CANNIE WIND FARM

Transmission Line Options Review

Landscape and Visual Impact Assessment

Desktop Review 2024

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REV - 0

March 2024

RES Australia Pty Ltd

Project No:	PJ0056
Document Title:	Landscape and Visual Impact Assessment
Document No.:	PJ0056 CannieWF TxL DTR FINAL 27.03.24 A3.docx
Revision:	FINAL
Date:	March 2024
Client Name:	RES Australia Pty LtD
Author:	Hayden Burge
File Name:	PJ0056 CannieWF TxL DTR FINAL 27.03.24 A3.docx

Landform Architects

ABN 90 656 219 251

T: +61 0438 677 175

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1. Introduction

RES Australia Pty Ltd (RES) are seeking a determination from the Minister for Planning (the Minister) if an Environment Effects Statement (EES) is required for the proposed Cannie Wind Farm (CWF).

A grid connection or transmission easement is yet to be established for the CWF.

1.1 Project Overview

The Project is located in cleared farming land west of Kerang in central Victoria. Key components of the whole Project will include up to 174 turbines with an overall height of up to 280.5m, and associated features, substations and related infrastructure and an overhead grid connection.

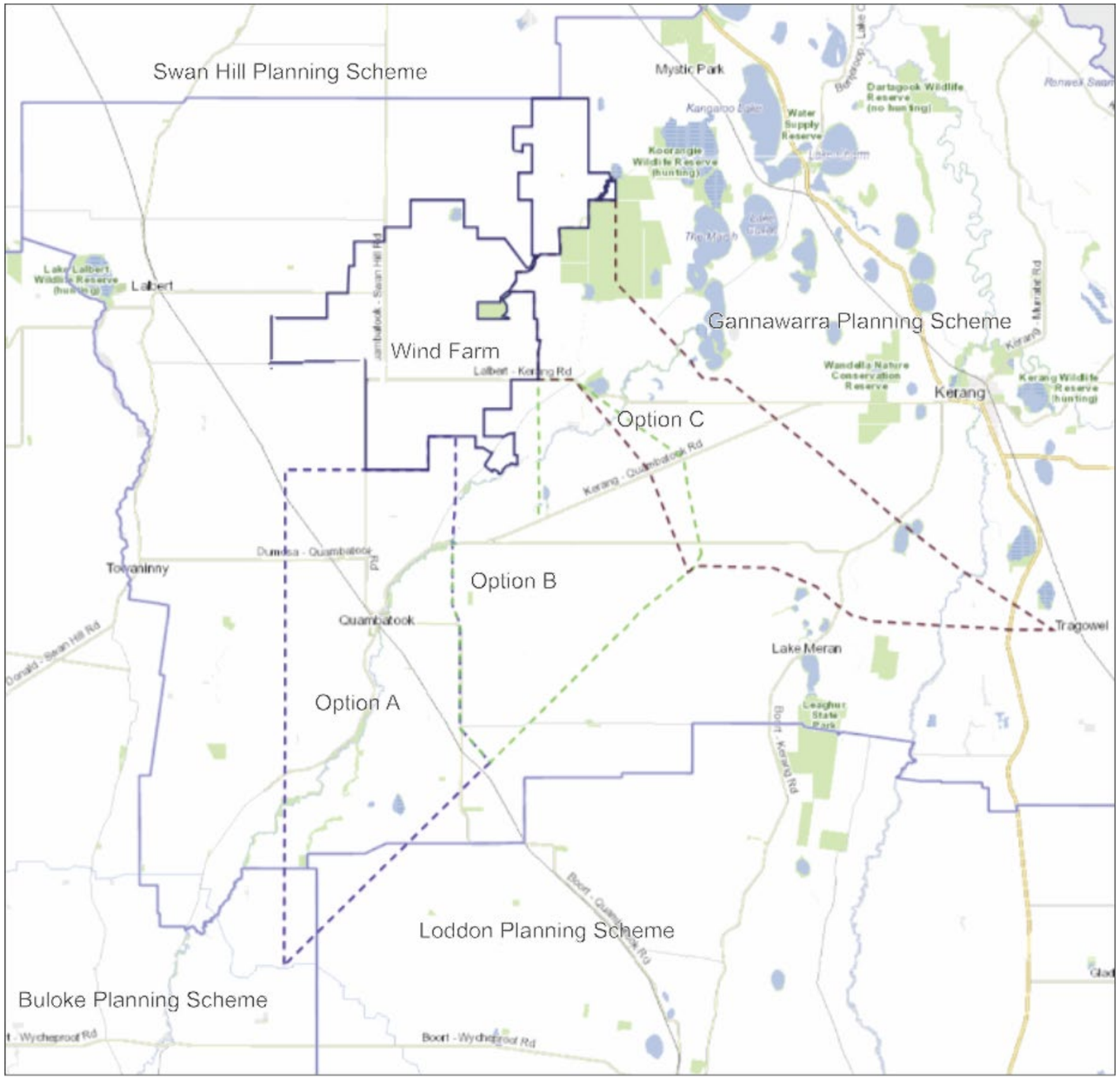
RES has identified three transmission line investigation areas for consideration. Figure 1-1 shows the three transmission line investigation areas relative to the proposed wind farm site boundaries.

Environmental Resources Management has engaged Landform Architects Pty Ltd on behalf of RES to identify potential Landscape and Visual Impacts to be considered in determining a preferred transmission line alignment associated with the Project.

1.2 Purpose of this report

This report provides a desktop review of considerations relevant to VIA for the three shortlisted options to assist RES in identifying a preferred transmission line route to carry forward in the detailed impact assessments.

Figure 1-1 Transmission line investigation areas



2. Report Structure

The methodology set out below includes the steps that have formed the basis of this review. This is an abridged version of the full methodology applied for a detailed assessment.

2.1 Project description

This chapter describes the key features of a 500kV overhead transmission line that are relevant to the review study areas and options.

2.2 The study area

The study area defines the distance at which the visual impact would not be greater than low where the supporting structures along the transmission line would be visible. This is determined by calculating the distance at which transmission line towers would occupy less than 0.5 degrees in the vertical field of view.

2.2.1 Zones of Visual Influence

Zones of Visual Influence (ZVI) quantify the scale of the potential effects of a Project over varying distances. For this report, the ZVI will assist in comparing options, such as township setbacks. The ZVI also assists in establishing criteria and considerations to manage impacts on neighbouring dwellings, which may influence the final preferred route.

2.3 Planning Policy Review

This chapter will identify relevant studies, policies, provisions and guidelines to assist with reviewing and comparing options for LVIA.

2.4 Review of Cumulative Considerations

This chapter will outline projects that may contribute to cumulative visual impacts.

2.5 Review of Options

Identify key viewing locations and areas that may be required to be considered as part of a detailed LVIA.

2.6 Mitigation measures

This section will review mitigation options available to the Project

Figure 2-1 Galvanised lattice tower

3. Project Overview

This chapter describes the key components of the Project that are useful to a desktop review of the three transmission line options.

3.1 Location

The rural township of Kerang is approximately 25 km east of the nearest proposed wind turbine. Kerang is the closest regional centre. Quambatook is approximately 9.0 km southwest and is the closest township.

3.2 Key features

The transmission line will connect to the proposed Cannie Wind Farm to the proposed 500kV VNI West High Voltage Transmission line. Three preferred alignments have emerged as the least constrained options.

Key visual features for any option will include:

- New onsite substations
- 500 kV overhead double-circuit lattice tower transmission lines;
- A new substation to connect to the NEM.

Transmission towers will be double-circuit steel lattice towers varying in height between 60m and 80m. Tower spacing will vary between 400 to 600 m from centre to centre. Tower heights and span length will be subject to property boundaries and fence lines, minimising impacts to existing farming operations (irrigation infrastructure, machinery clearances), vegetation and dwellings.

Where practicable, towers will located to minimise operational impacts to the host landholder and visual impacts from dwellings.

For line route Options A and B, a new 500kV switching station may be required in close proximity to the VNI West transmission line location to cut into the VNI West 500kV line. Option C would connect to a 'New Kerang 500/220kV substation' to be constructed under the VNI West development near Tragowel.

3.3 Circuit design Assumptions

Similar to wind turbines, supporting structures for overhead transmission lines are unavoidably large. Visual impacts can be reduced and minimised through circuit design. This is demonstrated in Figure 3-1.

From left to right, structures include a double-circuit lattice tower, a single-circuit lattice tower, and two horizontal single-circuit lattice towers which are positioned along the same transmission line. The two horizontal single-circuit buildings on the right carry the same electricity as the double-circuit tower on the left.

Single-circuit transmission lines carry one circuit on each structure (towers on the right), whereby each circuit is arranged horizontally, resulting in a broad structure that is often more noticeable. For some viewers, a single-circuit transmission is interpreted as two transmission lines rather than one alignment.

A double-circuit transmission structure (left) carries two circuits on a single tower, requiring only one supporting structure at each tower location. The effect reduces the number of visible structures and, therefore, visual clutter. This is achieved by arranging cables vertically along each side of the tower.

The technical requirements for this Project require two circuits. It is recommended that a double-circuit transmission line be adopted (image left).

3.4 Relevance to this desktop study

This review will be based on an 80m high, double-circuit transmission tower.

Figure 3-1 Circuit configuration and Structure design

4. Study area and zones of visual influence

The study area is the area that may be visually affected by Project features. The study area is different to the extent of visibility, as it may be possible to see the towers from locations outside the study area. Instead, the study area is where the proposed development could create a recognisable impact.

4.1 Calculations

This anthropometric data will form the basis for determining the study area and zones of visual influence for the Project.

Figure 4-1 shows the principles of the vertical field of view and parameters of the human vision relative to the features of this Project. These figures are based on data from '*Human Dimension and Interior Space', Julius Panero & Martin Zellnik, Witney Library of Design, 1979*. Similar data can be found in the more recent publication entitled '*The Measure of Man and Woman, Revised Edition', Henry Dreyfuss Associates, John Wiley & Sons, 2012*.

4.1.1 Study area – Public domain

When viewed from a distance of 9.2km, an 80m high double circuit transmission tower will occupy up to five per cent of the vertical field of view. This assessment will use 9.2km as the extent of the study area. The study area for this assessment is shown in Figure 4-2. The study area for each of the three options is shown on the following page. It must be recognised that the study areas below are larger and, therefore, conservative compared to the study area for a defined alignment and easement.

4.1.2 Study area – Private domain

The study area for dwellings it not considered in this assessment. Rather, the detailed assessment will consider dwellings within 2.0 km of the final transmission line route. This distance is established where an 80m high tower has the potential to be **highly visible and will usually dominate the landscape**.

4.2 Zones of visual influence

Visual prominence is one of several criteria considered when evaluating the overall visual impact from selected viewing locations. Distance ranges are used to determine visual prominence or scale over distance. Zones of Visual Influence are determined by reference to the tallest Project features and the parameters of the Hhman vision.

Zones of Visual Influence consider the visual prominence of the towers from viewing locations over varying distances within the study area and locations closer to the Project. For example, a structure viewed at a distance of 250m will occupy a greater percentage of the vertical field of view than the same structure viewed from 2.5km.

Table 4-1 (Opposite) sets out the combined distances for the study areas and ZVI of the Project. To be conservative, distances are rounded to the next (greater) 100 m.

Figure 4-1: Vertical Field of View

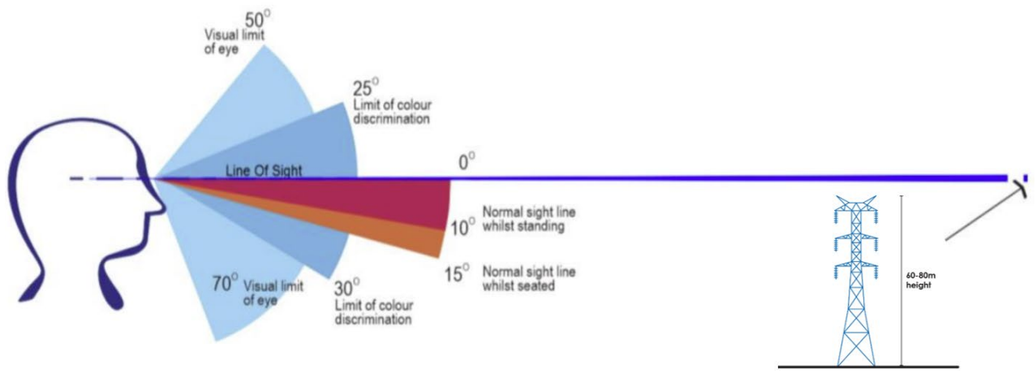


Table 4-1: Zones of Visual Influence

Vertical angle of view (°)	Distance to an 80m high tower	Zones of Visual Influence
<0.5	>9.2 km	**Visually insignificant – Extent of the project study area** A very small element that is difficult to discern and will be invisible in some lighting or weather circumstances.
0.5-1.0	4.6-9.2km	**Potentially noticeable, but will not dominate the landscape** The degree of visual intrusion will depend on the landscape sensitivity and the sensitivity of the viewer; however, the towers do not dominate the landscape.
1.0-2.5	2.0 -4.6km	**Potentially noticeable and can dominate the landscape** The degree of visual intrusion will depend on the landscape sensitivity and the sensitivity of the viewer.
2.5-5.0	1.0- 2.0km	**Highly visible and will usually dominate the landscape** The degree of visual intrusion will depend on tower placement within the landscape and factors such as foreground screening.
>5.0	<1.0 km	**Will always be visually dominant in the landscape where visible in full**

Figure 4-2: Reducing prominence over distance

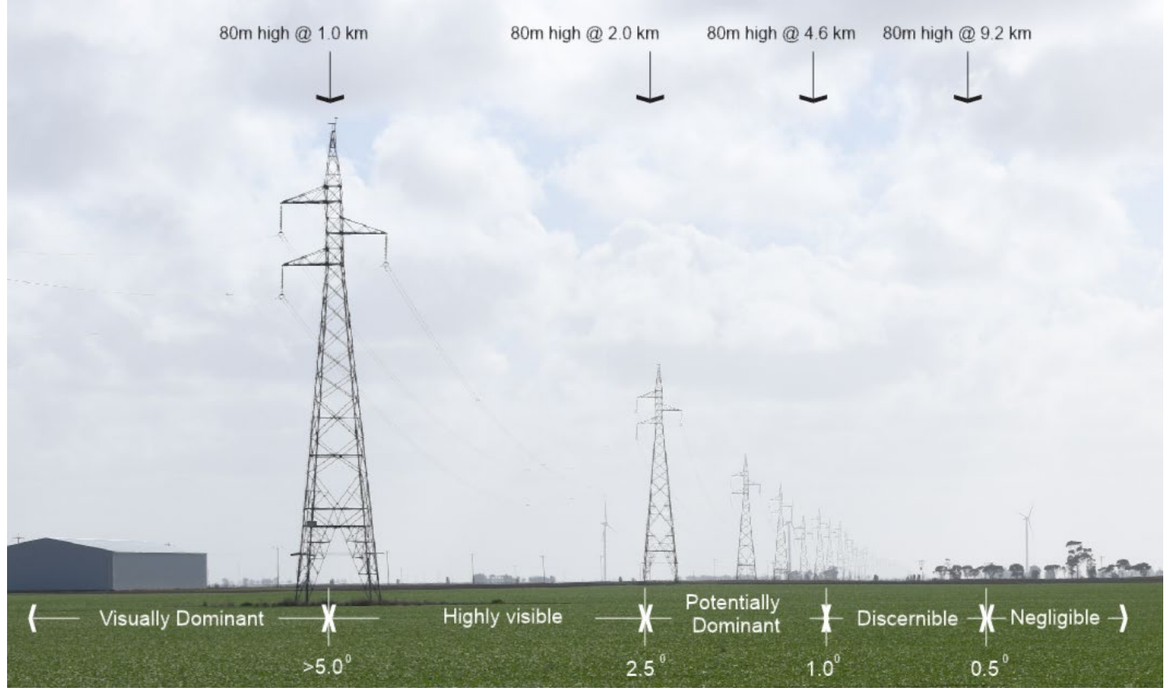
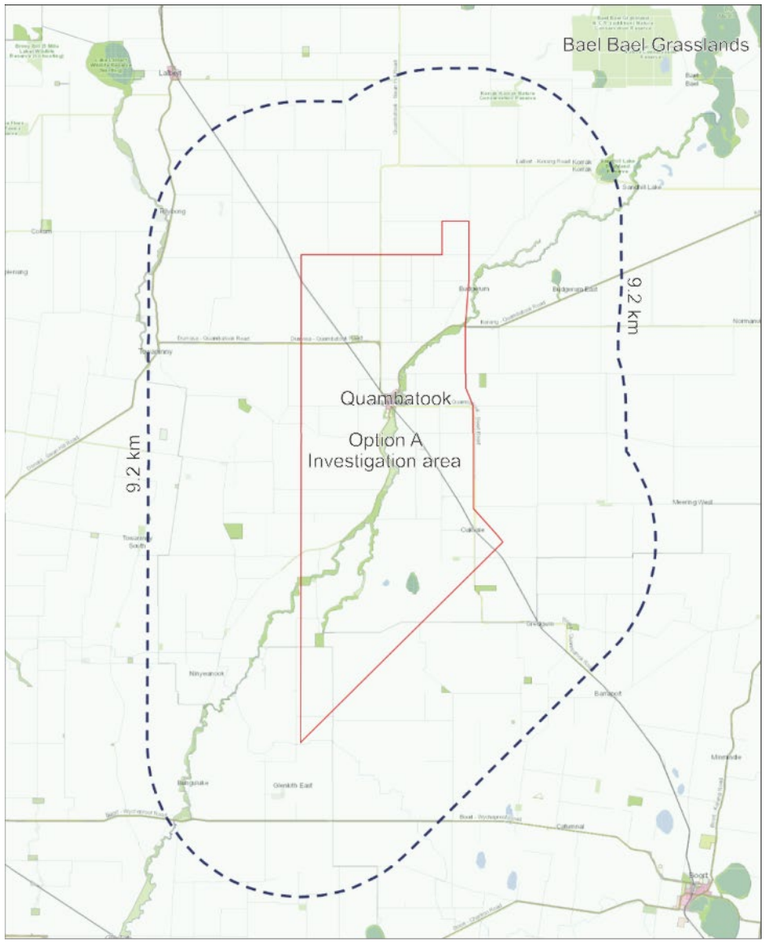


Figure 4-3 Option A investigation area and LVIA study area



4.3 Key Features within the Option A Study Area

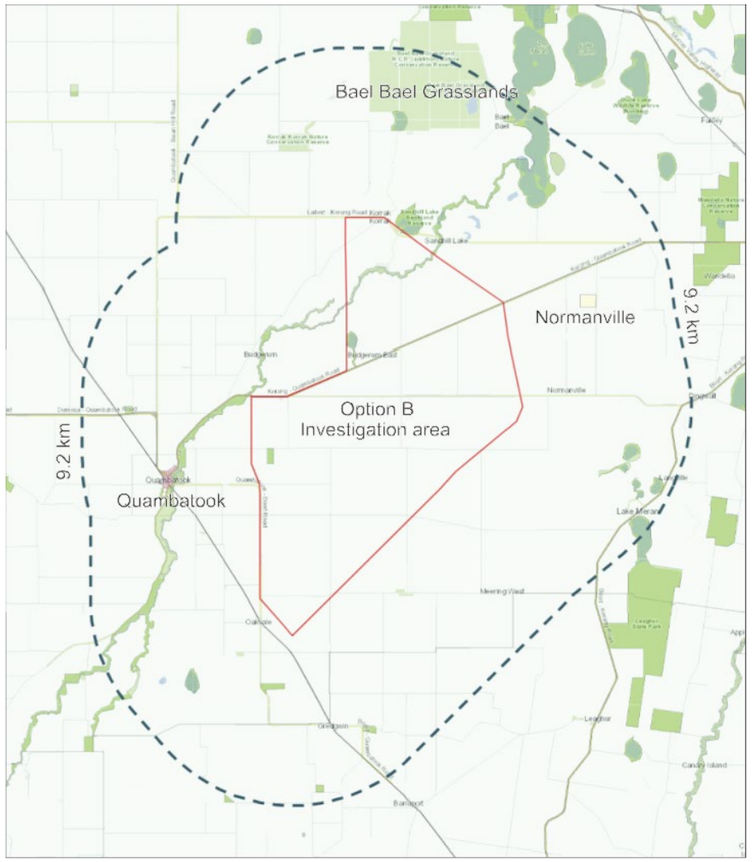
Figure 4-3 shows the Option A investigation area in red and 9.2 km LVIA study area dashed in blue.

The rural township of Quabatook is located roughly central to the Option A investigation area. The Avoca River and streamside reserves bisect the investigation and 9.2 km LVIA study areas.

Key roads are limited to the Kerang Quambatook Road and the Swan Hill-Quambatook Road.

The majority of the land within the investigation area and the LVIA study area is cleared flat farming land.

Figure 4-4 Option B investigation area and LVIA study area



4.4 Key Features within the Option B Study Area

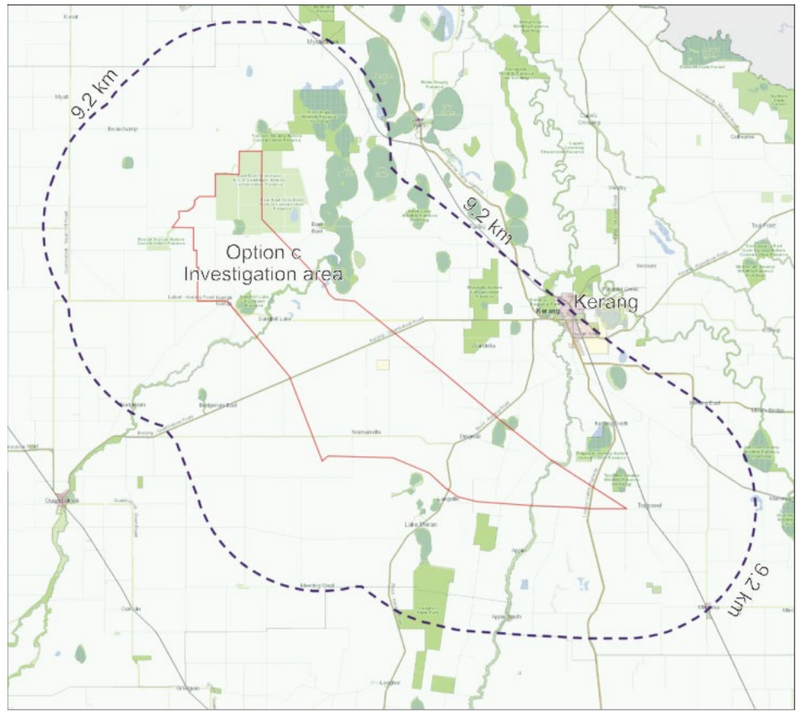
Figure 4-4 shows the Option B investigation area in red and 9.2 km LVIA study area dashed in blue.

The rural township of Quabatook is approximately 4.5 km from the investigation area but within the study area for LVIA. The Avoca River and streamside reserves bisect part of the northern investigation area and reside within the eastern part of the 9.2 km LVIA study area.

Key roads are limited to the Kerang Quambatook Road.

The majority of the land within the investigation area and the LVIA study area is cleared flat farming land.

Figure 4-5 Option C investigation area and LVIA study area



4.5 Key Features within the Option C Study Area

Figure 4-5 shows the Option C investigation area in red and 9.2 km LVIA study area dashed in blue.

Kerang is approximately 9.0 km to the eastern extent of the Study Area and is the only township in proximity to the LVIA Study Area.

The Avoca River and streamside reserves bisect part of the northern investigation area and reside within the eastern part of the 9.2 km LVIA study area.

Much of the land within the investigation and study area is within the Farming Zone. This land use and zoning is not sensitive, and one that includes few dwellings. A number of wild life reserves, waterbodies and lakes are included in the northern portion of the investigation area and LVIA Study Area. Leaghur State Park is located south of the investigation area but within the LVIA study area.

Policy implications relevant to LVIA are reviewed in the following chapter.

5. Policy Review

This chapter examines the planning context and considerations relevant to this assessment of the planning schemes within the combined Study Area for each Option.

The following Planning Policies and Guidelines were considered as part of this assessment.

- The State Planning Policy Framework.
- Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria (Department of Environment, Land, Water and Planning, November 2021).

The Gannawarra Planning Scheme applies to all three investigation areas.

5.1 Planning Policy Framework

State policy applies consistency across the whole of Victoria. Regional Policy provides local content to the areas within each local government area. Within the PPF, state policy is denoted with an 'S', regional Policy as' R' and local policy as 'L'. The PPF is currently being consolidated. As such, sections of the planning scheme review may not be complete.

All landscapes are valued. However, landscape character and values assigned to areas vary, as do the levels of protection. Areas and landscape features with statutory protections at the state and local levels are summarised below.

The transmission line options are entirely within the area covered by the Gannawarra Planning Scheme. The northern part of the study area includes areas covered by the Swan Hill Planning Scheme, the western part includes the area within Buloke Planning Scheme and the Loddon Planning Scheme to the south.

The Project boundary and most of the visual study area is within the Gannawarra Planning Scheme. The visual study area also includes areas within the Swan Hill Planning Scheme to the north, Loddon Shire to the south and Buloke to the west.

The provisions of the local planning schemes relevant to this assessment are set out below.

5.1.1 Gannawarra – Clause 02.03-2 Environmental and landscape values

Clause 02.03-2 Environmental and Landscape Values of the Gannawarra Planning scheme recognises *that the natural landscape of the municipality is characterised by the openness of irrigated and dryland farming areas. Areas of high landscape quality are generally found along vegetated streams and waterways and in the Kerang lakes area, Gunbower State Forest, the Murray River environs and other state parks and reserves. The rivers, wetlands and lakes systems provide significant habitat for flora and fauna as well as playing a key economic, social and tourism role….*

Many of the wetlands in the Kerang lakes area and Gunbower Forest have significant conservation value for native flora and fauna and are of national and international *significance (under the Ramsar convention). As there are significant numbers of rare or threatened species the importance of the wetlands as breeding grounds for birdlife has been recognised by listing under JAMBA (Japanese and Australian Migratory Bird Agreement) and CAMBA (Chinese and Australian Migratory Bird Agreement). The Northern Plains Grasslands are recognised as areas of particular significance.*

The stated *Strategic directions for the environment are to:*

- *Encourage the planting of additional native vegetation for habitat and landscape enhancement.*
- *Protect rivers, lakes, and wetlands of international significance.*
- *Protect and enhance native vegetation, especially in and around rivers, lakes, and wetlands.*
- *Protect and enhance soil and water quality, which is essential for agriculture and ecological health.*
- *Provide for a range of nature-based activities including conservation, recreation, and tourism.*

Although part of the stated objectives is to *Provide for a range of nature-based activities including conservation, recreation, and tourism.* This does not preclude the inclusion of Wind Energy Facilities.

5.1.2 Loddon – Clause 02.03-2 Environmental and landscape values

Clause 02.03-2 Environmental and Landscape Values of the Loddon Planning scheme to the south of the study area recognises *that the natural resource base is* the *economic foundation of the. The environmental values of the shire include Box Ironbark Forests, native grasslands, woodlands, wetlands, and the Loddon River….*

Of particular importance in the north of the shire is the Terrick Terrick National Park, which contains a forest of Murray Pines, grasslands, and the nationally endangered *ecological community of the Buloke Woodlands.*

Native grasslands were once widespread across the riverine plains of the north of the shire but are now restricted to a handful of isolated remnants on private and *public land, such as roadsides and railway lines. The greatest concentrations of significant grasslands are found around Mitiamo and are of national significance, as so little of this vegetation community remains Australia wide. The ongoing survival of these grasslands could be prejudiced by overgrazing, land development and changes to land management practices, such as the introduction of cropping…*

Many of the wetland systems in the shire are threatened or have been eliminated by drainage or alteration to the natural flow paths of water. Some of these wetlands are protected under international agreements such as Ramsar, JAMBA and CAMBA.

The stated objectives of the *Council's strategic directions for environmental and landscape values are to:*

- *Protect significant native vegetation and habitat, including native grasslands.*
- *Maintain remnant vegetation in viable sized parcels and enhance linkages between them.*
- *Ensure development and use of private land does not impact any adjoining public land parcels, in particular Terrick Terrick National Park, Leaghur State Park, and Kooyoora State Park.*
- *Support improvements to the natural quality of the lakes and surrounds in Boort.*
- *Protect the forest surrounds of Wedderburn.*

Although part of the stated objectives is to *Ensure development and use of private land does not impact any adjoining public land parcels, in* particular *Terrick Terrick National Park, Leaghur State Park, and Kooyoora State Park,* and to *Support improvements to the natural quality of the lakes and surrounds in Boort.* Wind Energy Facilities are not precluded.

5.1.3 Buloke – Clause 02.03-2 Environmental and landscape values

Clause 02.03-2 Environmental and Landscape Values of the Buloke Planning scheme to the west of the study area recognises *that the natural environment of Buloke is highly modified as a result of settlement and agriculture. Aspects of environmental significance that need to be protected include remnant vegetation along roadsides, watercourses and rivers, and significant wetlands* such *as Lake Buloke, Lake Tyrrell and the Wooroonook Lakes.*

The stated objectives of the Council's strategic directions for environmental and landscape values are:

- *Protecting biodiversity, native vegetation, habitat, and natural landscape values.*
- *Improving stormwater quality and enhancing natural waterways.*
- *Discouraging the expansion of development into areas of environmental sensitivity.*
- *The stated objectives* are *Discouraging the expansion of development into areas of environmental sensitivity.*

5.1.4 Gannawarra – Clause 02.03-9 Infrastructure

Clause 02.03-9 Infrastructure of the Gannawarra Planning Scheme recognises that *the shire has significant infrastructure advantages with an excellent power supply, world-class potable water supplies and access to the Loddon Valley and Murray Valley Highways.* Further, *the shire is ideally located to generate significant solar electricity.*

Amongst other things, the strategic directions for infrastructure within the shire seek to *Encourage the use and development of land for solar energy* production.

Clause 02.03-9 of the Gannawarra Planning Scheme indicates a contemplation at the policy level of the region hosting renewable infrastructure.

5.1.5 Loddon – Clause 02.03-8 Infrastructure

Clause 02.03-9 Infrastructure of the Loddon Planning Scheme recognises that *The shire, especially the northern half, has high levels of solar exposure. It is also bisected by an electricity transmission line and a 66-kilovolt line, meaning it is highly suitable for solar energy generation and distribution.*

Part of the Council's strategic directions for infrastructure are to *Direct renewable energy facilities to areas where they will not adversely affect agricultural land or production.*

Clause 02.03-9 of the Loddon Planning Scheme also indicates a contemplation at the policy level of the region hosting renewable infrastructure.

5.1.6 Land-use zones

Figure 7-1 (below) shows land-use zones that apply to the tudy area within the local planning schemes.

All land within the Project boundaries is within the Farming Zone (FZ). Areas zoned Public Conservation and Recreation Zone (PCRZ) comprise bushland reserves beyond the Project boundaries and the Avoca River to the southeast of the Project.

The purpose of the Farming Zone is:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To provide for the use of land for agriculture.*
- *To encourage the retention of productive agricultural land.*
- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
- *To encourage the retention of employment and population to support rural communities.*
- *To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision; and*
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*

Under General Issues, the decision guidelines relevant to LVIA direct the responsible authorities to consider:

- *The Municipal Planning Strategy and the Planning Policy Framework….*
- *Whether the site is suitable for the use or development and whether the proposal is compatible with adjoining and nearby land uses….*
- *How the use and development make use of existing infrastructure and services.*

Under Design and siting Issues, the decision guidelines relevant to LVIA direct the responsible authorities to consider:

- *The need to locate buildings in one area to avoid any adverse impacts on surrounding agricultural uses and to minimise the loss of* productive *agricultural land.*
- *The impact of the siting,* design*, height, bulk, colours and materials to be used, on the natural environment, major roads, vistas and water features and the measures to be undertaken to minimise any adverse impacts.*
- *The impact on the character and appearance of the area or features of architectural, historic or scientific significance or of natural scenic beauty or importance.*

The purpose of the Public Conservation and Recreation Zone is:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values.*
- *To provide facilities which assist in public education and interpretation of the natural environment with minimal degradation of the natural environment or natural processes. To provide for appropriate resource-based uses.*

5.2 Relevance to this study

Areas with the greatest protection and most valued areas are landscape areas within Public Conservation and Resource Zone (PCRZ), such as the Leaghur State Park Bael Bael Grasslands Nature Conservation Reserve, Water bodies and ephemeral wetlands. These areas are valued for their natural appearance, recreational uses, and biodiversity values.

Areas with the potential for more people and greater viewer numbers include townships and rural communities where the predominant land-use zone provisions are for living and recreation. These areas include land within the General Residential Zone (GRZ), Township Zones (TZ), and Rural Living Zones (RLZ). Such areas included in the study area for the CWF include Kerang to the east, Quambatook to the south, Lalbert to the west and Swan Hill, Lake Boga and Mystic Park to the north.

The Farming Zone contemplates that uses within these areas can impact the amenity of sensitive uses such as residential dwellings. Most approved and constructed wind farm projects in Victoria are within the Farming Zone. Typically, these areas are less sensitive to the landscape or visual change levels proposed through wind, solar and transmission line facilities. Consideration must, however be given to cumulative visual impacts brought about by multiple projects in these areas. The following chapter reviews the potential for this to occur.

Areas in the FZ with higher values, are recognised by schedules to the Significant Landscape Overlay, Environmental Significance Overlay, or Vegetation Protection Overlays in the local planning schemes. These are discussed below.

It is acknowledged that people live in the Farming Zone, but this is not recognised as the protection's primary purpose or focus. The protections seek to limit or preclude modifications directly impacting the integrity of the recognised features and the value of these areas.

5.3 Overlays

Overlays applied to landscapes and features in the study area that can protect landscape character, views, and amenity include the Significant Landscape Overlay, Vegetation Protection Overlay, Design and Development Overlay, and Heritage Overlays referred to above. Figure 5-1 shows overlays in the combined study areas

5.3.1 SLO's

There are no Significant Landscape Overlays within the investigation or study areas for each Option. This is significant because is it schedules to the Significant Overlay of the local planning schemes that typically refer to visual impact as one of the objectives to be managed or considered by decision-makers.

5.3.2 ESO's

Several schedules to the Environmental Significance overlay (ESOs) apply to land and features within the study area. The objective of most ESO's seek to protect water quality across the various catchment areas to which they are applied.

The exception to this is Schedule 1 to Environmental Significance Overlays (ESO1) and Schedule 3 to the Environmental Significance Overlays of the Gannawarra Planning Scheme. Schedule 3 and Schedule, 4 to the Environmental Significance Overlays, also apply to many areas within the investigation and study areas for each Option.

The majority of the Option A Investigation area, is affected by Schedule 4 Environmental Significance Overlays to the Gannawarra Planning Scheme. The southern part of the investigation and study areas for Options B and C are unaffected and, therefore, least constrained. Schedules 3 and 4 to the Environmental Significance Overlays of the Gannawarra Planning Scheme are described below.

5.3.2.1 Gannawarra - Schedule 3 – Lake Environs to Clause 42.01 Environmental Significance Overlay

Schedule 3 – Waterway Environs to the Environmental Significance Overlay recognises *The Kerang Wetlands are a system of public lands reserved as Nature Reserves, Wildlife Refuges and State Forest. The wetlands systems are integral to the maintenance of natural, cultural and catchment values associated with major rivers in the municipality including the Loddon and Avoca Rivers and the riparian environs of the Murray River. Incorporated into these wetlands is a comprehensive irrigation system for agricultural and horticultural use.*

The wetlands contain outstanding ecological values, including internationally significant wildlife habitats and catchment values concerning water supply, water quality, drainage, salinity control and recreational values.

Environmental objectives to be achieved include:

- *To recognise the important* function *and significance of existing lakes in the land pattern.*
- *To protect and enhance the* biodiversity*, ecological values, and cultural values of the lake environs.*
- *To protect the visual and* environmental *quality and character of the lakes and their environs.*
- *To provide for appropriate development on land adjacent to Lake Charm, Kangaroo Lake, and Racecourse Lake, consistent with the use of the area for tourist, holiday and recreational purposes, while protecting the natural beauty and amenity of the land and* lakes *themselves.*
- *To maintain the function of* the *lakes as a flood control basin.*
- *To protect the natural beauty of the area.*

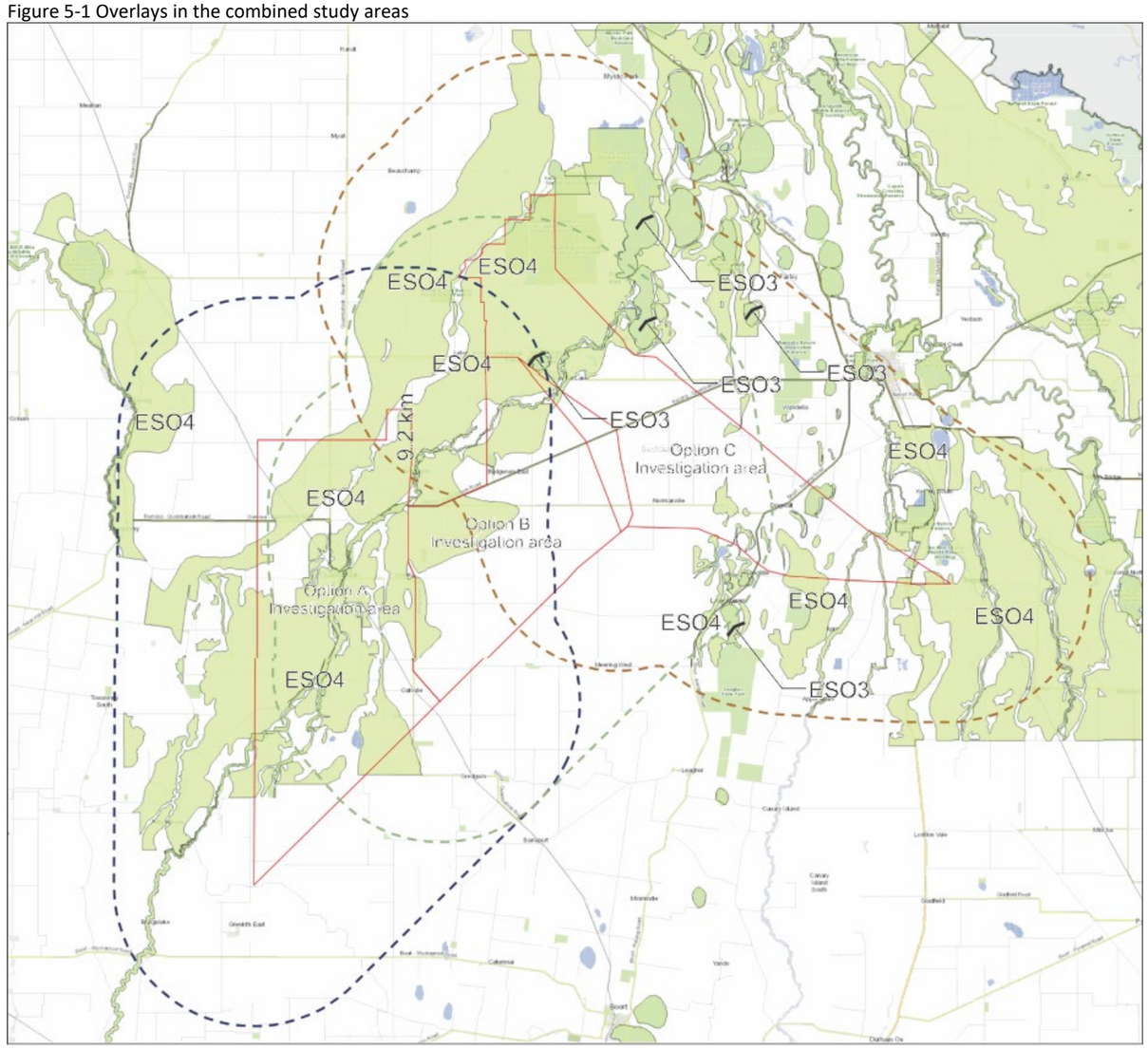
Sites within this area are identified as Ramsar Wetlands. The management outcomes of ESO 3 include amenity considerations from specific areas such as lakes, waterways and recreation areas.

5.3.2.2 Ganawarra – Schedule 4 Areas of poor drainage or potentially subject to inundation

The area affected by Environmental Significance Overlay - Schedule 4 – Areas of Poor Drainage or Potentially subject to inundation. ESO4 applies to the Project area and many areas within the study area for each Option.

The statement of significance for Schedule 4 to the ESO (ESO4) seeks to *ensure that any development maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and with local drainage conditions and will not cause any significant rise in flood levels or flow velocity*.

Figure 5-1 Overlays in the combined study areas



6. Cumulative considerations

The UK Guidelines define cumulative visual impacts as the combined effect of changes brought about by a proposed development in conjunction with other similar developments in an area, which may result in changes to the perceptions of the local community or a visitor to the region. The potential for cumulative visual impacts to occur is where there may be:

- Sequential views to multiple similar projects along roads within the study area and
- Simultaneous views from publicly accessible viewpoints or private viewing locations may occur.

The greatest potential for cumulative visual impacts to occur is in areas where the study area (distance at which a project is a discernible visual feature) of one or multiple constructed or approved projects overlap.

Sequential cumulative impacts may occur over greater distances, such as driving along roads and viewing multiple wind farms or transmission infrastructure throughout a journey. For this reason, projects in the broader region outside of the Project study area will also be considered.

Constructed, approved and proposed wind farms, transmission lines, and terminal stations near the study area are listed below.

6.1 Nearby existing, proposed and approved transmission lines

The 220kV Kerang Terminal to Bendigo Transmission line bisects the proposed wind farm site and north of the Projects' three transmission line investigation areas. The proposed 500kV VNI West overhead transmission line investigation area is south of the Projects transmission line options.

6.2 Nearby existing and approved wind farms

The closest operating wind farms are the Yawong Wind Farm, approximately 56km west and the Coonooer Bridge Wind Farm, approximately 58km west. The Berrimal Wind Farm, approximately 71km south, is the closest approved but not yet constructed wind farm.

6.3 Nearby existing and approved Solar Farms

The Wandella Solar Farm is approximately 14 km to the east. The Wandella Solar Farm is the only one operating within the study area. The approved Kerang Solar Farm is approximately 16 km to the east and east of the Loddon Valley Highway.

6.4 Summary of cumulative considerations

Figure 9-1 shows the location of constructed or approved wind and solar projects in proximity to the transmission line options. The blue outline shows the locations and extent of the operating wind and solar facilities. The green outline shows the locations and extent of approved but not yet constructed developments.

Existing Developments:

- 220kV Kerang Terminal to Bendigo Transmission line
- Wandella Solar Farm

Approved but not yet construction developments:

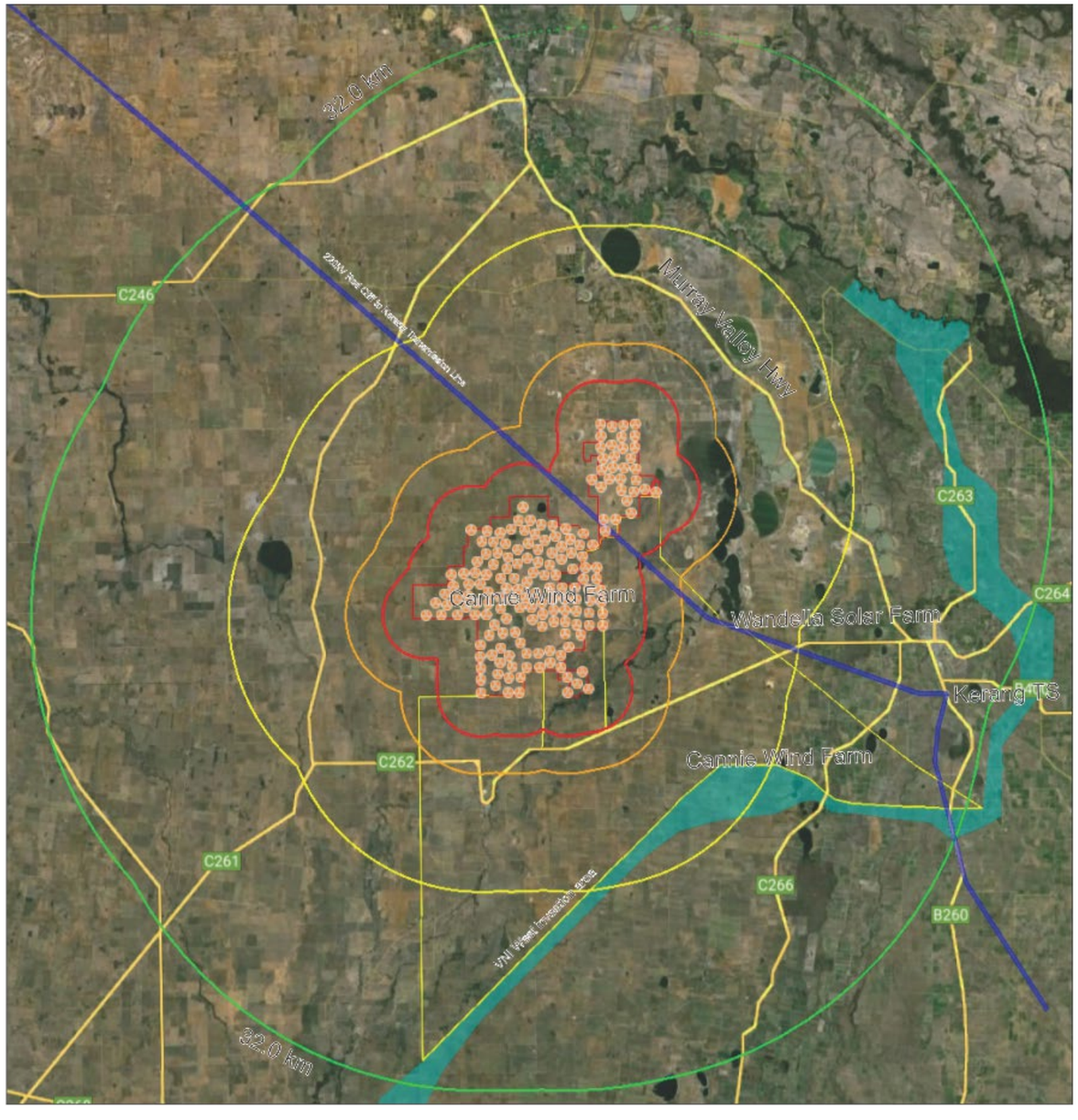
- Kerang Solar Farms

Developments that are proposed and currently being assessed:

- VNI West Transmission line investigation area
- Normanville Wind Farm (Pending Approval)

The following section will review each Option based on the above analysis.

Figure 6-1 Constructed, approved and proposed development.



7. Transmission line - Option A

The study area for Transmission Line Option A has been defined by RES. Assumptions for LVIA include an overhead transmission line up to 80 m in height, connecting to an undefined location along the proposed VNI West Transmission Line.

Figure 5-1 shows the extent of the Option A investigation area in red and the 9.2 km study area for LVIA in blue.

7.1 Transmission line Option A Existing environment

Primary areas of open space and recreational uses within the study area or near the alignment are limited to streamside reserves along the Avoca River, Sandhill Lake toward the outer edge of the study to the northeast, and reserves with Quambatook Township. These areas are shown shaded in dark green.

Residential areas include land within the General Residential Zone and Low-Density Residential Zone, limited to Qumabatook, which is roughly central to the Option A investigation area.

Much of the land within the investigation and study area is within the Farming Zone, which is not sensitive and includes few dwellings. These areas are shown shaded in light green.

The VNI West investigation area runs along the southern edge of the Option A investigation area.

7.2 Key considerations – Option A Transmission line

Key considerations and areas of interest for LVIA of Option A are discussed below.

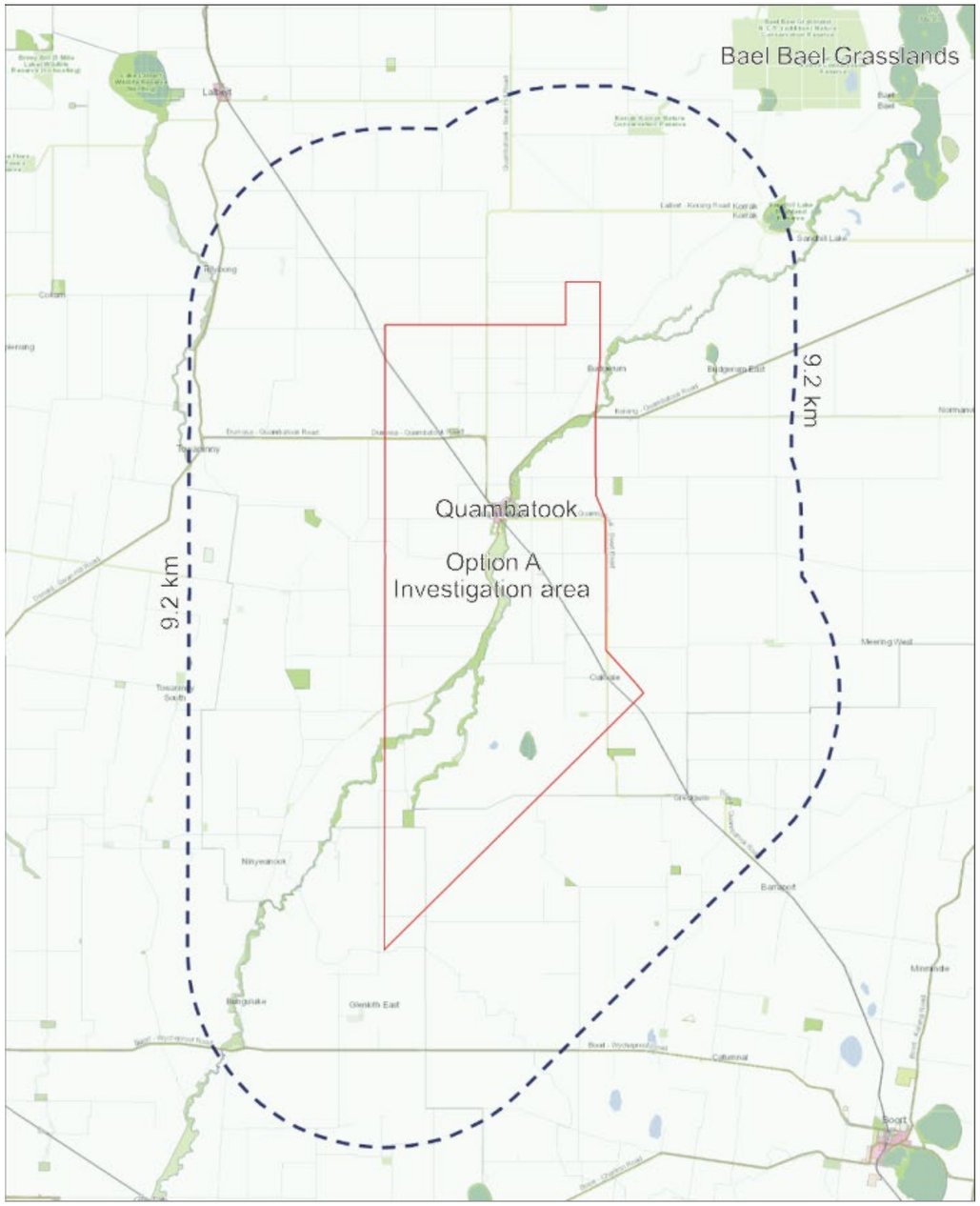
Quambatook Township and Avoca River are located roughly central to the investigation area and LVIA study area. Any preferred alignment within the Option A investigation area should seek to limit cumulative visual impacts through fragmentation brought about by multiple transmission lines and terminal stations and simultaneous and sequential views along Kerang-Quambatook Road and Swan Hill-Quambatook Road.

Further, the preferred alignment east of Quambatook will prevent the township from being "islanded" or encircled by features and assets associated with electricity generation and transmission.

Key viewing locations include:

- Quambatook Township
- Avoca Streamside Reserves
- Kerang – Quambatook Road
- Swan Hill-Quambatook Road

Figure 7-1 Option A - Investigation area and LVIA Study Area



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8. Transmission line - Option B

The study area for Transmission Line Option B has been defined by RES. Assumptions for LVIA include an overhead transmission line up to 80 m in height, connecting to an undefined location along the proposed VNI West Transmission Line.

Figure 6-1 shows the extent of the Option B investigation area in red and the 9.2 km study area for LVIA in blue.

8.1 Transmission line Option B Existing environment

Primary areas of open space and recreational uses within the study area or near the alignment are limited to streamside reserves along the Avoca River to the north and west, Sandhill Lake and Korak Korak Nature Reserve to the north, Bael Bael Grasslands and Lake Bael Bael toward the outer edge of the study area to the northeast along with reserves, sportsfields and the golf course to the east of Quambatool. These areas are shown shaded in green.

Residential areas include land within the General Residential Zone, and Low-Density Residential Zone are limited to Qumabatook, approximately 4.5 km west of the Option A investigation area.

The majority of the land within the investigation and study area is within the Farming Zone, which is not sensitive and includes few dwellings. These areas are shown shaded in light green.

The VNI West investigation area runs along the southern edge of the Option B investigation area.

8.2 Key considerations – Option B Transmission line

Key considerations and areas of interest for LVIA of Option B are discussed below.

The majority of the land within the investigation and study area is within the Farming Zone, which is not sensitive and includes few dwellings. Sensitive areas include Quambatook, which is located approximately 4.5 km west of the investigation area, Avoca River and streamside reserves, to the north and west of the investigation area and Bael Bael Grasslands towards the outer extent of the study area to the north.

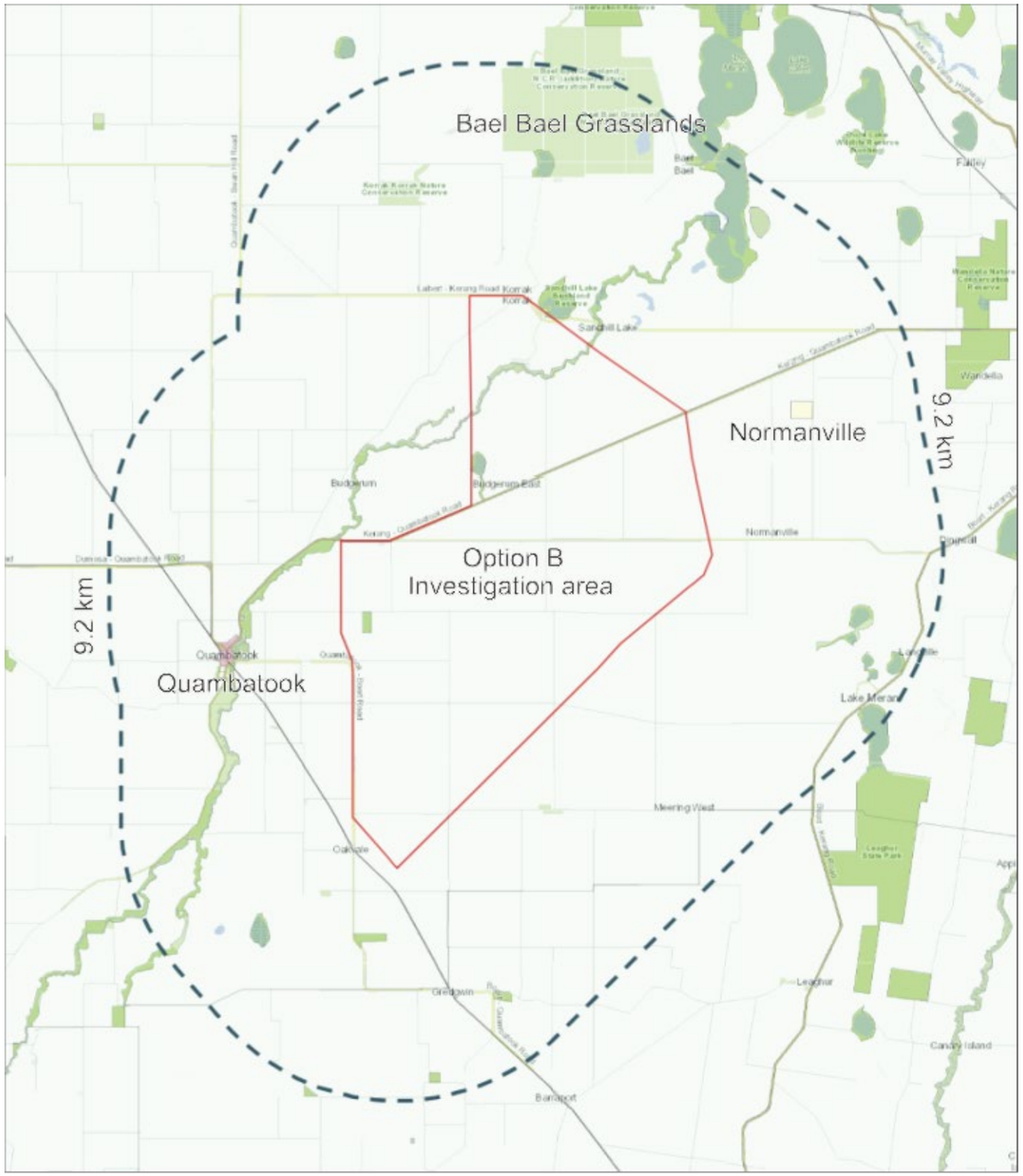
Quambatook township is approximately 4.5 km west of the Option B investigation area. At this distance, the transmission line has the potential to be noticeable but not visually dominant. For this reason, it is recommended that any transmission line route in Option B seek to maximise the setback to Quambatook.

Any preferred alignment within the Option B investigation area should also seek to limit cumulative visual impacts through fragmentation brought about by multiple transmission lines, terminal stations, and simultaneous and sequential views along Kerang-Quambatook Road. This may be achieved through co-location, shared assets or alignment design.

Key viewing locations include:

- Quambatook Township
- Avoca Streamside Reserves
- Kerang – Quambatook Road
- Bael Bael Grasslands
- Korak Korak Nature Resreve

Figure 8-1 Option B - Investigation Area and LVIA Study Area



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9. Transmission line - Option C

The study area for Transmission Line Option C has been defined by RES. Assumptions for LVIA include an overhead transmission line up to 80 m in height, connecting to an undefined location along the proposed VNI West Transmission Line.

Figure 6-1 shows the extent of the Option C investigation area in red and the 9.2 km study area for LVIA in blue.

9.1 Transmission line Option C Existing environment

Primary areas of open space and recreational uses within the study area or near the alignment include:

- Leaghur State Park
- Streamside Reserves along the Avoca River,
- Sandhill Lake Bushland Reserve
- Lake Lookout
- Western edge ofKangaroo Lake
- Lake Cullen
- Lake Bael Bael
- Lake Elizabeth
- Lake Meran
- Lake Gilmour Wildlife Reserve Lake Murphy Wildlife Reserve
- Tragowell Swamp Nature Reserve
- Wandell Nature Conservation Reserve
- Bael Bael Grassland Reserve
- Korrak Korrak Nature Conservation Reserve
- Mystic Park Bushland Reserve

Residential areas include land within the General Residential Zone and Low-Density Residential Zone are limited to Qumabatook, approximately 4.5 km west of the Option C investigation area.

The majority of the land within the investigation and study area is within the Farming Zone, which is not sensitive and includes few dwellings. These areas are shown shaded in light green.

The VNI West investigation area runs along the southern edge of the Option B investigation area. The proposed Normaville Wind Farm is located south of the Kerang Quambatook Road and is roughly central to the investigation area.

9.2 Key considerations – Option A Transmission line

Key considerations and areas of interest for LVIA of Option C are discussed below.

Much of the land within the investigation and study area is within the Farming Zone. This land use and zoning is not sensitive, and one that includes few dwellings. Distinct from Options A and B, the investigation and LVIA study areas include larger areas of open space and wild reserves toward the north. Option C is the only study area that includes state parks (Leaghur State Park).

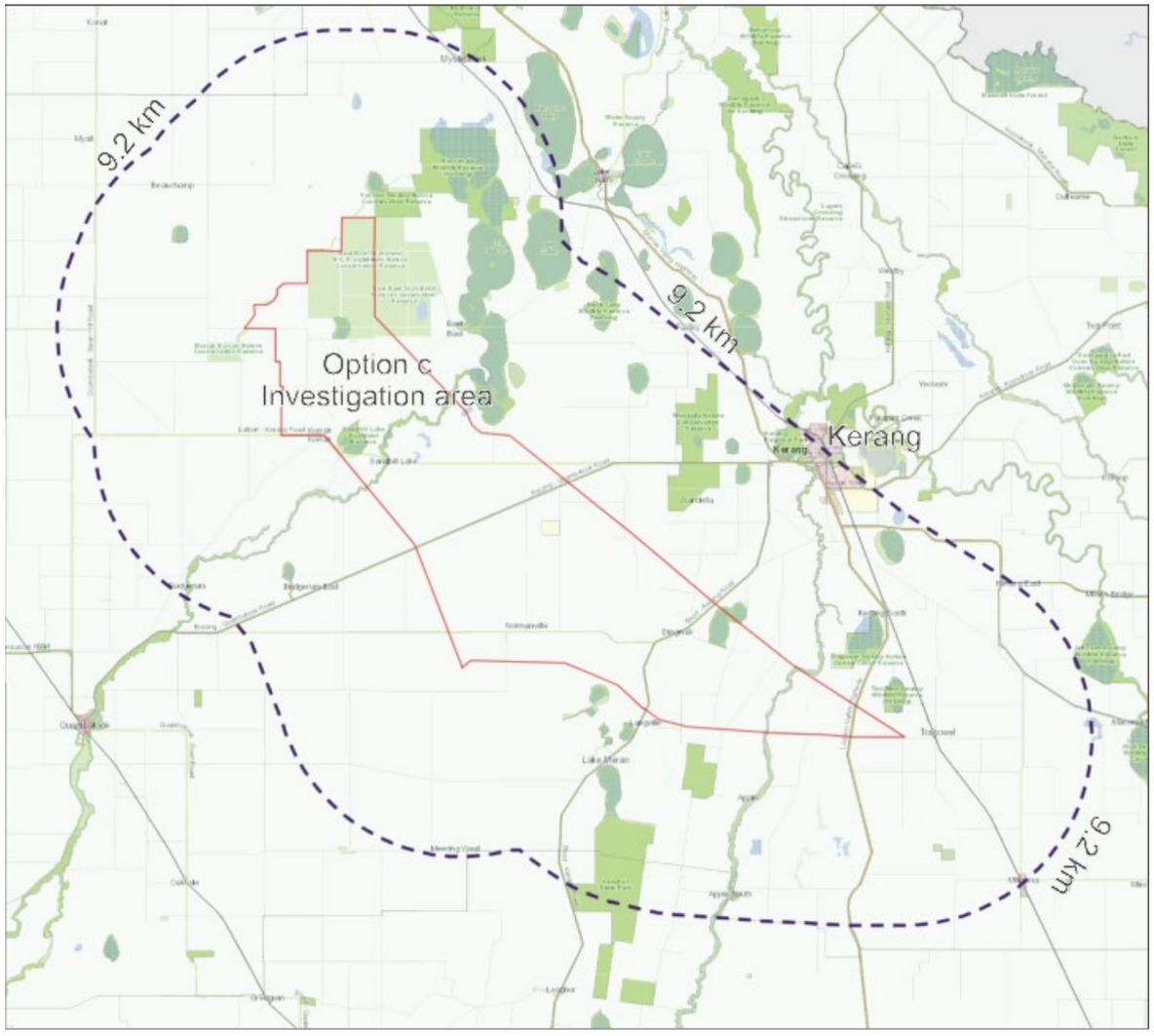
Kerang is approximately 9.0 km to the eastern extent of the study area. Kerang is the only township in proximity to the LVIA Study Area.

Any preferred alignment within the Option C investigation area should seek to limit cumulative visual impacts through fragmentation brought about by multiple transmission lines and terminal stations associated with the proposed VNI West Transmission line and any grid connecting infrastructure associated with the proposed Normanville Wind Farm. This includes the potential for simultaneous and sequential views of one or more wind farms and transmission lines from locations along Kerang-Quambatook Road and the Loddon Valley Highway to the east.

Key viewing locations include:

- Kearng Township
- Kerang – Quambatook Road
- Loddon Valley Highway
- Bael Bael Grasslands
- Korak Korak Nature Resreve

Figure 9-1 Option C - Investigation area and LVIA Study Area



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10. Mitigation

The supporting structures for overhead transmission lines are un-avoidably large. Visual impacts can, however be reduced and minimised. Design measures include:

- Circuit design; and
- Structure type.

The effect of circuit design and structure types is described in Chapter 3. Additional measures may be implemented to further reduce impacts, particularly from some residential dwellings if required. These include:

- Treatments or applied finishes; and
- Offsite mitigation.

The usefulness of these techniques is described below in sections 10.2 and 10.3.

10.1 Alignment Design

Measures to assist in managing cumulative visual impacts include:

- Co-location of transmission lines adjacent to existing easements where practicable
- Reducing visual clutter through structure placement and design where co-location of easements and infrastructure is to occur.
- Limiting or avoiding the effect of fragmentation or island areas through multiple transmission lines
- Locating new terminal station development away from dwellings and settled areas

10.2 Treatment

Steelwork used for transmission structures is traditionally hot dip galvanised for protection against corrosion to increase structure service life. Mitigation options include pre-dulling of hot-dip galvanised steel sections and painting.

Chemical pre-treatment of freshly galvanised steel will reduce reflective sheen to advance the process or natural weathering to achieve a matte, dull grey appearance.

Painting structures can assist in reducing the visibility and prominence of structures when viewed against a backdrop of terrain or vegetation.

10.2.1 Steel monopoles

When viewed over greater distances, the silhouette of a steel monopole is visually similar to power poles found along many road reserves and across farming properties in the Project Area. The relationship between a steel monopole and a high-voltage transmission line is diminished when viewed over distance or in transit.

The stronger levels of support found in case studies are attributed to the sleeker and less complicated design of steel monopoles and cross arms. [1]

[1] Aesthetic Design of Electric Transmission Structures - Task Committee on Aesthetic Design of Electric Transmission Structures Published by the American Society of Civil Engineers, 2020

10.3 Offsite mitigation – Neigbouring Dwellings

Similar to wind farm projects, landscape screening is one method that can be applied to ameliorate visual impacts from sensitive locations, particularly dwellings. Landscape plantings can be designed to screen or filter views to individual towers, retaining desired components of the view or established to screen a larger area.

10.3.1 Placement and Screening

Figure 13-4 shows an example of existing vegetation and the placement of new landscaping to assist with screening views of towers.

Alternatives may include carefully placing single trees or clusters to screen views to the nearest and most visually noticeable structure.

10.3.2 Vegetation heights

Analysing view angles for each structure height assists in determining the approximate height that landscape mitigation will require to achieve to assist with mitigating visual impacts from residential dwellings.

Table 13-1 shows vegetation heights to mitigate views of an 80m high tower. The left-hand column shows the distance of the viewing location from the Project Proposed Route. The corresponding rows show vegetation heights over varying distances from the viewing location. Vegetation heights have been determined using calculations for the extent of the study area and the ZVI discussed in Chapter 5 of this report. 1.8m has been added to allow for a standing view.

The form of vegetation shown in the figure above is indicative only. The vegetation type will determine whether views are screened, partially screened, or filtered. The model conditions for wind farms provide flexibility for landholders to select vegetation that suits their individual needs and tastes.

Table 13-1: Landscape Mitigation Indicative Heights – 80m high structure

Dwelling setback	View angle	Vegetation height at 20m	Vegetation height at 30m	Vegetation height at 50m
250 m	17.74°	7.9m	11.2m	17.5m
500 m	9.1°	4.8m	6.5m	9.7m
1.0 km	4.5	3.2m	4.2m	5.6m
1.5 km	3.0	2.7m	3.2m	4.3m
2.0 km	2.3	2.5m	2.8m	3.6m

10.3.3 Bushfire considerations

For dwellings located within a Bushfire Management Overlay, it will be important to consider design requirements such as canopy separation, defendable space, and distance from the dwelling. For these reasons, vegetation has been shown at varying distances from the dwelling, assuming flat terrain.

Any landscape mitigation should consider design requirements such as canopy separation, defendable space and distance from the dwelling and follow the guidance provided by the Country Fire Authority (CFA) in *Landscaping for Bushfire – Garden Design and Plant Selection* (CFA 2022).

10.3.4 Recommendations

Landscape screening should be contemplated for all neighbouring dwellings within 2.0km along the preferred 500kV alignment. This includes dwellings beyond the study area of the wind farm but within the study area resulting from the preferred transmission line route.

Figure 10-1: Murra Warra Wind Farm -- 230m high wind turbine at 1.0 km distance

11. Conclusion

This study has undertaken a high-level desktop review of the considerations to assist RES in arriving at a preferred transmission line study area and criteria to assist in the design of a preferred corridor.

Based on the above, Option B investigation area would present the least constrained Option from a landscape and visual impact when compared to Option A & C. The reasons for this are summarised below:

- The whole of the investigation area and 9.2 km study area that would be applied to an 80m high transmission line in this area would be within the study area defined for the proposed Cannie Wind Farm. This limits the geographical extent of the potential visual impact of the Project as a whole.
- From a landscape sensitivity and protection perspective, there are fewer schedules to the various Environment and Landscape Overlays within the Option B Investigation and LVIA study area. Those that do apply to Optino B are generally to the north, where the transmission line is to the south.
- Any alignment in Option B would be set back from nearby townships and settlements of Quambatook and Kerang or has the potential to be located away from these areas such that any impacts would not be greater than Low.
- Although an alignment in Option B would be in close proximity to the proposed Normavill Wind Farm, the close proximity brings with it the opportunity to reduce or manage cumulative visual impacts, achieved by either co-location of infrastructure, sharing of assets and easements and limiting fragmentation of farming landscaped through multiple transmission lines.

Although Option B presents as the least constrained Option for LVIA, it is acknowledged that the final alignment may vary when balanced against the impacts and considerations of all other assessments. Regardless, the considerations and recommendations to avoid, minimise and reduce the impacts of an overhead transmission line identified in this review will apply.