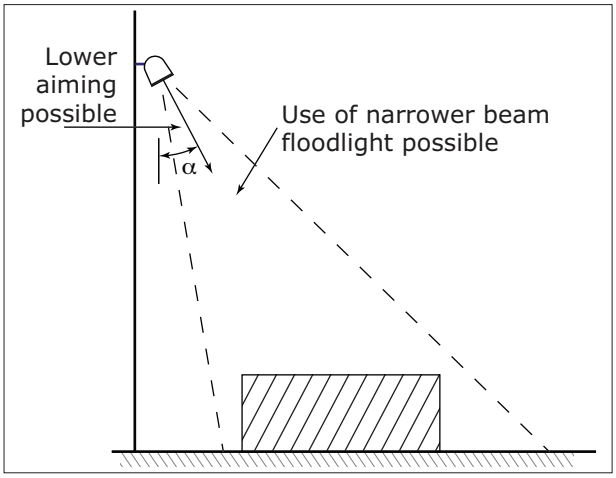


Figure 2a: Higher mounting height – less spill light and glare

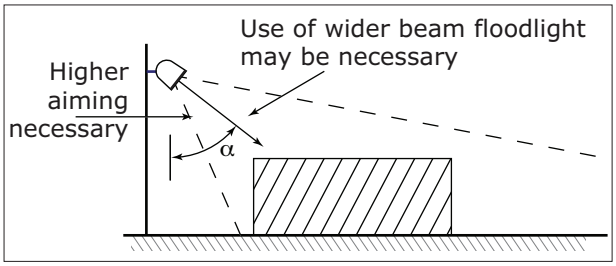


Figure 2b: Lower mounting height – more spill light and glare

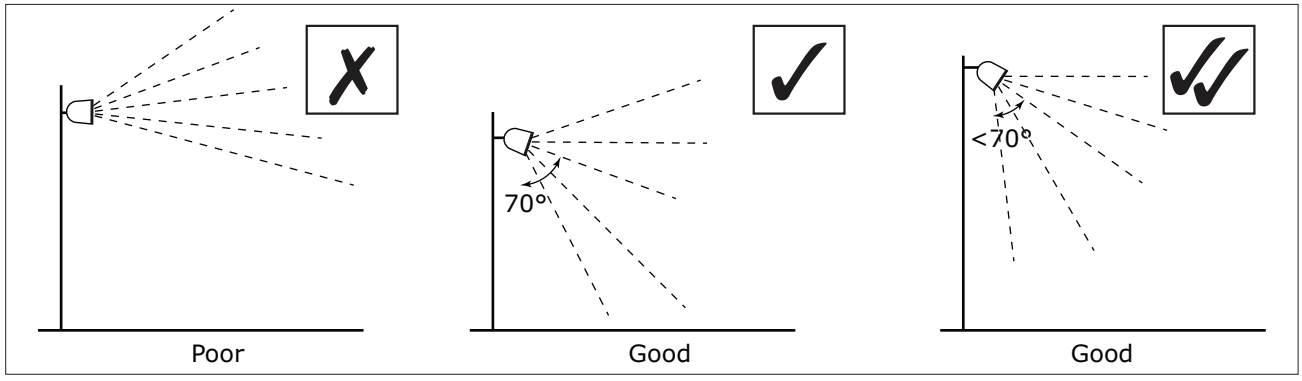


Figure 3 Luminaire aiming angles

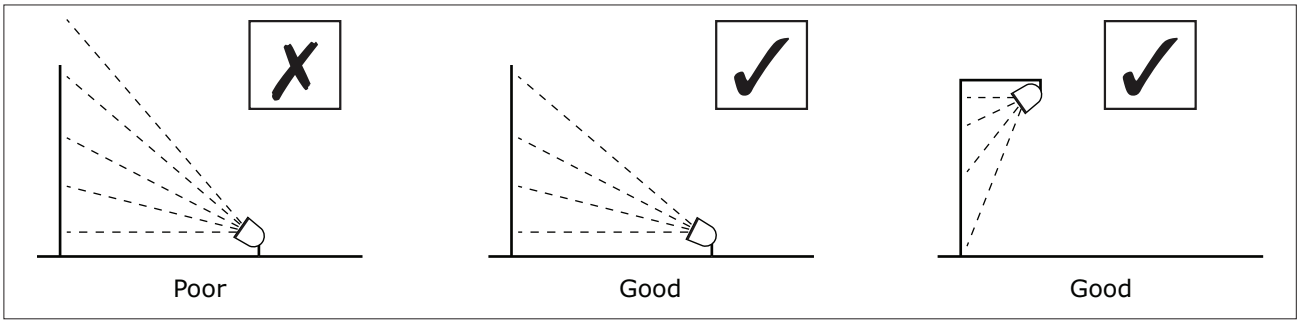


Figure 4 Façade illumination

heights allow lower main beam angles, which can assist in reducing glare.

In areas with low ambient light levels, glare can be very obtrusive, and extra care should be taken when positioning and aiming lighting equipment. With regard to domestic security lighting, the ILP produces an information leaflet GN09:2018 *Domestic exterior lighting: getting it right!* which is freely available from its website.

When lighting vertical structures such as advertising signs, direct light downwards wherever possible. If there is no alternative to up-lighting, as with much decorative lighting of buildings, then the use of luminaires with the correct optical distribution, coupled where required with shields, baffles and louvres, will help minimise spill light around and over the structure.

For road and amenity lighting installations, light near to and above the horizontal should normally be minimised to reduce glare and sky glow (Note the Upward Lighting Ratios (ULR's) advised in Tables 5 and 6). In rural areas the use of full horizontal cut off luminaires installed at 0° uplift will, in addition to reducing sky glow, help to minimise visual intrusion within the open landscape. However, in some urban locations, luminaires fitted with a more decorative bowl and good optical control of light should be acceptable and may be more appropriate.

Clean Neighbourhoods and Environment Act 2005 (CNEA)

The Clean Neighbourhoods and Environment Act 2005 (CNEA) gives local authorities and the Environment Agency additional powers to deal with a wide range of issues by classifying artificial light emitted from defined premises as a statutory nuisance.

The CNEA 2005 amended paragraph 79(1)(fb) of the Environmental Protection Act 1990 to extend the statutory nuisance regime to include light nuisance stating the following:

'artificial light emitted from premises so as to be prejudicial to health or a nuisance'.

Guidance produced on Sections 101 to 103 of the CNEA 2005 by DEFRA (DEFRA, April 2006) extends the duty on local authorities to ensure their areas are checked periodically for existing and potential sources of statutory nuisances including nuisances arising from artificial lighting. Local authorities must take reasonable steps to investigate complaints of such nuisances from artificial light. Once satisfied that a statutory nuisance exists or may occur or recur, local authorities must issue an abatement notice (in accordance with section 80(2) of the Environmental Protection Act 1990), requiring that the nuisance cease or be abated within a set timescale.

National Planning Policy Framework (NPPF)

The NPPF was introduced as a more concise and useable planning document to aid developers and designers in the design and construction of developments within the UK.

The National Planning Policy Framework 2019 makes little reference to lighting with regard to the control of obtrusive light with section being the only reference, which states:
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.

With regard to the planning aspect, many local planning authorities (LPAs) have already produced, or are producing, policies that within the planning system will become part of their local development framework. For new developments there is an opportunity for LPAs to impose planning conditions related to external lighting, including curfew hours.

National planning policy

The national on-line planning guidance resource looks at when lighting pollution concerns should be considered.

The guidance provides a high-level overview for planners, with links to appropriate documents looking at the subject through seven discussion points:

- What light pollution considerations does planning need to address?
- What factors can be considered when assessing whether a development proposal might have implications for light pollution?
- What factors are relevant when considering where light shines?
- What factors are relevant when considering when light shines?
- What factors are relevant when considering how much the light shines?
- What factors are relevant when considering possible ecological impacts of lighting?
- What other information is available that could inform approaches to lighting and help reduce light pollution?

It is to be hoped that whilst the guide does not specifically require it planners will consider the application of artificial light and consult with lighting designers. The planners can then be advised on the planning conditions that might be applicable for each project and review any submissions to determine if the planning conditions have been met.

The Scottish Executive has published a design methodology document (March 2007) entitled "*Controlling Light Pollution and Reducing Lighting Energy Consumption*" to further assist in mitigating obtrusive light elements at the design stage.

Environmental zones

It is recommended that local planning authorities specify the environmental zones given in Table 2 for exterior lighting control within their development plans.

Design guidance

The following limitations based upon CIE150 may be supplemented or replaced by an LPA's own planning guidance for exterior lighting installations. As lighting design is not as simple as it may seem, you are advised to consult and/or work with a competent professional lighting designer when considering any exterior lighting.

Table 2: Environmental zones

Zone	Surrounding	Lighting environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

Notes:

1. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.
2. Rural zones under protected designations should use a higher standard of policy.
3. Zone E0 must always be surrounded by an E1 Zone.
4. Zoning should be agreed with the local planning authority and due to local requirements a more stringent zone classification may be applied to protect special/specific areas.
5. SQM (Sky Quality Measurements) referenced by the International Dark-Sky Association (IDA), the criteria for E0 being revised in mid 2019 but not retrospective.
6. Astronomical observable dark skies will offer clearer views of the Milky Way and of other objects such as the Andromeda galaxy and the Orion Nebula.
7. Although values of SQM 20 to 20.5 may not offer clear views of astronomical dark sky objects such as the Milky Way, these skies will have their own relative intrinsic value in the UK.

Table 3 (CIE 150 table 2): Maximum values of vertical illuminance on properties.

Light technical parameter	Application conditions	Environmental zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (E_V)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

Note:

* If the installation is for public (road) lighting then this may be up to 1 lx.

Recommended maximum values of light parameters for the control of obtrusive light

Limitation of illumination on surrounding properties

Light intrusion/nuisance

Limits apply to nearby dwellings/premises or potential dwellings/premises and specifically windows; the values are the summation of all lighting installations.

Spill light

Table 3 can also be considered for the management of spill light; however, designers must consider the task performance requirements of any adjacent lit areas and ensure that any spill light does not adversely affect these performance parameters as this could affect their safe use. This may result in a need to minimise spill and intrusive lighting values to less that might be expected for the environmental zone within which the installation lies.

Limitation of bright luminaires in the field of view.

The limits for the luminous intensity of bright luminaires are dependent on the viewing distance *d*, (between the observer and the bright luminaire(s)) and the projected area A_p, of the bright part of the luminaire in the direction of the observer.

Table 4 shows the maximum values for the luminous intensity of luminaires in designated directions where views of bright surfaces of luminaires are likely to be a nuisance to occupants of premises or from positions where such views are likely to be maintained, that is, not momentary or short-term.

Considerations to aid the application of Table 4 and the assessment process.

a) The assessment of A_p for observers can prove difficult and will vary for all observer positions and distances. To aid this assessment values of A_p corresponding to the geometric mean diameter of each luminaire group have been extracted from CIE 150 Annex C and included within Table 4. These areas can be considered for an assessment of likely A_p in the observer direction to calculate a maximum luminous intensity value.
b) The above information is applicable for the consideration of a single luminaire but where two or more luminaires are located in close proximity to each other that to the observer they appear as a single light source then the assessment shall be undertaken based upon the combined bright surfaces of luminaires (A_p) in the direction of the observer or, from positions where such views are likely to be maintained.
c) In installations that involve mast lighting the luminaires will often be viewed against the night sky. The contrast between the background sky and the bright surface areas of the luminaires can be considerable. In such installations the curfew levels set for each environmental zone shall be applied with the exception that such installations within an E4 zone will be designed to suit the curfew requirements of an E3 zone.

Limitation of the effects on transport systems

Limits apply where users of road networks are subject to a reduction in the ability to see essential information. CIE 150 2017; Table 5 gives values that are for relevant positions and for viewing directions in the path of travel.

This assessment does not just apply to road lighting installations but to any installation where luminaires positioning falls under the above definition.

Limitation of sky glow

See Tables 6 and 7

Table 4 (CIE 150 table 3 (amended)): Limits for the luminous intensity of bright luminaires[4].

Light technical parameter	Application conditions	Luminaire group (projected area A_P in m^2)					
		$0<A_P \leq 0.002$	$0.002<A_P \leq 0.01$	$0.01<A_P \leq 0.03$	$0.03<A_P \leq 0.13$	$0.13<A_P \leq 0.50$	$A_p>0.5$
Maximum luminous intensity emitted by luminaire (*I* in cd)	E0						
	Pre-curfew	0	0	0	0	0	0
	Post-curfew	0	0	0	0	0	0
	E1						
	Pre-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
	Post-curfew	0	0	0	0	0	0
	E2						
	Pre-curfew	0.57 *d*	1.3 *d*	2.5 *d*	5.0 *d*	10 *d*	7,500
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	500
	E3						
	Pre-curfew	0.86 *d*	1.9 *d*	3.8 *d*	7.5 *d*	15 *d*	10.000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	1,000
	E4						
	Pre-curfew	1.4 *d*	3.1 *d*	6.3 *d*	13 *d*	26 *d*	25,000
	Post-curfew	0.29 *d*	0.63 *d*	1.3 *d*	2.5 *d*	5.1 *d*	2,500
Aid to gauging A_p		2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)		3.2	7.1	14.1	26.3	56.6	>80
Corresponding A_p representative area (m^2)		0.0008	0.004	0.016	0.063	0.251	>0.5

Notes:

1. d is the distance between the observer and the glare source in metres;
2. A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut-off in the designated directions;
3. A_p is the apparent surface of the light source seen from the observer position
4. For further information refer to Annex C of CIE 150
5. Upper limits for each zone shall be taken as those with column $A_p>0.5$

Limitations of the effect of over-lit building façades and signs

Table 8 provides recommendations regarding luminance values that provide visibility in order that a balanced urban lighting master plan can be considered and such lighting does not cause negative impacts such as a continuous increase in the lighting levels (ratcheting) between buildings and within areas and light pollution.

Illuminated advertising signage should be assessed as advised in the ILP's Professional Lighting Guide *The brightness of illuminated advertisements*, (PLG 05)

4 Amended based upon the approach taken by NSVV Nederlandse Stichting Voor Verlichtingskunde (Dutch: Dutch Foundation for Illumination; The Netherlands) and to consider CIE 150 Annex C Table C.2

Table 5 (CIE 150 table 4): Maximum values of threshold increment and viewing direction in the path of travel.

Light technical parameter	Road classification*			
	No road lighting	M6/M5	M4/M3	M2/M1
Veiling luminance† (L_V)	0.037 cd/m^2	0.23 cd/m^2	0.40 cd/m^2	0.84 cd/m^2
Threshold increment	15% based on adaption luminance of 0.1 cd/m^2	15% based on adaption luminance of 1.0 cd/m^2	15% based on adaption luminance of 2.0 cd/m^2	15% based on adaption luminance of 5 cd/m^2

Notes:

* Road classifications as given in CIE 115:2010

† The veiling luminance values specified in this table are based upon on a permissible TI value of 15%

Definitions:

TI The measure of disability glare (the reduction in visibility caused by intense light sources in the field of view) expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare.

L_V The luminance that would need to be superimposed on a scene in object space to reduce the scene's contrast by an amount equal to the added retinal illuminance from scattered light on the scene's retinal image. It is most commonly used to describe the contrast-reducing effect of a glare source in the field of view.

Table 6 (CIE 150 table 5): Maximum values of upward light ratio (ULR) of luminaires.

Light technical parameter	Environmental zones				
	E0	E1	E2	E3	E4
Upward light ratio (ULR)/%	0	0	2.5	5	15

Note:

This does not take into account the effect of light reflected upwards from ground that also contributes to sky glow. This is the traditional method to limit sky glow and is suitable to compare different single luminaires.

For illuminated advertising signs the aim should be to achieve the limits advised in PLG05.

Table 7 (CIE 150 table 6): Maximum values of upward flux ratio of installation (of four or more luminaires).

Light technical parameter	Type of installation	Environmental zones				
		E0	E1	E2	E3	E4
Upward flux ratio (UFR)/%	Road	n/a	2	5	8	12
	Amenity	n/a	n/a	6	12	35
	Sports	n/a	n/a	2	6	15

Notes:

Table 7 allows the effect of both direct and reflected upward components of a whole installation to be taken into account. The factor being the upward flux ratio (UFR) and CIE 150 suggests that table 7 is used for all installations consisting of four or more luminaires.

Clauses 6.4.2 and 6.4.3 of CIE 150:2017 describe the calculation methods for both ULP and UFR.

Light emitted just above the horizontal in a zone between 90o and 110o is extra critical for sky glow in large open areas around observatories. An additional measure in these areas limits the luminous intensities ($I_{90} - I_{110}$) as follows:

- between 90° and 100° < 0.5 cd/1000lm;
- between 100° and 110° 0 cd.

Table 8 (CIE 150 table 7): Maximum permitted values of average surface luminance (cd/m^2).

Light technical parameter	Application conditions	Environmental zones				
		E0	E1	E2	E3	E4
Building façade luminance (L_b)	Taken as the product of the design average illuminance and reflectance divided by π	< 0.1	< 0.1	5	10	25
Sign luminance (L_s)	Taken as the product of the design average illuminance and reflectance divided by π, or for self-luminous signs, its average luminance.	< 0.1	50	400	800	1.000

Note:
The values apply to both pre- and post-curfew, except that in zones 0 and 1 the values shall be zero post curfew. The values for signs do not apply to signs for traffic control purposes.

Relevant publications and standards

British Standards

- BS 5489-1:2013 *Code of practice for the design of road lighting – Part 1 Lighting of roads and public amenity areas*;
- BS EN 13201-2:2015 *Road lighting. Part 2: Performance requirements*;
- BS EN 13201-3:2015 *Road lighting. Part 3: Calculation of performance*;
- BS EN 13201-4:2015 *Road lighting. Part 4: Methods of measuring lighting performance*;
- BS EN 12193:2018 *Light and lighting. Sports lighting*;
- BS EN 12464-2:2014 *Lighting of work places. Outdoor work places*;
- PD CEN TR 13201-1:2014 *Road lighting. Guidelines on selection of lighting classes*.

CIE publications

- CIE 001 *Guidelines for minimizing urban sky glow near astronomical observatories*;
- CIE 094-1993 *Guide for floodlighting*;
- CIE 112-1994 *Glare evaluation system for use within outdoor sport and area lighting*;
- CIE 115:2010 *Lighting of roads for motor and pedestrian traffic*;
- CIE 126:1997 *Guidelines for minimizing sky glow*;
- CIE 129:1998 *Guide for lighting exterior work areas*;
- CIE 136:2000 *Guide to the lighting of urban areas*;
- CIE 150:2017 *Guide on the limitation of the effects of obtrusive light from outdoor lighting installations*;
- CIE 169:2005 *Practical design guidelines for the lighting of sport events for colour*.

ILP publications

- PLG04 *Guidance on undertaking environmental lighting impact assessments*;
- PLG05 *The brightness of illuminated advertisements*;
- PLG06 *Guidance on installation and maintenance of seasonal decorations and lighting column attachments*
- GN09 *Domestic exterior lighting: getting it right!*

SLL/CIBSE Publications

- LG01 *The industrial environment* (2018);
- LG04 *Sports lighting*;
- LG06/16 *The exterior environment*;
- LGLOL *Guide to limiting obtrusive light*.

NB: These notes are intended as guidance only and the application of the values given in the various tables should be given due consideration along with all other factors in the lighting design. Lighting is a complex subject with both objective and subjective criteria to be considered. The notes are therefore no substitute for professionally assessed and designed lighting, where the various and maybe conflicting visual requirements need to be balanced.

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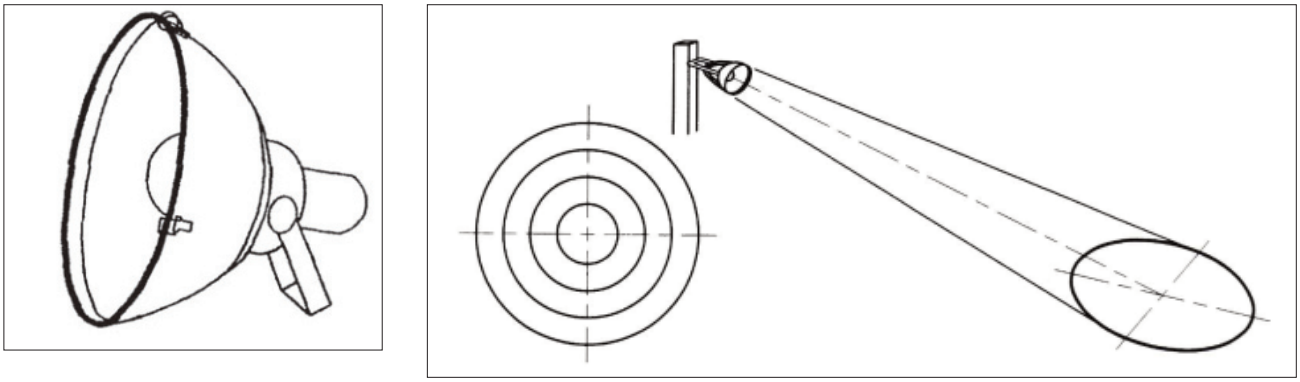
Appendix 2 images – acdc

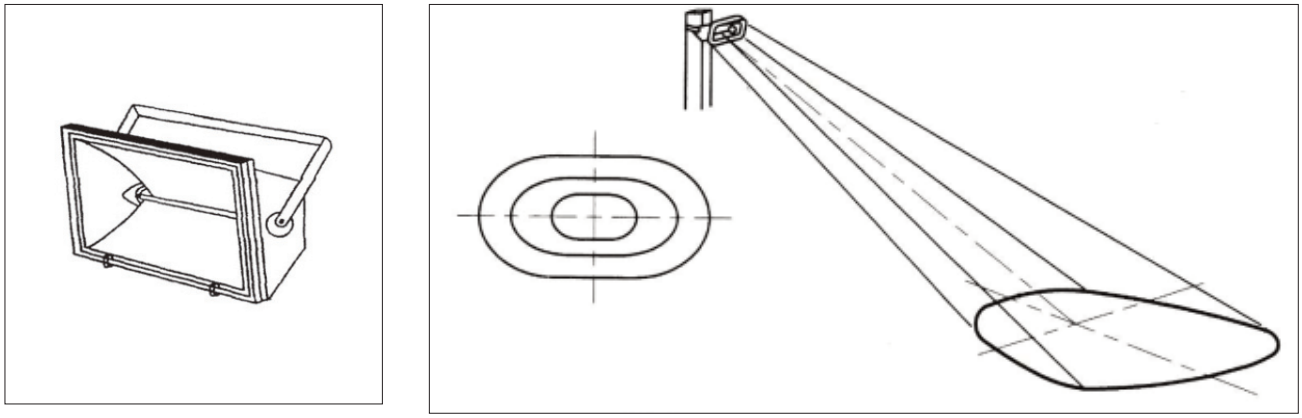
Appendix 1

Outdoor luminaire classification system

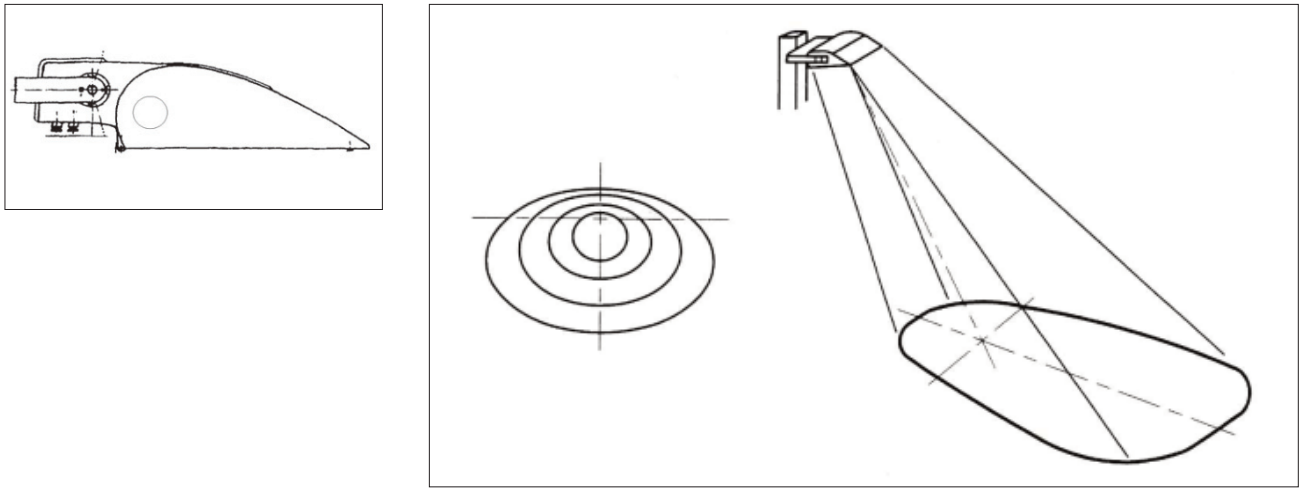
Based upon CIE 150:2017 and for the purpose of this and associated documents the following figures illustrate the luminaire classification (CIE 150:2017)



Type A: Floodlight/projector producing a symmetrical beam



Type B: Floodlight/projector producing a fan-shaped beam



Type C: Floodlight/projector producing a double asymmetric distribution in the vertical plane

Appendix 2

Illustrations of luminaire accessories for limiting obtrusive light

Luminaire with cowl, hood and shield

With louvre

With cowl

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