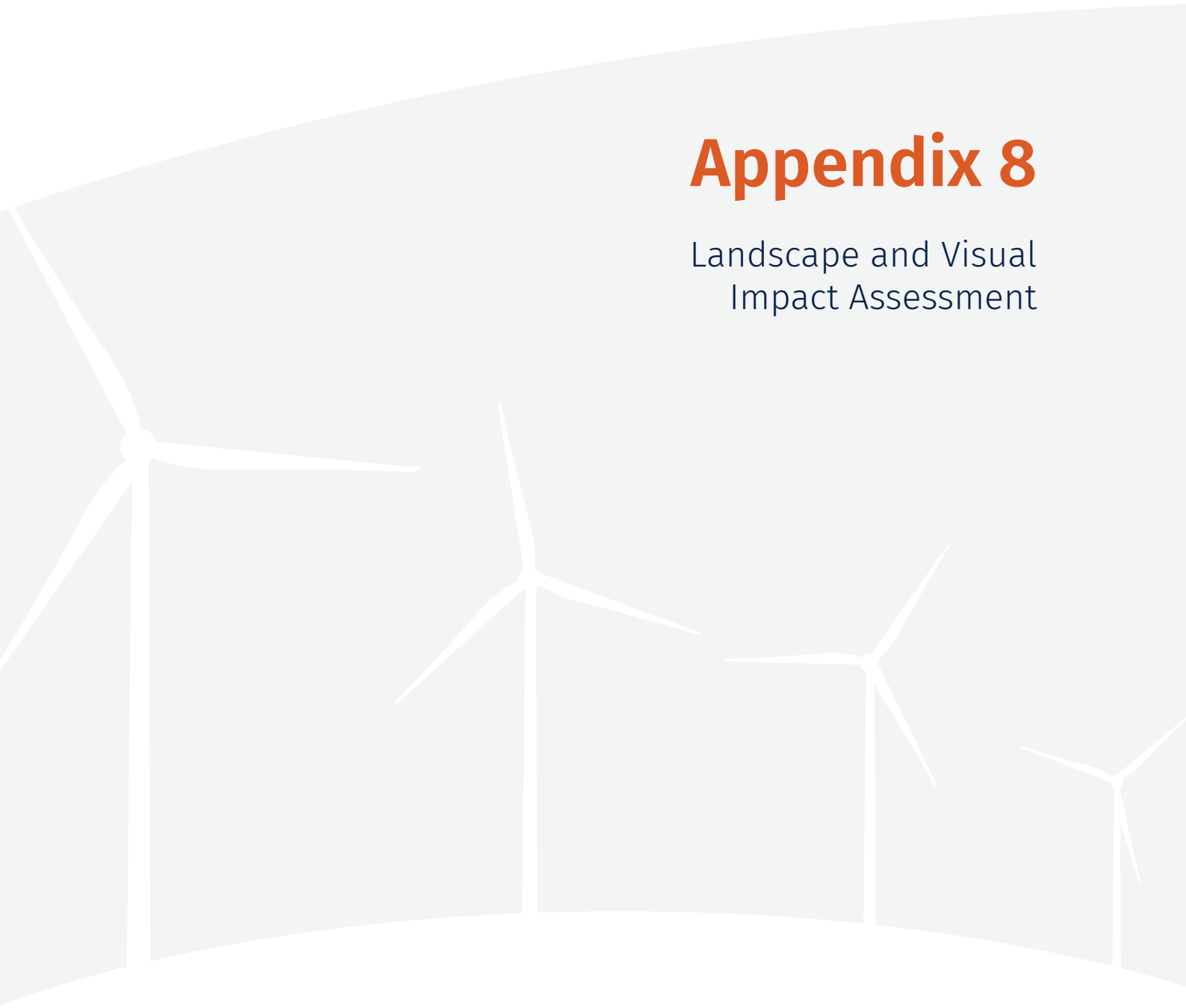
Appendix 8

Landscape and Visual Impact Assessment



Landscape and Visual Impact Assessment

Thunderbolt Energy Hub - Stage 1

moir landscape architecture

Prepared for: ***Umwelt (Australia) Pty Ltd***

Project No: ***2060*** Issue: ***REVISION G***

Date: ***24th February 2022***

DOCUMENT HISTORY AND STATUS

Project No: ***2060***

Project Name: ***Thunderbolt Energy Hub - Stage 1 Landscape and Visual Impact Assessment***

Issue	Status	Date of Issue	Author	Approved by
A	Draft for Review	09.12.2021	AR	DM
B	Final Draft LVIA for Review	20.12.2021	AR	DM
C	Final LVIA Report for Review	18.01.2022	AR	DM
D	Final LVIA Report for Review	24.01.2022	AR	DM
E	Final LVIA Report for Review	27.01.2022	AR	DM
F	Final LVIA Report for Adequacy	28.01.2022	AR	DM
G	Final LVIA - For Exhibition	24.02.2022	AR	DM

moir landscape architecture

Moir Landscape Architecture Pty Ltd,
Studio 1, 88 Fern Street, PO Box 111, Islington NSW 2296
Ph.(02) 4965 3500 Fax.(02) 4965 3555 admin@moirla.com.au
www.moirla.com.au ACN: 097 558 908 ABN: 48 097 558 908

Contents

Contents

Executive Summary

Moir Landscape Architecture (Moir LA) have been commissioned by Umwelt (Australia) Pty Ltd to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Thunderbolt Energy Hub Stage 1.

The proposed Thunderbolt Energy Hub is located in the Kentucky Area of New South Wales (NSW), approximately 47 kilometres (km) north east of Tamworth adjacent to the New England Highway. SEARs were issued by the Department of Planning, Industry and Environment (DPIE) in December 2020 for the construction, operation and decommissioning of a wind farm with an estimated capacity of 380 megawatts (MW), a maximum of 70 turbines and a maximum height of 250 metres. The Thunderbolt Energy Hub was proposed to include wind and solar electricity generation and battery storage. The Thunderbolt Energy Hub is now progressing in two stages.

This LVIA relates to Stage 1 of the Thunderbolt Energy Hub (the Project), which consists of the installation, operation, maintenance and decommissioning of up to 32 Wind Turbine Generators (WTGs), ancillary infrastructure and temporary facilities. During the development period, iterative project design has resulted in a slight increase to the maximum blade tip height to 260 m.

Stage 2 will form part of a separate future LVIA and approval process and (subject to further design) would include further renewable energy generation capacity (wind and solar) located to the south of the New England Highway.

In addition to the wind turbines, ancillary infrastructure including access tracks, road upgrades, underground and overhead electricity cabling, substation, switching station, operations and maintenance facility and grid connection to the existing 330 kV transmission line have been assessed in this LVIA.

Moir Landscape Architecture have utilised a quantitative study methodology with regards to the guidelines of the Wind Energy: Visual Assessment Bulletin (the Bulletin). Relevant literature and guidelines relating to large scale energy projects and Moir Landscape Architecture's previous experience on large scale infrastructure projects has also been considered in the Study Method.

The LVIA includes a comprehensive assessment of the existing landscape character, scenic quality and visibility of the Project. Visual influence zones have been established from viewpoints and sensitive receptors and assessed against visual performance objectives outlined in the Bulletin.

Extensive field work was undertaken by Moir Landscape Architecture to develop a visual baseline against which the Project has been assessed. The assessment determined the regional landscape character is typical of the New England Tablelands region characterised by agricultural land predominately utilised for grazing, with some areas of remnant vegetation. The landscape was categorised into five (5) Landscape Character Units (LCUs). A quantitative frame of reference was applied to establish the Scenic Quality Rating of these LCUs which ranged from a low to moderate. The Scenic Quality Ratings are utilised in defining Visual Influence Zones which are assessed against objectives outlined in the Bulletin.

The Bulletin states generally, the visual impact of a wind energy project will depend upon the characteristics and values of the existing landscape, the extent to which the existing landscape is changed by the Project and how these changes are perceived by individuals and the broader community. The assessment, in conjunction with community consultation identified the key landscape features and valued viewpoints within the Study Area.

Key factors which form a part of the existing landscape character would assist in reducing the potential for viewing the Project. These include large areas of vegetation, undulating topography, roadside vegetation and riparian vegetation associated with creek lines. The assessment found the Project could be undertaken whilst maintaining the key visual features of the landscape.

In accordance with the Bulletin, Moir LA applied the Preliminary Assessment Tools to the Project Layout to determine residences requiring detailed assessment. The assessment identified a total of 37 dwellings within 5,100 metres of the nearest turbine associated with the Project.

- 23 dwellings were identified within the black line of visual magnitude (3,450 m).
- 14 dwellings were identified between the black and blue line of visual magnitude (3,450 m - 5,100m).

Extensive assessments were undertaken to determine the level of visual impact for all 37 dwellings within 5,100 m. The visual impact ratings of all 37 dwellings within 5,100 m are presented in **Figure A**. During the Visual Assessment Process, Neoen undertook consultation with landowners within 5,100 m of the Project. Neoen utilised photomontages and proposed mitigation measures to aid discussions with landowners, resulting in agreements being reached with three (3) landowners (a total of ten (10) dwellings within 5,100 m). These dwellings are now referred to as Associated Dwellings throughout the report and where assessments were undertaken, these have been included in the report for transparency.

As a result of the agreements in place there are 27 Non-associated Dwellings within 5,100m. The visual impact rating was largely rated as nil, negligible or low (from 20 of the dwellings). Seven (7) Non-associated Dwellings were assessed as having the potential to have a moderate visual impact. Practical and feasible mitigation measures have been proposed for each of the dwellings that were rated as having a moderate visual impact. A breakdown on the anticipated visual impact ratings to dwellings within 5,100 m of the nearest turbine (with mitigation measures implemented) is presented in **Figure B**.

Executive Summary

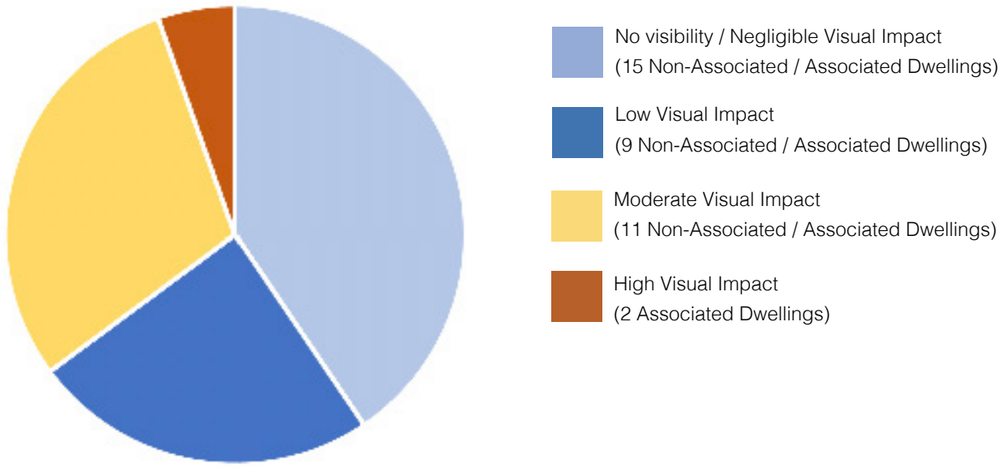


Figure A. Breakdown of Visual Impact Ratings for all dwellings within 5,100 m (without mitigation)

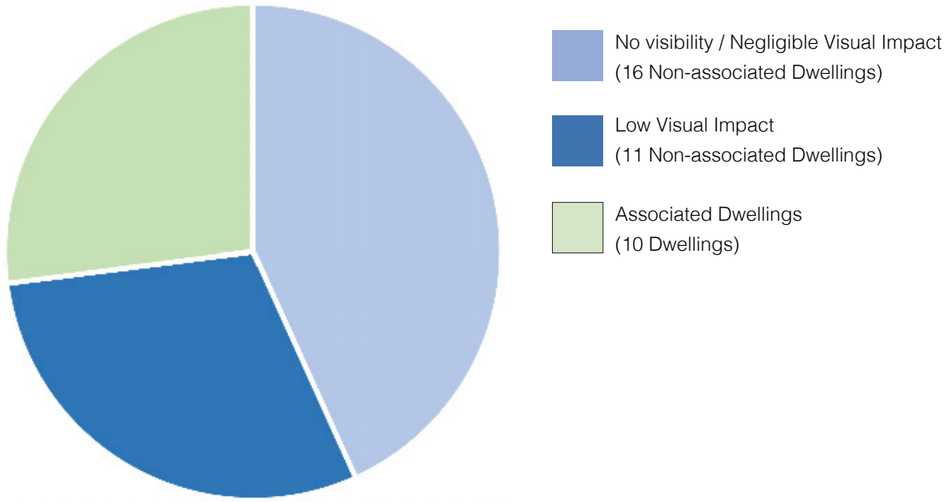


Figure B. Breakdown of anticipated Visual Impact Ratings (with mitigation measures implemented) for all dwellings within 5,100 m

The proposed mitigation methods recommended in the report will assist in significantly reducing the visual impacts resulting from the majority of these dwellings. Mitigation measures in keeping with the existing character include screen planting and supplementary planting of existing vegetation.

On evaluation, the Project is compliant with the performance objectives as per the Visual Assessment Bulletin.

1.0 Introduction

1.1 Introduction

Moir Landscape Architecture have been commissioned by Umwelt to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Thunderbolt Energy Hub - Stage 1.

The proposed Thunderbolt Energy Hub is located in the Kentucky Area of NSW, approximately 47 km north east of Tamworth and adjacent to the New England Highway. The Thunderbolt Energy Hub includes wind and solar electricity generation. The Thunderbolt Energy Hub is now progressing as two separate stages, with the Stage 1 Project Area (the subject of this assessment) forming approximately 5,918 hectares (ha) located to the north of the New England Highway. Stage 2 of the Thunderbolt Energy Hub will be subject to separate development approval processes.

The Thunderbolt Energy Hub – Stage 1 (the Project) will include approximately 32 turbines with a maximum tip height of 260 m and a capacity of approximately 192 megawatts (MW). The Project also includes the construction and operation of associated infrastructure including operation and maintenance buildings, roads, civil works and electrical infrastructure (including one new substation and one switching station) required to connect to the existing electricity transmission network.

The purpose of this report is to provide a comprehensive assessment of visibility and potential visual impacts associated with the Project on the landscape character, landscape values, landscape amenity and any scenic vistas. The report details the results of the field work, documents the assessment of the landscape character and visual setting, and makes recommendations to assist in the mitigation of any potential visual impacts resulting from the Project.

This LVIA has been prepared in accordance with the *Wind Energy: Visual Assessment Bulletin December 2016.* This LVIA forms a part of the Environmental Impact Statement (EIS) to be submitted to the New South Wales Department of Planning, Industry and Environment (NSW DPIE). This information will assist the community and NSW DPIE to understand and assess the likely visual impacts.

1.2 Relevant Experience

The Bulletin states *the proponent is expected to engage professionals from relevant natural resource management and design professions (for example environmental planners, geographers, landscape architects, architects, or other visual resource specialists), with demonstrated experience and capabilities in visual assessment to carry out a wind energy project visual assessment.*

Moir Landscape Architecture Pty Ltd is a professional design practice and consultancy specialising in the areas of Landscape Architecture, Landscape Planning and Landscape and Visual Impact. Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for large scale infrastructure projects, including the mining industry, sustainable energy sector and commercial / residential developments in visually sensitive areas. Our capabilities include digital terrain modelling, viewshed assessment, photo montage development, landscape character assessment and community consultation.

Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for wind energy projects. In the context of our experience and with guidance from the Visual Assessment Bulletin we have developed methodologies to ensure a comprehensive and qualitative assessment of the Project. Relevant experience includes the preparation of Landscape and Visual Impact Assessments for the following Wind Energy Projects:

- ***Uungula Wind Farm*** (Wellington, New South Wales)
- ***Crudine Ridge Wind Farm*** (New South Wales)
- ***Bodangora Wind Farm*** (Bodangora, New South Wales)
- ***Capital II Wind Farm*** (Bungendore, New South Wales)
- ***Cherry Tree Wind Farm*** (Seymour, Victoria)
- ***Lakeland Wind Farm*** (Lakeland, Queensland)
- ***Hills of Gold Wind Farm*** (Nundle, New South Wales)
- ***Barneys Reef Wind Farm PVIA*** (Barneys Reef, New South Wales)
- ***Burrawong Wind Farm*** (Balranald, New South Wales)
- ***Jeremiah Wind Farm PVIA*** (Adjungbilly, New South Wales)

2.0 Study Method

2.1 SEARs

The Project is classified as State Significant Development (SSD) and will be assessed and determined under the provisions of the Environmental Planning and Assessment Act 1979.

Secretary's Environmental Assessment Requirements (SEARs) issued in December 2020 for the Project state: *the EIS must include a detailed assessment of the visual impacts of all components of the project (including turbines, transmission lines, substations, and any other ancillary infrastructure and (if required) night lighting) in accordance with the NSW Wind Energy: Visual Assessment Bulletin (DPE, 2016), including detailed consideration of potential visual impacts on local residences.*

A brief overview of the requirements of the *Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development* is outlined in ***Section 2.2***.

2.2 Wind Energy: Visual Assessment Bulletin

The *Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development* (referred to hereafter as 'the Bulletin') was adopted by the Department of Planning and Environment in December 2016. The Bulletin has been developed to guide the appropriate location of wind energy development in NSW and to establish an assessment framework for the assessment of visual impacts associated with wind energy. Visual impacts are one of a range of issues considered in the assessment and determination of wind energy projects.

The objectives of the Bulletin are to:

- provide the community, industry and decision-makers with a framework for visual impact analysis and assessment that is focused on minimising and managing the most significant impacts;
- facilitate improved wind turbine and ancillary infrastructure siting and design during the pre-lodgement phase of a project, and encourage early consideration of visual impacts to minimise conflicts and delays where possible, and provide for a better planning outcome;
- provide the community and other stakeholders with greater clarity on the process along with an opportunity to integrate community landscape values into the assessment process; and
- provide greater consistency in assessment by outlining appropriate assessment terminology and methodologies.

The visual assessment process is broken into two main stages: Preliminary Environmental Assessment and EIS Phase. Stage 1: Preliminary LVIA was undertaken by Umwelt in November 2020 and the findings of the assessment undertaken have been included in this report.

2.3 Overview of the Study Method

In accordance with the Bulletin, the visual assessment includes:

- a baseline study that includes analysis of the landscape character, scenic quality and visibility from viewpoints of different sensitivity levels;
- establishing visual influences zones from viewpoints using data collected in the baseline study;
- assessment of the proposed layout against visual performance objectives; and
- justification for the final proposed layout and identification of mitigation and management measures.

Moir Landscape Architecture have formulated a quantitative study methodology with regards to the Visual Assessment Bulletin and with consideration of previous experience on large scale infrastructure projects and relevant literature and guidelines relating to large scale energy projects.

Detailed methodologies for each part of the assessment have been included in the relevant chapters of the report.

Extensive field work and photographic survey work for the study was undertaken in August and October 2021 from public and private property.

2.4 Report Structure

Table 1 provides an outline of the report structure, a brief overview of the objectives of the Bulletin and a summary of how these have been addressed in the LVIA.

2.0 Study Method

Landscape and Visual Impact Assessment Report Structure	
Section 3.0: Project Overview	***Visual Bulletin Requirements Addressed:***
• Detailed Project Description • Wind Turbine Design • Associated Infrastructure	• The VIA is to include a full description of the proposed wind energy project design, the layout, structural elements and scenarios being considered.
Section 4.0 Community Consultation	***Visual Bulletin Requirements Addressed:***
• Community Consultation Process • Community Landscape Values • Community Perception	• The proponent is to further consult with the community to verify the community consultation findings from the scoping and design stage.
Section 5.0 Visual Baseline Study	***Visual Bulletin Requirements Addressed:***
• Detailed assessment of Landscape Character and Key Features of the Region • Landscape Character Unit Classification • Application of Scenic Quality Class Ratings	• A visual baseline study must be undertaken to establish the existing landscape and visual conditions. The baseline study is prepared and evaluated by the proponent prior to undertaking any visual analysis. • Describe, assess and map these factors in written and graphic forms supported by photographic representations of the area. • Identify Scenic Quality Classes
Section 6.0 Preliminary Assessment Tools	***Visual Bulletin Requirements Addressed:***

Define the Visual Catchment of the Project:
• Preliminary Assessment Tools:
  • Visual Magnitude
  • Multiple Wind Turbine Effect
	• Visual Magnitude Assessment: Mapping the dwellings, key viewpoints and proposed turbines at scale to establish the potential visual magnitude.
	• Map into six sectors of 60° any proposed turbines and any existing or approved turbines within each dwelling or key public viewpoint.

Section 7.0 Zone of Visual Influence	***Visual Bulletin Requirements Addressed:***
• Zone of Visual Influence	• Establish the theoretical 'zone of visual influence' of the proposal (the area from which the proposal is theoretically visible or the 'visual catchment').
Section 8.0 Viewpoint Analysis	***Visual Bulletin Requirements Addressed:***
Assessment of viewpoints from areas identified within the visual catchment. ***Refer to Appendix B - Viewpoint Analysis***	• All key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed. • The visual performance objectives form the principle framework and guide for assessing the proposed wind energy project when applied to individual viewpoints.
Section 9.0 Photomontage & WIre Frame Diagrams	***Visual Bulletin Requirements Addressed:***
• Photomontage selection process • Photomontage development process ***Refer to Appendix C - Photomontages***	• Photomontages shall be prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms. • The visual assessment needs to include a concise description of the complete methodology used to create any photomontages presented in the visual assessment.

Landscape and Visual Impact Assessment Report Structure (continued)	
Section 10.0 Dwelling Assessment Overview	***Visual Bulletin Requirements Addressed:***
• Summary of impact on Dwellings ***Refer to Appendix D - Dwelling Assessment***	• All key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed.
Section 11.0 Cumulative Visual Impacts	***Visual Bulletin Requirements Addressed:***
• Cumulative Visual Impacts	• address potential cumulative impacts of wind energy projects in the region (the wind energy project as well as existing and approved projects).
Section 12.0 Associated Infrastructure	***Visual Bulletin Requirements Addressed:***
• Overview of impact resulting from Associated infrastructure	• the assessment of visual impacts from all ancillary facilities and infrastructure will be required.
Section 13.0 Night Lighting	***Visual Bulletin Requirements Addressed:***
• Night Lighting Assessment	• Consider whether any obstacle lighting required is likely to result in any significant increase in visual impacts.
Section 14.0 Visual Impact on Landscape Character	***Visual Bulletin Requirements Addressed:***
• Overview of LCUs with regards to Visual Performance Objectives • Summary of impact on Landscape Character • Summary of impact of associated infrastructure	• Assess the Project using visual performance objectives.
Section 15.0 Mitigation Methods	***Visual Bulletin Requirements Addressed:***
• Wind Farm Design • Mitigation Methods for Residences • Associated Infrastructure • Lighting	• An outline of any mitigation and management options proposed, including consultation with affected property owners regarding the proposed mitigation works
Section 16.0 Visual Performance Evaluation	***Visual Bulletin Requirements Addressed:***
• Evaluation of Visual Performance Objectives	• An assessment of the proposed wind energy project against each visual performance objective and demonstration of whether each objective is achieved and how the standard has been achieved.
Section 17.0 Conclusion	

Table 1: Landscape and Visual Impact Assessment Report Structure

2.0 Study Method

2.5 Additional Literature

In addition to the Bulletin, the following literature has assisted in the formulation of the study methodology and where relevant have been referenced in the report:

- *Scottish Natural Heritage, Visual Representation of Wind Farms - Good Practice Guidance (February, 2017)*
- *Environment Protection and Heritage Council, Draft National Wind Farm Development Guidelines (July 2010)*
- *Landscape Institute and Institute of Environmental Management & Assessment, Guidelines for Landscape and Visual Impact Assessment Third edition (2013)*
- *Clean Energy Council, Best Practice Guidelines for Wind Energy Development (June, 2018)*

2.6 Policy Considerations

2.6.1 Local Government Policies

The proposal is considered a State Significant Development and will be assessed as such by the NSW DPIE, however relevant local government policies have also been considered. The Project spans across two Local Government Areas (LGAs) including the Uralla Shire Council and Tamworth Regional Council. Walcha Shire Council LGA is located to the South East of the Project.

2.6.2 Civil Aviation Safety Authority

The LVIA includes an assessment of potential visual impact associated with night lighting in accordance with the Civil Aviation Safety Authority (CASA). Refer to ***Section 13.0*** of this LVIA.

3.0 Project Overview

3.1 The Project Area

The Project Area is located in the Kentucky Area of NSW, approximately 47 km north east of Tamworth and adjacent to the New England Highway. The Project Area is located within the New England Renewable Energy Zone (REZ) identified in the NSW Government's Electricity Strategy (NSW Government, 2020). The REZ is expected to play a vital role in delivering affordable energy to the community across NSW (NSW Energy, 2019). The Project is therefore strategically located in an area identified as suitable for renewable energy projects.

The Kentucky region has been identified as having high wind energy resource potential. Wind monitoring undertaken on site by Neoen has guided the development of the conceptual wind turbine generator (WTG) layout for the Project.

Figure 1 and Figure 2 present the Project Area Locality. The following provides an overview of all aspects of the Project to be considered in this LVIA.

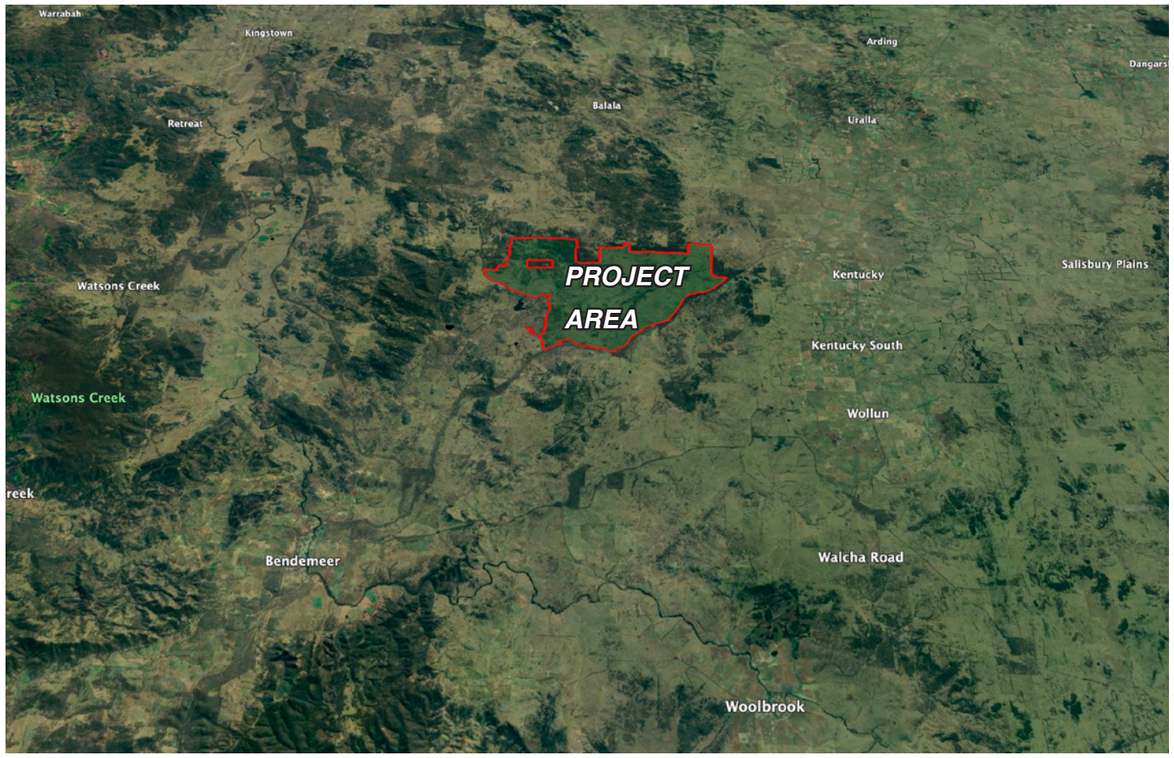


***Figure 1:** Birds Eye View of Project Area (Map Source: Google Earth)*

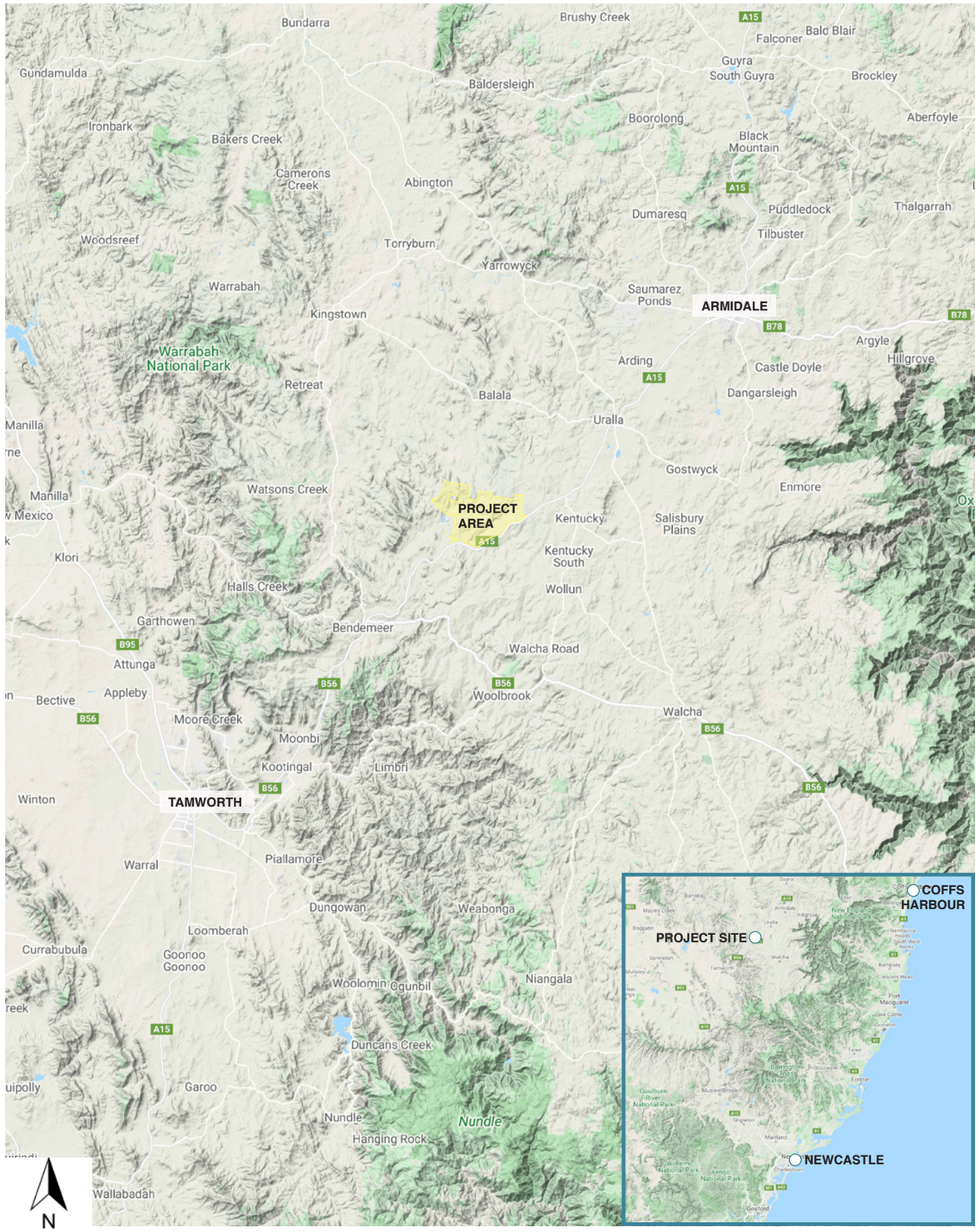


***Figure 2:** Project Area Locality (Map Source: Google Maps)*

3.0 Project Overview

3.2 The Project

The Project includes up to 32 wind turbine generator (WTG) locations with a combined maximum installed capacity of approximately 192 megawatts (MW).

The Project also includes:

- An internal electrical reticulation network (both overhead and underground);
- One on-site substation and one on-site switching station;
- New and upgraded access roads;
- Temporary construction facilities (including concrete batching plants and a construction compound); and
- Operation and maintenance buildings.

The Conceptual Project Layout is presented as ***Figure 4***.

3.3 Wind Turbine Design

The WTG model selected for the proposal will have the following parameters:

- maximum blade tip height of 260 metres.
- a capacity of 5 - 8 MW
- a three-bladed rotor and nacelle mounted onto a tubular steel tower and concrete foundation
- a crane hardstand and laydown area for assembly of the WTG
- a WTG transformer located either in the nacelle or inside the base of the WTG

Table 2 provide an overview of dimensions of the WTG components that have been used for this assessment. ***Figure 3*** shows the dimensions of the WTG and all visual elements referred to in this report. To best represent a worst case scenario, the maximum hub height of 170 metres and tip height of 260 metres has been used for modelling and visualisation purposes in this report.

An image of a typical wind turbine has been provided as ***Image 4***.

Wind Turbine Components		
Project Component	***Dimensions used in LVIA:***	***Quantity***
Maximum Blade Tip	260 metres AGL	32
Maximum Tower (hub) height	170 metres	
Maximum Blade length	90 metres	

Table 2: ***Wind Turbine Dimensions for Visual Assessment***

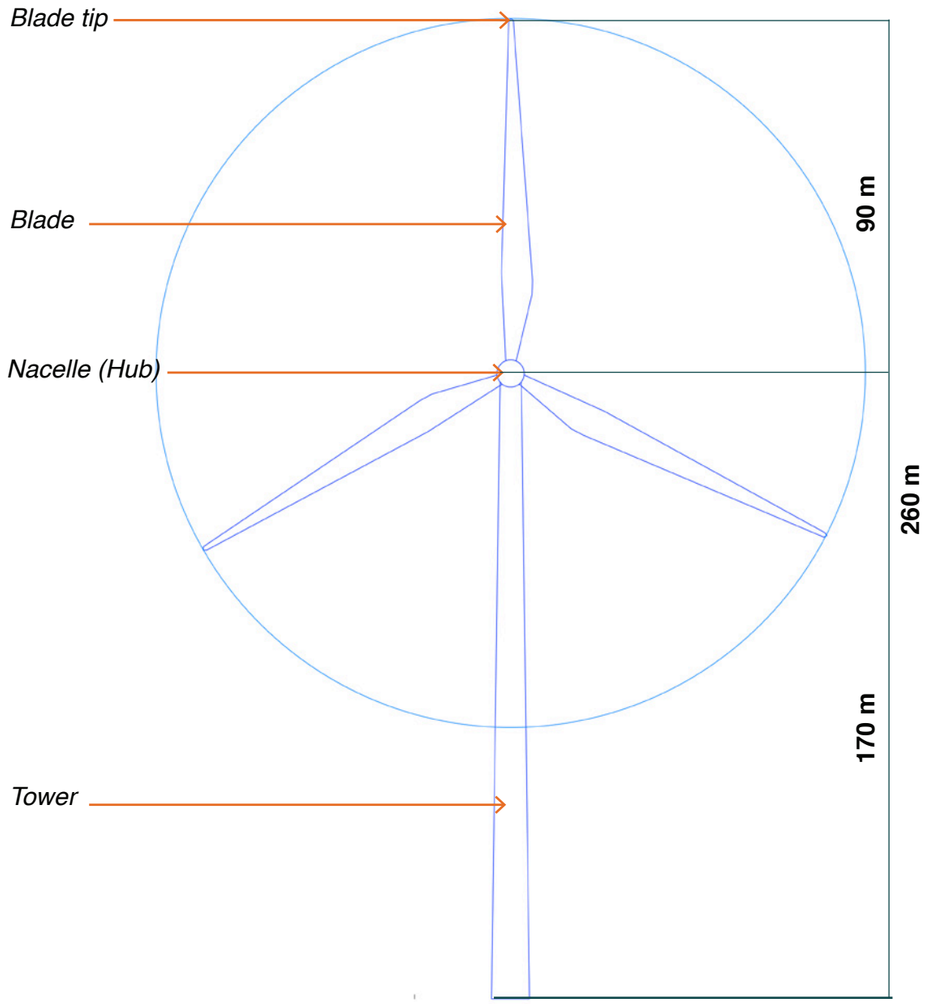
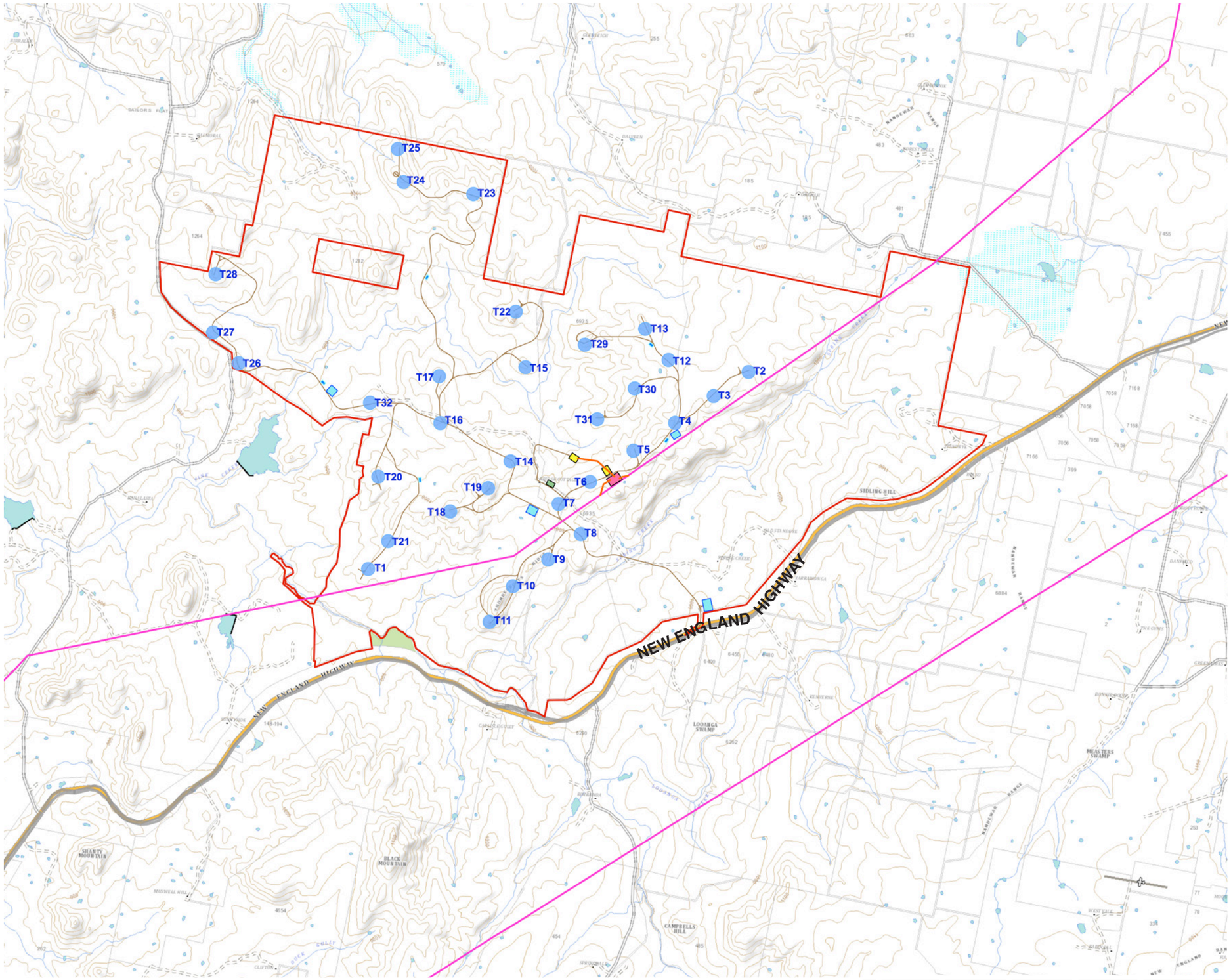


Figure 3: ***Turbine Dimensions used for Visual Assessment***

3.0 Project Overview



Project Layout
Thunderbolt Energy Hub (Stage 1)

LEGEND:

- Project Area Boundary
- Proposed WTG Location
- Internal Access Roads
- 330 kV Overhead Transmission Line
- O & M Facility
- Substation Location Options (One will be selected)
- Switching Station
- Laydown Area (Temporary)
- Batching Plant (Temporary)

Figure 4: Project Layout (Map Source: Six Maps)

3.0 Project Overview

3.4 Associated Infrastructure

In addition to the WTGs, the following provides an overview of the permanent associated infrastructure components proposed for the Project which may contribute to the visual impact. An overview of the assessment of the potential visual impacts resulting from the associated infrastructure has been provided in ***Section 12*** of this report.

Premanent Associated Infrastructure	
Project Component	***Description***
Operations and Maintenance Facility	One (1) Operations and Maintenance Facility (O&M Facility) will be required. It is anticipated the building will include storage shed, an office and parking. ***See Image 1.***
Electrical Infrastructure	Combination of underground and overhead electrical cabling to connect to the existing 330kV transmission lines. ***See Image 3.***
Switching Station	One (1) Switching station approximately 2.6 hectares. ***See Image 2.***
Substations	One (1) substation - two potential locations have been proposed for the Project. ***See Image 1.***
Meteorological Monitoring Masts	One (1) meteorological mast is currently installed. Up to six (6) masts to be installed during operations in proximity to turbines.
Internal Access Roads	Internal access roads are required for construction and access during operations. The proposed access tracks ranging between 6 - 9 metres.
Road Upgrades	Access to the Project is via an existing intersection on New England Highway.
Mobile Concrete Batch Plant	Approximately 2 hectares per batching plant. Three (3) possible locations.
Construction Compound and Laydown Areas	One (1) Main Compound approximately 2.4 hectares in size. Three (3) Satellite Compounds approximately 0.3 hectares in size.

Table 3: Associated Infrastructure

3.0 Project Overview

Image 1 ***Typical Substation and O&M Facility (Source: Neoen)***

Image 2 ***Typical Switching Station (Source: Neoen)***

Image 3 ***Existing Transmission Line (Source: Umwelt)***

Image 4 ***Typical Wind Turbine Design (Gullen Range Wind Farm)***

4.0 Community Consultation

4.1 Community Consultation Process

Community consultation was undertaken in the early stages of the Project to establish landscape values, key landscape features, important viewpoints and the community's perception of the Project. It is important to note that whilst taken into consideration when undertaking the Visual Baseline Study, the landscape values of the community are considered to be subjective.

The Proponent consulted with the community on the preliminary project boundary to gather feedback and an understanding of the key landscape features, areas of scenic quality and key public viewpoints. The community feedback has been reflected in the Visual Baseline Study that informs this LVIA.

The Bulletin suggests community members rate the scenic quality of the landscape character as low, medium or high. However, in the context of a proposed development this is a complex process and it is likely that the results would be highly subjective. It is best practice to utilise an objective frame of reference (***refer to Scenic Quality Rating - Section 5.5***) which can be applied by professionals. This process can be undertaken whilst also taking into account (but not being driven by) values identified by the community.

4.2 Community Perception

Understanding of the community perception towards the Project is an important element of the LVIA.

A CSIRO study published in 2012: *Exploring community acceptance of rural wind farms in Australia* provides a snapshot of community acceptance levels regarding Australian wind farms from a variety of stakeholder perspectives. It found levels of acceptance among the public are highly subjective and can differ depending on location, local context and place attachment.

4.3 Community Landscape Values

Landscape values are highly subjective and can differ depending on location, local context and place attachment.

Ongoing consultation and discussions with the community aimed to gain an understanding of the values associated with the landscape. The results of these discussions indicated that some members of the community have concerns over the potential change to the character of the existing visual landscape, however there are also members of the community that are not concerned about visual impacts.

For many community members, when asked about what they valued about the community, the rural character and visual amenity of the area surfaced as a key discussion point.

For some community members, the Project represented a substantial change to the character of the area and subsequently the values that people hold. Changes to the rural landscape and visual amenity impacts were raised as a key concern during consultation. Participants raised concerns that the presence of the turbines would change the views in the areas which were highly valued by the community.

- *Worried about our own view – Landholder (Neoen Meeting)*
- *Visual pollution in our regions, that will be put in a fairly high-density area, as there are lots of lifestyle blocks (of 100 acres or so) – Landholder (Umwelt interview)*
- *Visual and effect on natural ecosystems – Online Survey Response*
- *Visual amenity impacts are a concern for small holdings in particular – Online Survey Response*
- *Not concerned about solar. Only concerned about visual impact with wind turbines (only aesthetic) – Landholder (Neoen meeting)*
- *Are the turbines white? Can you paint them green to make them blend in? – Special Interest Group*

4.0 Community Consultation

Participants noted concern relating to shadow flicker from the WTGs and blades and aviation lighting from the WTGs at night. During the CCC meeting questions were raised about whether there would be lights on top of the turbines and if they would flash.

- *Flickering of sunlight or the red lights at night – see we don't know what it will be like – FOKAG Representative*
- *Light flickering from blades as this will be to the west of Kentucky village – Online Survey Response*

Shadow Flicker has been addessed in the Shadow Flicker Report undertaken by DNV Energy Systems and Night lighting has been address in ***Section 13.0*** of this report.

Some participants likened the visual impact of the turbines as industrialising the landscape, with some stating that solar would have less of a visual impact.

> *Probably solar is better as its less intrusive, and less impacts on the amenity of the region. The size and number of the towers is an industrial impact on the area - FOKAG Representative*

Other landholders however noted that they were not concerned about the visual impacts. When asked about concerns relating to visual impacts, one landholder noted 'no, [I] like the look of them [the turbines]' (Neoen meeting).

- *Not worried about visual – Landholder (Neoen meeting)*
- *No. Lots of hills and valleys, so not all in a big line – Landholder (Neoen meeting)*
- *Not worried at all – Landholder (Neoen meeting)*
- *No - there is a ridge behind us (other direction to project) – Landholder (Neoen meeting)*
- *Not worried about visual impact - Landholder (Neoen meeting)*

It is important to note, feedback provided by the community is generally related to the entire Thunderbolt Energy Hub Project. Discussions with landowners during Moir Landscape Architecture's site inspections were largely related to the potential visual impacts of Stage 2. Many land owners along New England Highway were concerned with the potential visual impacts of Stage 2, and had no concerned about the visual impacts resulting from Stage 1. Neoen have responded to these concerns by staging the Project to ensure more detailed assessment and consultation will be undertaken for Stage 2 as it is of greater concern to the community.

Many community members were concerned about the cumulative visual impacts on the region due to the Renewable Energy Zone (REZ). The cumulative visual impacts has been assessed in ***Section 11.0*** of this report.

4.4 Scenic Qualities and Key Viewpoints

Respondents were asked to assign a level of visual significance to local landscape features and areas. The results of which have assisted in the scenic quality rating of Landscape Character Units in the Visual Baseline Assessment (refer to ***Section 5.0***). The results have been included as ***Figure 8***.

Additionally, the community was asked to identify important public viewpoints and areas of public visibility for further assessment. Where specific locations have been identified, these have been mapped within the Visual Baseline Study (***Section 5.0***). Moir LA have undertaken viewpoint analysis from public locations identified by the community (refer to ***Section 8.0*** and ***Appendix C***). Refer to ***Table 4*** for responses.

5.0 Visual Baseline Study

5.1 Visual Baseline Study

In accordance with the Bulletin: *A visual baseline study must be undertaken to establish the existing landscape and visual conditions. This forms the basis of determining the level of impacts of a proposed wind energy project. The baseline study is prepared and evaluated by the proponent prior to undertaking any visual analysis.*

A Preliminary Visual Impact Assessment was undertaken by Umwelt as part of Stage 1: Preliminary Environmental Assessment (pre-lodgement). In accordance with the Bulletin a preliminary landscape baseline study was prepared. Moir LA have developed upon the study undertaken in Phase 1 to provide a detailed baseline study.

The baseline study should consider the following inputs in the 'visual catchment' for the project:

- *elements of the landscape important to the community, including public and private viewpoints;*
- *the sensitivity of the viewers who use those viewpoints, and the distances at which they may view the landscape and potential wind turbines and other ancillary facilities;*
- *the character of the landscape associated, its key features and the relative scenic quality of the area; and*
- *the location of any existing operational or approved wind energy projects within both a regional and local context, including any nearby surrounding wind energy projects within eight kilometres which may have the potential to create direct or indirect visual impacts between the proposed and any other operational, approved or proposed wind energy projects.*

The purpose of the Visual Baseline Study is to establish the existing landscape and visual conditions through descriptions, mapping and photographic representations. The study method for undertaking the Visual Baseline Study has been established in accordance with ***Appendix A of the Bulletin*** where relevant and in conjunction with previous experience on large scale wind energy projects.

Table 4 provides an overview of the methodology used to establish a quantitative approach to defining and assessing the landscape character.

Visual Baseline Study Inputs:	
Sensitive Land Use Designations	
• *Map Layer identifying National and State Sensitive Land use Designations and LEP Zones.*	***Refer to Section 5.2 and 5.3***
Landscape Character Type	
• *Describe the broad area of land in which the wind energy project is located.*	***Refer to Section 5.4***
Key Landscape Features	
• *Identify areas of visual interest or quality that stand out visually in the landscape.*	***Refer to Section 5.5***
Landscape Character Unit Classification	
• *Landscape is categorised into Landscape Character Units (LCU) and Scenic Quality Ratings are applied to each LCU.*	***Refer to Section 5.6 and Appendix B***
Viewpoint Inventory and Sensitivity Levels	
• *Undertake a viewpoint inventory from public and private locations and establish the Visual Influence Zones for each.*	***Refer to Section 8.0***
Visibility Distance Zones	
• *Undertake visibility or view shed mapping when assessing what may be visible from a given viewpoint looking in all directions.*	***Refer to Section 7.0***

Table 4: ***Visual Baseline Study Inputs***

5.0 Visual Baseline Study

5.2 Bioregion Context

The Project Area is located within the New England Tableland Bioregion. The New England Tableland Bioregion lies between the North Coast and Nandewar bioregions in northeast NSW, extending north just into Queensland. This bioregion is one of the smaller bioregions in NSW, occupying 3.57% of the state. In NSW, the bioregional boundary extends from north of Tenterfield to south of Walcha and includes towns such as Armidale and Guyra.

The bioregion is characterised by a stepped plateau of hills with undulating basalt hills and plains with elevations between 600 -1500m. Vegetation is diverse with a high degree of endemism which includes open forests and woodlands of Manna Gum, Snow Gum and Black Sallee. The bioregion has unique geological, geomorphological and vegetation elements which are characterized by well-developed pseudokarst landscapes (NPWS, 2003). ***Images 5 & 6*** illustrate the typical character of the landscape within the Study Area, which is consistent with the character of the NSW New England Tableland Bioregion.

Image 5 *Typical character of New England tablelands: gentle rolling hills with open Eucalypt woodlands*

Image 6 *Views of vegetated rolling hills and cleared pastoral areas along New England Highway*

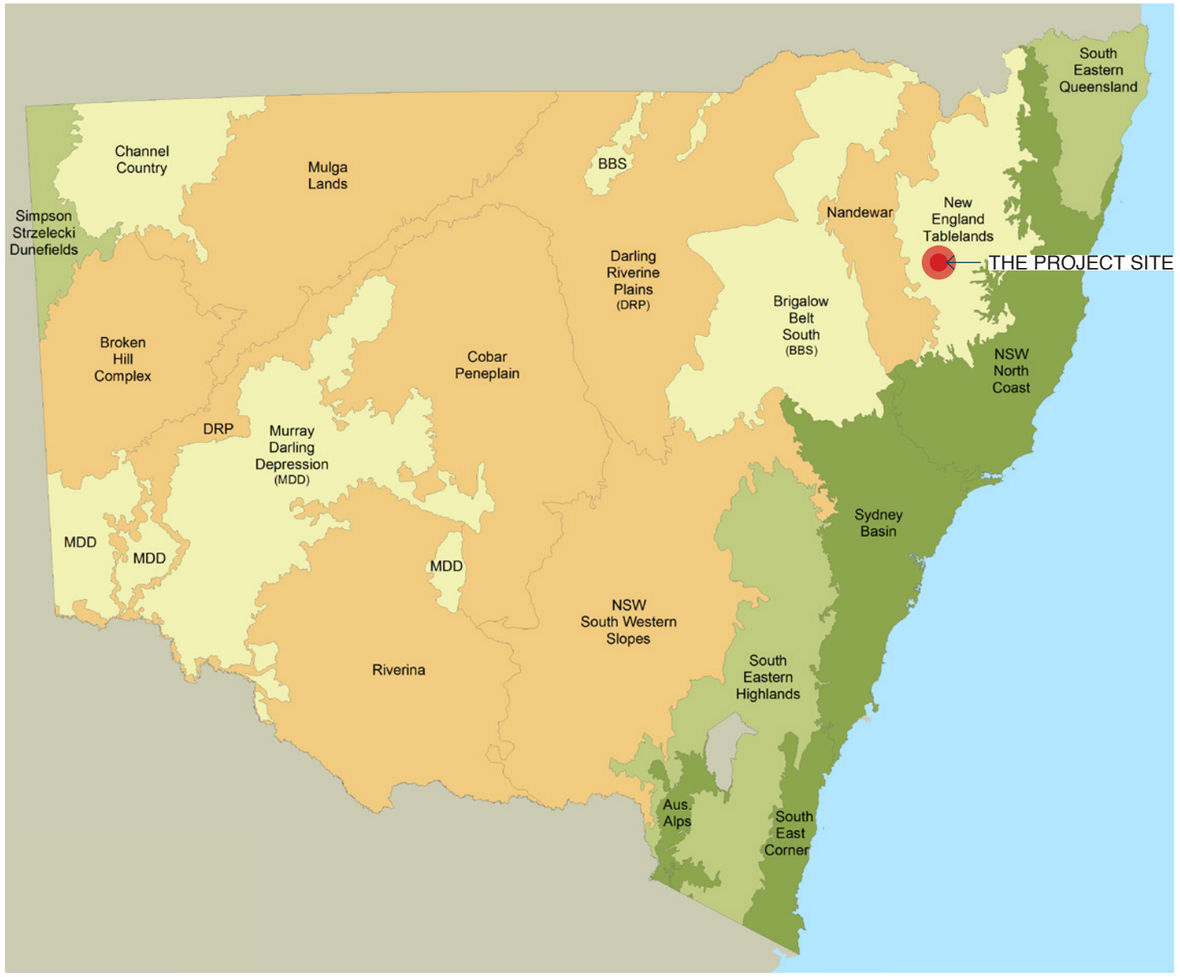


Figure 5 ***Bioregions of New South Wales (Source: NSW Department of Planning, Industry and Environment, 2012)***

5.3 Sensitive Land Use Designations

The Project Area is located predominately within the Tamworth Regional Local Government Area (LGA), with the northern portion within the Uralla LGA. The Walcha LGA is located to the south east of the Project Area. The following provides an overview of land zoning within the Project Area and its immediate surrounds as shown in ***Figure 6***.

5.3.1 RU1: Primary Production Zoning

A large portion of the land within and surrounding the Project Area is zoned *RU1 - Primary Production*. An objective of the RU1 zoning within the Tamworth Regional LEP is to '*permit development for purposes where it can be demonstrated that suitable land or premises are not available elsewhere.*'

5.3.2 RU2: Rural Landscape Zoning

Land within the extents of the Uralla Shire LEP is zoned *RU2 - Rural Landscape* zone located along the northern boundary of the Project Area. The LEP zone objectives are to encourage sustainable primary production, maintain rural character and provide a range of compatible land uses including extensive agriculture.

5.3.3 RU4: Primary Production Small Lots

Large portions of land located around the village of Benedemeer are zoned *RU4 - Primary Production Small Lots*. Objectives of the Tamworth Regional LEP state that the objectives of this zone are to enable sustainable primary production, promote employment opportunities related to primary industry enterprises and minimise conflict between land uses of this zone and its surrounding areas.

5.3.4 E1: National Parks and Nature Reserves

Watsons Creek National Park which is categorised as *E1- National Parks and Nature Reserves* is located approximately 12 kilometres west of the Project Area. The Watsons Creek National Park is categorised as Zone 1 Community Conservation Area under the NPW Act to protect its natural and cultural values. It is situated on the Moonbi Ranges and has significant associations with Watsons Creek and Oaky Creek.

The National Park comprises of a long, narrow reserve that surrounds Watsons Creek and protects associated riparian habitats that are located amidst grazing lands (NSW Office of Environment & Heritage, 2014). According to the Management Statement of Intent, the National Park's natural and cultural values are as follows:

• The National Park protects unique riparian and wetland communities that are located in an area dominated by grazing land.

• The area is an important area of native remnant vegetation and represents vegetation characteristics of the north-western slopes of New England Tablelands. Predominant vegetation includes dry sclerophyll forest and woodland communities.

5.3.5 Other land zoning designations

Other land parcels located around the Project Area are predominantly categorized as low density or rural residential lots that spread across the settlements of Uralla and Bendemeer. All these lots are generally subjected to the requirements of the Tamworth Regional LEP and Uralla Shire LEP.

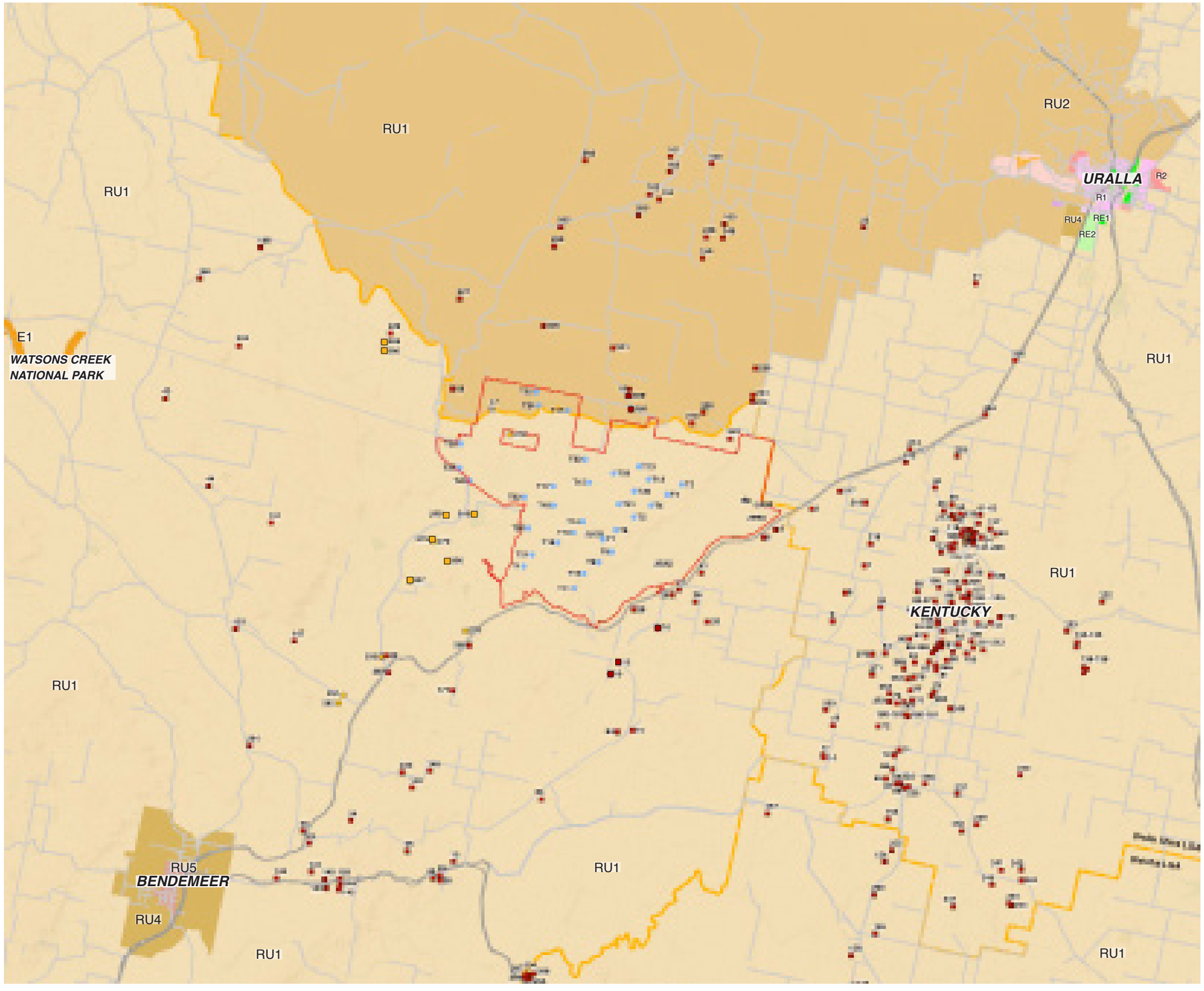
5.4 Land Use

Land Use within and surrounding the Project Area is primarily dedicated to agriculture and primary production as highlighted in the previous section. Large extents of land within the Project Area have been cleared for grazing with remnant vegetation. The next most prominent land use is grazing over modified pastures to support agriculture and livestock (see ***Figure 7***). Other land parcels are commonly used for dryland cropping and these are dispersed near the settlements of Kentucky, Uralla and Bendemeer.

Traces of nature conservation and minimal use areas lie to the west-southwest of the Project Area. These comprise of some of the peaks identified within the Moonbi Ranges and the New England Tablelands. Certain parcels of land located southwest of the Project Area are dedicated to plantation forestry. Several gullies and creeks also drain the region which further adds to the fertility of soils prevalent in the area.

Significant towns and settlements identified in the region are Kentucky, Bendemeer and Uralla, with smaller localities including Kentucky South, Wollun, Walcha Road and Woolbrook. Major highways and roads that connect these towns include the New England Highway and Oxley Highway.

5.0 Visual Baseline Study



Land Zoning

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- T25 — Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Road
- LGA Boundary

LAND ZONING:

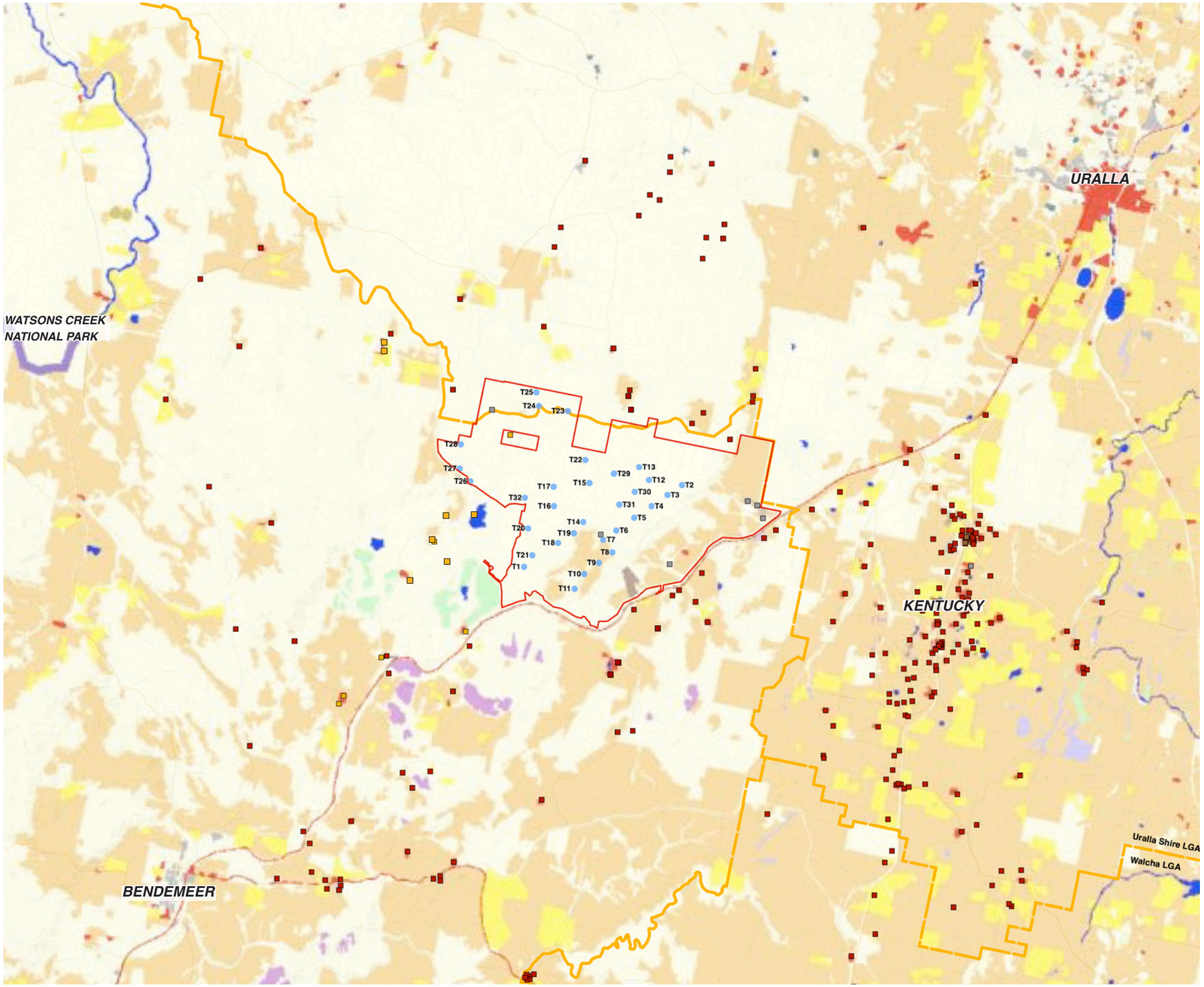
- E1 - National Parks & Nature Reserves
- RU1 - Primary Production
- RU2 - Rural Landscape
- RU4 - Primary Production Small Lots
- RU5 - Village
- R1 - General Residential
- R2 - Low Density Residential
- RE1 - Public Recreation
- RE2 - Private Recreation

N

0 2 4 6 8 10km

Figure 6: Land Zoning (Sources: NPWS 2003, Environment NSW 2016; Map Source: SIX Maps)

5.0 Visual Baseline Study



Land Use

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- T25 Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Road
- LGA Boundary

LAND USE:

- Dryland Cropping
- Grazing, native vegetation
- Grazing, modified pastures
- Irrigated horticulture
- Minimal use
- Nature conservation
- Plantation forestry
- Rural residential & farm infrastructure
- Water
- Urban and intensive uses

N

0 2 4 6 8 10km

Figure 7: Land Use (Map Source: Environment NSW 2021)

5.0 Visual Baseline Study

5.5 Existing Landscape Character

Generally one of the first steps in carrying out a Landscape and Visual Impact Assessment is to identify and map the landscape character of the Project Area and its surrounding area (the Study Area). The following section of the LVIA describes the typical landscape character of the Study Area.

5.5.1 Nearby Towns and Villages

The Project is located within the Tamworth Regional LGA. Towns in closest proximity to the Project Area are Uralla, Bendemeer and Kentucky. Tamworth is located approximately 47 km southwest and Walcha is approximately 60 km to the southeast of the Project Area.

Uralla:

Uralla is one of largest settlements located about 25 km northeast of the Project Area. The district was originally inhabited by the Anaiwan Aboriginals but the settlement was established soon after gold was discovered at Rocky River in 1851. About 2,743 people live in Uralla as per the 2016 Census (ABS, 2016). The town is located at the intersection of New England Highway and Thunderbolts Way and serves as an important stopover / resting spot for motorists travelling towards Armidale (refer to ***Image 7***). The town is surrounded by rich, fertile soils of the New England region.

Bendemeer:

Bendemeer is a small village with a population of 492 people (ABS, 2016). Prior to European settlement the area was occupied by the Kamilaroi Aboriginal people. The village was established in 1853 and it is located on the New England Highway between Tamworth and Uralla. Currently the settlement is recognised for its low density residential living in a rural setting and is situated upon the Macdonald River (refer to ***Image 8***).

Kentucky:

The smallest settlement in closest proximity to the Project Area is Kentucky which (including Kentucky South) has a population of 283 people as per the 2016 Census (ABS, 2016). The settlement was established just off the New England Highway as a residence for soldiers. Prevalence of fruit orchards and alpaca, sheep and cattle farms are a result of the rich, fertile soils that has led to the dominance of agricultural activity. The town is located 15 km south west of Uralla (refer to ***Image 9***).

Image 7 *Uralla's town centre*

Image 8 *The settlement of Bendemeer located at the foothills of the Moonbi Ranges along New England Highway*

Image 9 *Character of Kentucky - rural setting with low density residences with the train line running next to Noamlimba Avenue*

5.0 Visual Baseline Study

Wollun, Woolbrook and Walcha Road township:

The small towns are interspersed along Wollun Road and Oxley Highway and are located south of Kentucky. All these settlements engage in agricultural activity and are settled in areas with fertile soils with large, cleared lots to support cattle and sheep farming. Of these, Woolbrook is the largest town with a population of 185 people, followed by Wollun which has 67 residents and Walcha Road township with about 20 people (ABS, 2016). The settlements of Wollun, Walcha Road and Kentucky were established specifically along the Armidale train line to carry large volume goods such as wool, livestock and other agricultural items. The train line is no longer used for these purposes.

5.5.2 Accessibility

New England Highway is the most significant major road that runs along the southeast boundary of the Project Area. It connects Uralla, Armidale, Bendemeer, Tamworth and many other towns in the region. Oxley Highway is another important road that runs east-west from Bendemeer to Walcha. Thunderbolts Way is another important road which, although not directly related to the Project, plays an important role in the overall infrastructure and road connectivity. These roads play a very important role in linking all settlements in the region. They convey high volumes of traffic all year round.

Low-use roads that arise from these major roads provide access to dwellings via Green Valley Road, Glenburnie Road, Top Congi Road, Rimbanda Road, Old Wollun Road among others. Most of these roads are unsealed.

5.5.3 Landform

The Project Area is situated east of the Moonbi Range and the Great Diving Range on the Permian granites of the Yarrowyck-Kentucky Downs IBRA Sub-region. Ridgelines generally run diagonally from northeast to southwest. The landform is characterized by undulating to hilly slopes that range from 750 -1100 m in elevation (NPWS, 2003). The land is studded with rocky outcrops and hills/peaks. Lower undulations and rolling hills have been modified to imbibe agricultural associations.

Yarrowyck-Kentucky subregion is characterized by mellow textured contrast soils on drained slopes and harsh texture contrast soils on lower slopes with coarse sandy topsoils that are prone to erosion located over levelled lands (NPWS, 2003).

5.5.4 Vegetation

Consistent with the New England Bioregion's characteristics, native vegetation within and around the Project Area is dominated by fairly healthy Blakely's red gum woodlands and River oaks in riparian areas. Many areas have been cleared or slashed to encourage grazing. Other prominent tree species include New England Peppermint, Rough-barked Apple, New England Stringybark and Yellow Box (NPWS, 2003). Rocky hills are generally dominated with tumbledown gums and black cypress pines.

5.5.5 Water Form - Rivers and Creeks

The Macdonald River runs generally west-southwest of the Project Area. It is a perennial river and is part of the Namoi catchment. It rises from the foothills of the Moonbi Range and flows through the towns of Bendemeer and Woolbrook. Recreational associations with the river are established at these towns. The width of the river also varies and it presents opportunities for flooding in areas where it distributes into creeks and streams.

Landscapes in proximity of all these water channels are extensively used to rear livestock and other agricultural activities. A number of dams also provide irrigation for crops and livestock. The region is well-drained with creeks, rivulets, streams and rivers that don't carry very large volumes of water. They, therefore, culminate in large dams on private properties to support agricultural land uses. Notable water channels include Kentucky Creek, Carlisles Gully, Looanga Creek & Swamp, Pine Creek and Spring Creek. Some low-lying depressions within and around the Project Area act as ephemeral water bodies in marshy, reedy landscapes.

A part of the New England North West Region Strategic Regional Land Use Plan 2012 mentions that biodiversity offsets will be maintained from infrastructure projects in order to prioritise conservation of landscapes of high value. The presence of these corridors is noted in the existing visual character of the landscape.

5.0 Visual Baseline Study

5.6 Key Landscape Features

The Bulletin states: *Key landscape features should be identified and shown on the baseline study map for further reference. Key landscape features may include natural features such as a distinctive mountain peak or hill top, a large rock outcrop or cliff, a waterfall, a visually distinctive stand of trees, or even a single large tree that stands out visually in the scene.*

The following provides an overview of the key features identified within the Study Area and its surrounds which contribute to the visual character of the landscape (refer to ***Figure 8***).

5.6.1 High points within the landscape

The New England Tableland landscape is characterised by a generally undulating topography with prime production land contrasted against the ridgelines associated with the Great Dividing Range, Thunderbolts Ridge, Flaggy Range, Nandewar Range and Moonbi Range. A number of peaks such as Mount Lookout, Sliding Hill, Foxs Knob, Mount Gemini, Shanty Mountain and Black Mountain are located in close proximity of the Project. However, there is no formal recreational association with these peaks. The Flaggy Range and Nandewar Range are closest to the Project Area (approximately 7 kilometres west and 5 kilometres south east respectively).

5.6.2 Walking tracks and points of interest

As mentioned before, rocky outcrops and hillocks dominate the region. Thunderbolt's Rock is one such cluster of granite boulders that are located on New England Highway just outside of Uralla. It was originally known as Split Rock and served as an important vantage point. It is a Registered Heritage Site of State significance and is a part of the Captain Thunderbolt Sites located in the Uralla region. Captain Thunderbolt's Rock stands out with large rocky outcrops in an otherwise planar landscape (NSW Office of Environment & Heritage, 2014). The site is also used as a rest stop for travellers.

Other famous points of interest include the Wooldridge Recreation and Forssicking Area and Mount Mutton walking trails which are located in the town on Uralla. Woolbrook and Bendemeer offer rest spots along the Macdonald River, although these are in excess of 15 kilometres from the Project Area.

5.6.3 Watsons Creek National Park

This Nature Reserve is located approximately 17km west of the Project Area. The Watsons Creek National Park is situated on the Moonbi Ranges and has significant associations with Watsons Creek and Oaky Creek. The National Park comprises of a long, narrow reserve that surrounds Watsons Creek and protects associated riparian habitats that are located amidst grazing lands (NSW Office of Environment & Heritage, 2014). It protects dry sclerophyll forests and woodlands of Blakely's red gum and red stringybark predominant in New England Bioregion's riparian habitats and also includes a range of native orchids.

5.6.4 Other conservation areas and vegetation patches

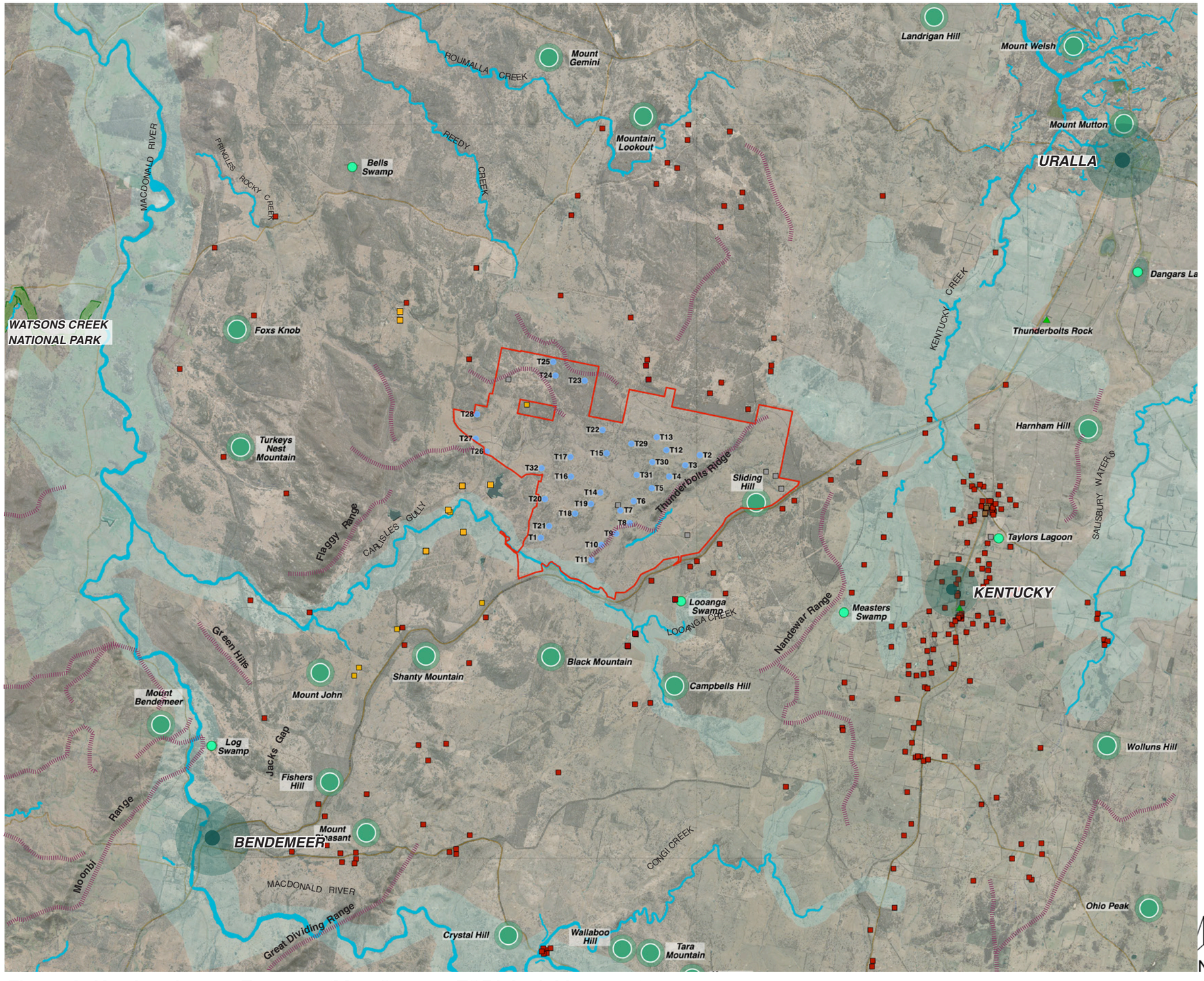
Lana Wildlife Refuge is located approximately 10 km north of the Project Area. The property is managed privately and comprises open to partly cleared woodlands of Blakely's red gum, yellow box, rough-barked apple, mountain gum and open stringybark forests in a landscape characterized by undulating flats and occasional granite hills/outcrops (Reid, 2006).

Image 10 *Thunderbolts Rock, New England Highway*

Image 11 *Intersection of Carlisles Gully & Looanga Creek*

Image 12 *View of the Moonbi Ranges near Rocky Gully Road on New England Highway*

5.0 Visual Baseline Study



Key Landscape Features

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- T25 Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Main Road
- Minor Road
- National Park
- Indicative ridgelines
- Highpoints / peaks
- Swamps / lagoons
- Rivers & creeks
- Parks / rest areas
- Towns and settlements

Figure 8: Key Landscape Features (Map Source: ESRI Aerial Imagery)

5.0 Visual Baseline Study

5.7 Scenic Quality Class Rating

The Bulletin states: *the baseline study inputs, including key landscape features and sensitive land use designations, should lead to the identification of Scenic Quality Classes. Scenic quality refers to the relative scenic or aesthetic value of the landscape based on the relative presence or absence of key landscape features known to be associated with community perceptions of high, moderate or low scenic quality. It is both a subjective and complex process undertaken by experts in visual impact assessment, taking into account community values identified in early community consultation.*

In accordance with the Bulletin, a Scenic Quality 'frame of reference' has been formulated by Moir LA (***Table 5***) utilising *An approach to landscape sensitivity assessment* by Natural England. The frame of reference developed for the Thunderbolt Energy Hub is in keeping with the example frame of reference provided in the Bulletin.

Each category of the 'frame of reference' has been quantified for each Landscape Character Unit (summarised in ***Section 5.6*** and overviews provided in ***Appendix B***) to determine a Scenic Quality Rating of **low**, **moderate** or **high.** The resulting *Scenic Quality Rating* is used to assist in defining the Visual Influence Zones in accordance with the Bulletin (refer to matrix in ***Appendix A***).

SCENIC QUALITY RATING		
Description	**LOW** ← **MODERATE** → **HIGH**	
Landform	- Flat Topography - Absence of Landscape Features - Open, broad extents of spaces	- Diversity in Topographical Range - Unique Landscape Features - Intimate spaces
Waterforms	- Absence of Water	- Presence of Water - Visually prominent lakes, reservoirs, rivers streams and swamps.
Vegetation	- Absence of vegetation - Lack of diversity - Land cleared of endemic vegetation - Low level of connection between vegetation and landscape / topography	- Abundant vegetation - High diversity - High retention of endemic vegetation. - High level of connectivity between natural landscape and landforms.
Human Influence	- High population. - High density in settlement - High presence of Infrastructure - High levels of landscape modification	- Low / dispersed population - No settlement - Absence of infrastructure - Landscape in natural state
Activity	- High levels of traffic movement - Presence of freight and passenger transport networks - Presence of production or industry.	- Low traffic movement - Absence of freight and passenger transport - Absence of production or industry
Rarity	- Typical landscape within a local and regional context	- Unique combination of landscape features in a local and regional context
Relationship with Adjoining Landscapes	- Low visible connection with adjoining landscapes - Low variability between adjoining landscapes. - Landscape features do not contribute to amenity from adjoining landscapes	- High visibility with adjoining landscapes. - High variability and contrast with adjoining landscapes - Landscape features contribute significantly to amenity of adjoining landscapes

Table 5 ***Scenic Quality Class Rating Frame of Reference***

5.0 Visual Baseline Study

5.8 Landscape Character Unit Classification

Due to the large scale of the Study Area and varying landscape character the Study Area has been categorised into five (5) *Landscape Character Units* to assist in the assessment.

The Landscape Character Units (LCU) are classified by slight variations in the landscapes geology, topography, land use and vegetation which create distinct character areas within the Study Area. The LCUs have been informed by land use patterns, vegetation coverage, topographical maps, site images and site inspection.

The general extent of the LCUs are shown on ***Figure 9*** on the following page and detailed description of each Landscape Character Unit has been included in ***Appendix A*** of this report.

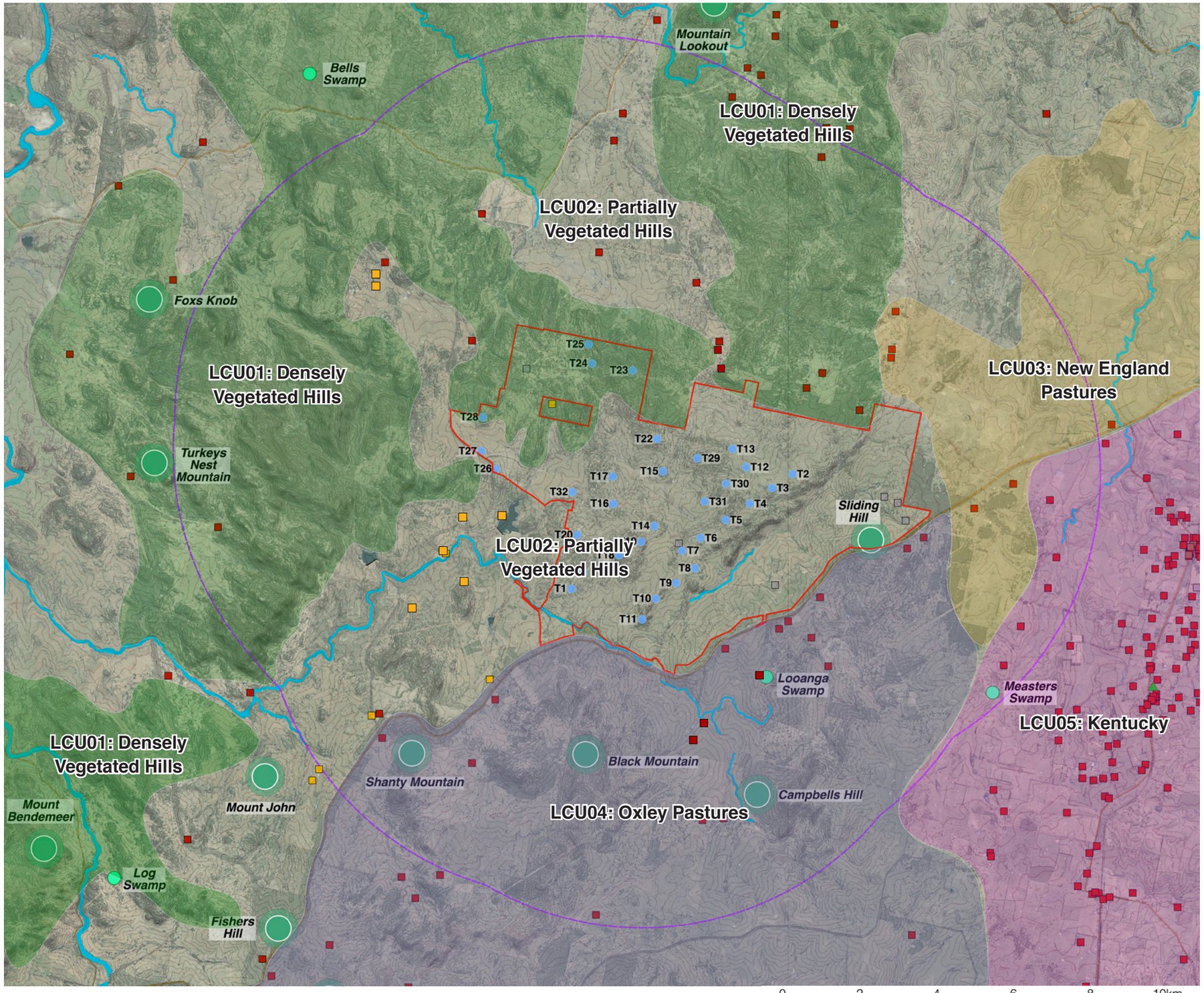
The Scenic Quality 'frame of reference' has been applied to each LCU (refer to ***Appendix A*** and ***Table 6***).

Overview of Landscape Character Units

LCU:	Overview:	Scenic Quality Rating:
LCU01: Densely Vegetated Hills	The LCU is characterised by undulating hills and ridges with dense vegetation that is represents the New England Tableland character. The LCU has limited accessibility.	**Moderate** *Refer to Appendix A1*
LCU02: Partially Vegetated Hills	The majority of the Project is located within the Partially Vegetated Hills LCU. The LCU is characterised by gentle to rolling undulations that have been partially cleared to support grazing.	**Moderate** *Refer to Appendix A2*
LCU04: New England Pastures	The LCU is generally defined as the gently rolling to flat topography to the north of Kentucky. Lands have been extensively cleared to support agricultural activity - predominantly grazing.	**Low** *Refer to Appendix A3*
LCU04: Oxley Pastures	This LCU defines the land to the south of the New England Highway running down to the Oxley Highway. The LCU consists of undulating farmlands that have been extensively cleared to support grazing and cropping.	**Moderate** *Refer to Appendix A4*
LCU5: Kentucky	Comprises of rural settlements Kentucky and its surrounds. The settlement is generally characterised by rural residential land running along Kentucky Road.	**Low** *Refer to Appendix A4*

Table 6. ***Overview of Landscape Character Units***

5.0 Visual Baseline Study



Landscape Character Units

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Main Road
- Minor Road
- 8000 m from turbines

Landscape Character Units:

- LCU01: Densely Vegetated Hills
- LCU02: Partially Vegetated Hills
- LCU03: New England Pastures
- LCU04: Oxley Pastures
- LCU05: Kentucky

Figure 9: Landscape Character Units (Map Source: SIX Maps)

6.0 Preliminary Assessment Tools

6.1 Overview of Preliminary Assessment Tools

To assist in defining the visual catchment, preliminary assessment tools have been developed in the Bulletin. In accordance with the Bulletin, the purpose of the preliminary assessment tools are: *to provide an early indication of where turbines require careful consideration because of potential visual impacts. The tools apply to both dwellings and key public viewpoints in the study area. The tools provide an early indication of where placement of turbines will require further assessment and justification, and where consultation with potentially affected landowners needs to be focused – including discussions for landholder agreements.*

The preliminary assessment tools involve analysis of two key visual parameters:

1. Visual Magnitude (***Refer to Section 6.2***)
2. Multiple Wind Turbine Tool (***Refer to Section 6.4***)

Once defined, the Bulletin states: *Further assessment and justification for placement of turbines located in these sensitive areas in the EIS will be required, along with a description of mitigation and management measures being employed to reduce impacts. This assessment may identify that factors such as topography, relative distance and existing vegetation may minimise or eliminate the impacts of the project.*

Dwellings identified through the application of the Preliminary Assessment tools have been assessed in detail in ***Appendix D*** of this LVIA.

6.2 Preliminary Assessment Tool 1: Visual Magnitude

The Visual Magnitude Threshold is based on the height of the proposed wind turbines to the tip of the blade and distance from dwellings or key public viewpoints as shown in ***Figure 10.***

In accordance with the Bulletin: ***proposed turbines below the black line must be identified along with the dwellings or key public viewpoints as part of the request for SEARs.*** The proposed wind turbines are based on a maximum blade tip height of ***260 metres***. The 'black line 'intersects at a distance of ***3,450 metres*** and the 'blue line' intersects at ***5,100 metres***.

For the purpose of the Preliminary Assessment, the Visual Magnitude thresholds are based on a 2D assessment of the Project alone. Further assessment indicates factors such as topography, relative distance and existing vegetation may minimise or eliminate the impacts of the project from residences.

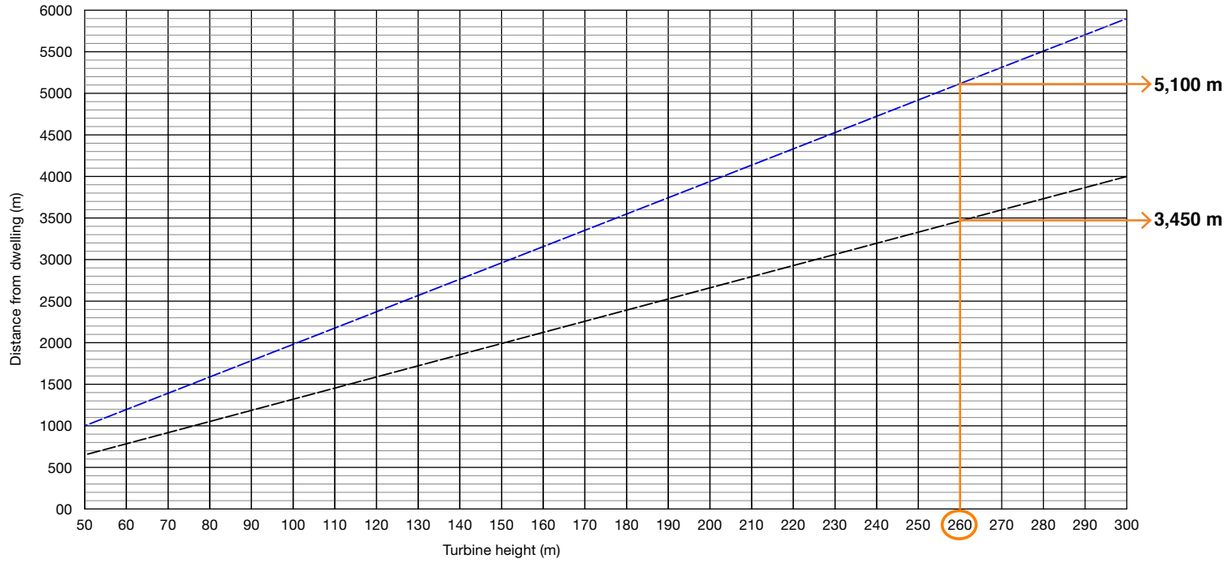
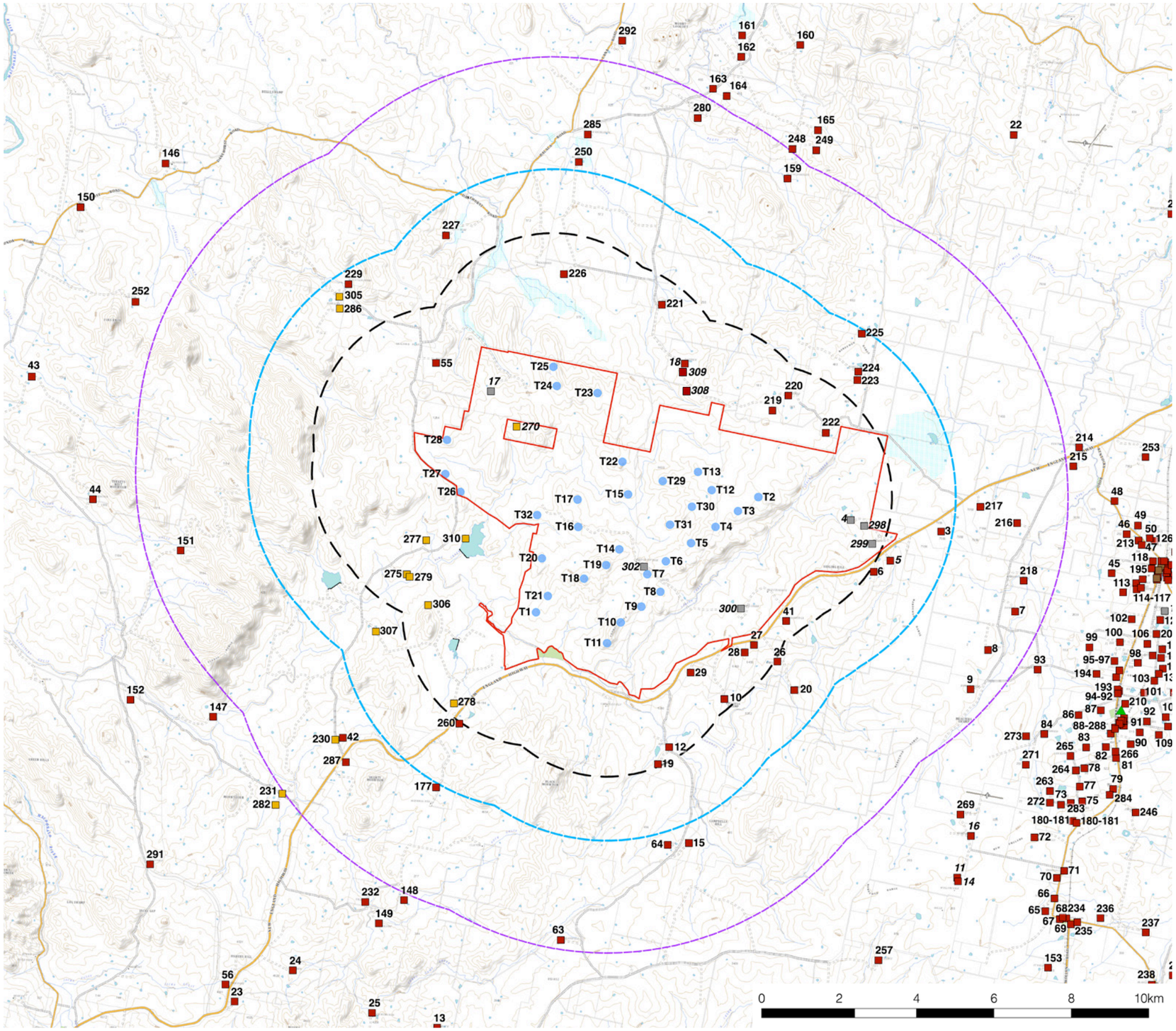


***Figure 10* Visual Magnitude thresholds for Project Layout @ 260m (Source: Visual Assessment Bulletin)**



Visual Magnitude

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Boundary
- Proposed 260m Turbine Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- 3,450 m from turbine (Black Line of Visual Magnitude)
- 5,100 m from turbine (Blue Line of Visual Magnitude)
- 8,000 m from turbine

Note:

Preliminary Assessment Tool 1: Visual Magnitude is based on a 2D Assessment alone and does not take into account topography, vegetation or other screening factors which may reduce the potential for viewing turbines.

For detailed assessment of Non-associated Dwellings identified refer to ***Appendix D.***

Figure 11 ***Preliminary Assessment Tool 1: Visual Magnitude - Thunderbolt Wind Farm Stage One (Map Source: Six Maps)***

6.0 Preliminary Assessment Tools

6.3 Results of Preliminary Assessment Tool 1: Visual Magnitude

Application of the Preliminary Assessment Tools to the Project identified dwellings which require further assessment in accordance with the Bulletin. Non-associated dwellings identified within 3,450 metres and between 3,450 - 5,100 metres of the nearest proposed turbine are shown on ***Figure 11*** and outlined in ***Section 10.0*** of the LVIA***.***

Non-associated Dwellings within the Black Line of Visual Magnitude (3,450 m):

- 16 non-associated dwellings have been identified within 3,450 metres of a proposed wind turbine location (within the black line of visual magnitude).
- Seven (7) dwellings within the black line of visual magnitude have entered into negotiated agreements with Neoen and are classified as 'Associated Dwellings'.

Non-associated Dwellings within the Blue Line of Visual Magnitude (Between 3,450 - 5,100 m):

- 11 non-associated dwellings are located within 3,450 - 5,100 metres of a proposed wind turbine (between the black and the blue line of visual magnitude).
- Three (3) dwellings located between the black and blue line of visual magnitude have entered into negotiated agreements with Neoen and are classified as 'Associated Dwellings'.

Assessments of all non-associated dwellings within the blue line of visual magnitude have been provided in ***Appendix D*** and summarised in ***Tables 10 - 13 (Section 10.0)***.

6.4 Preliminary Assessment Tool 2: Multiple Wind Turbine Tool

The Multiple Wind Turbine Tool provides a preliminary indication of potential cumulative impacts arising from the proposed wind energy project. To establish whether the degree to which dwellings or key public viewpoints may be impacted by multiple wind turbines, the proponent must map into six sectors of 60° any proposed WTGs, and any existing or approved WTGs within eight (8) kilometres of each dwelling or key public viewpoint. ***Figure 12*** below provides examples of where a dwelling or key public viewpoint may have views to turbines in multiple 60° sectors.

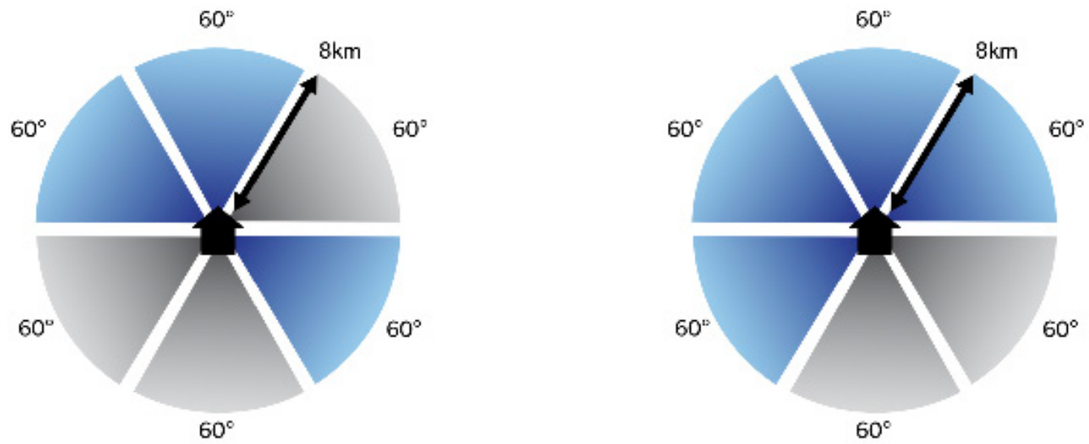
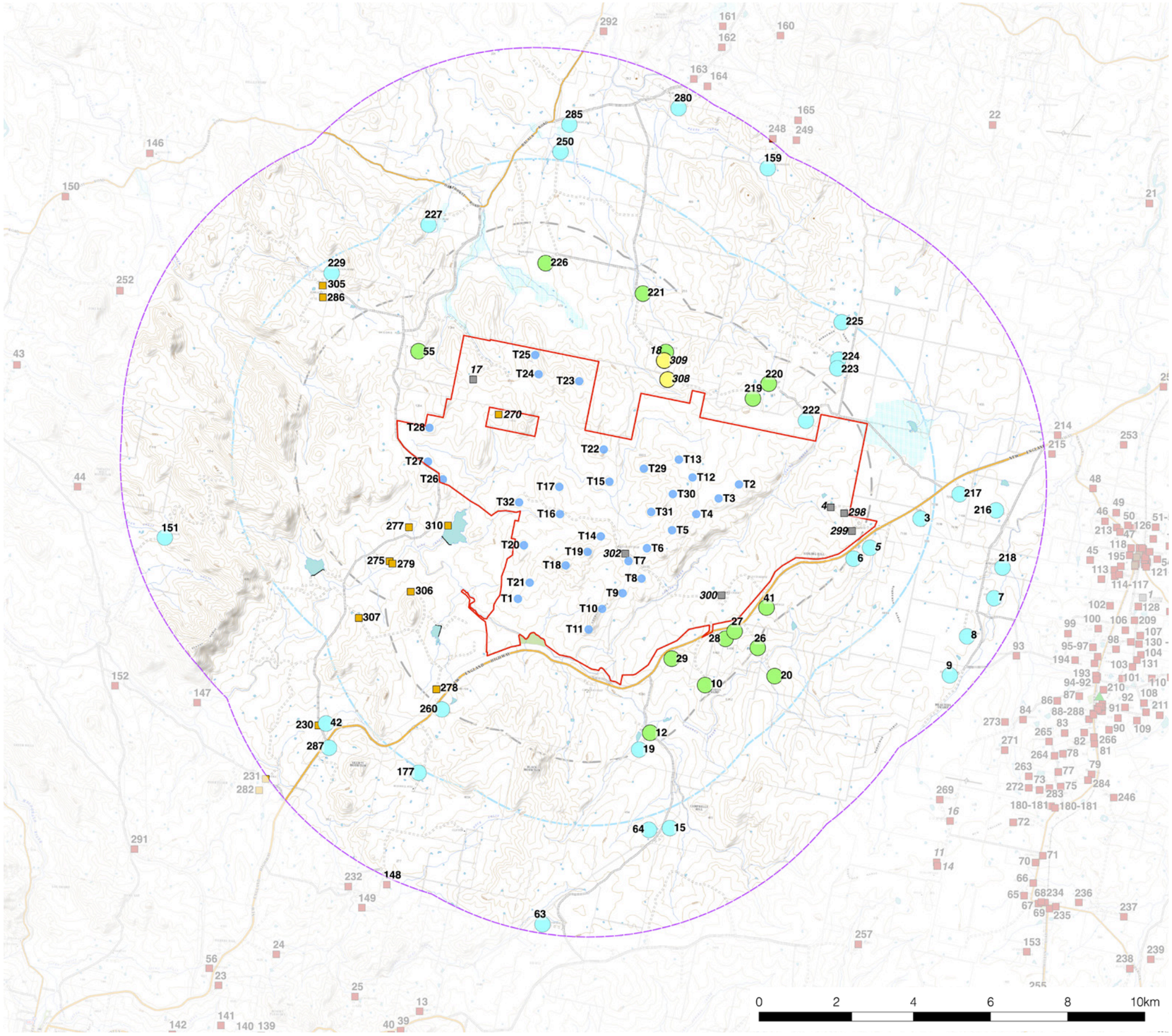


Figure 12 ***Preliminary Assessment Tool: Multiple Wind Turbines***

(Source: Visual Assessment Bulletin)

In accordance with the Bulletin *Where wind turbines are visible within the horizontal views of the dwelling or key public viewpoints in three or more 60° sectors, the proponents must identify the turbines, relative dwelling and key public viewpoint, along with the relative distance and submit these to the Department as part of the request for SEARs.* These turbines will become a focus for assessment in the EIS.

Figure 13 provides an overview of the number of 60° sectors visible from each of the dwellings identified within 8 kilometres.



Multiple Wind Turbine Tool

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- Proposed 260m Turbine Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- 3,450 m from turbine (Black Line of Visual Magnitude)
- 5,100 m from turbine (Blue Line of Visual Magnitude)
- 8,000 m from turbine

Multiple Wind Turbine Tool Results:

- One 60° Sector (60°)
- Up to two (2) 60° Sectors (120°)
- Up to three (3) 60° Sectors (180°)

Note:

Preliminary Assessment Tool 2: Multiple Wind Turbine Tool is based on a 2D Assessment alone and does not take into account topography, vegetation or other screening factors which may reduce the potential for viewing multiple turbines.

For detailed assessment of Non-associated Dwellings identified refer to ***Appendix D.***

Figure 13 ***Preliminary Assessment Tool 2: Multiple Wind Turbine Tool applied to the Project Layout (Map Source: Six Maps)***

6.0 Preliminary Assessment Tools

6.5 Results of Preliminary Assessment Tool 2: Multiple Wind Turbine Tool

When applied to the Project, the 2D Multiple Wind Turbine Tool (see ***Figure 13***) identified:

- 28 non-associated dwellings have turbines located within up to one (1) 60 degree sector.
- 16 non-associated dwellings have turbines located in up to two (2) 60 degree sectors.
- Two (2) non-associated dwellings have turbines located in up to three (3) 60 degree sectors (Dwelling 308 and 309). Detailed assessment of these dwellings identified topography reduces the potential to view turbines and turbines are likely to be visible in up to one (1) 60 degree sector for Dwelling 308 and two (2) 60 degree sectors for Dwelling 309 which is deemed acceptable.

7.0 Zone of Visual Influence

7.1 Overview of Zone of Visual Influence

The Bulletin states *'the use of Geographic Information Systems (GIS) to facilitate the application of the tools will streamline the evaluation phase of a project during the pre-lodgement stage. This can also assist in refining the number of turbines and viewpoints that will ultimately need more detailed assessment.'*

The Zone of Visual Influence (ZVI) (also known as a Zone of Theoretical Visibility Model) represents the area over which a development can theoretically be seen, and is based on a Digital Terrain Model (DTM). The ZVI usually presents a bare ground scenario - ie. A landscape without screening, structures or vegetation, and is usually presented on a base map (Scottish Natural Heritage, 2017)

The ZVI has been determined through the use of digital topographic information and 3D modelling software *WindPro*. The ZVI has been assessed to approximately 20 km from the Project Area. Although it is possible for the development to be visible from further than 20 km away, it is generally accepted that beyond this distance visibility is diminished.

Two (2) ZVI Diagrams have been prepared for the Project to illustrate the theoretical visibility of the Project one from blade tip height (260m) and one from hub height (170 m).

- ***Figure 14*** depicts the areas of land from which the proposed development may theoretically be visible and provides an indicative number of wind turbines based on the blade tip height of 260 metres.
- ***Figure 15*** illustrates the areas of land from which the proposed development may be theoretically visible at a hub height of 170m.

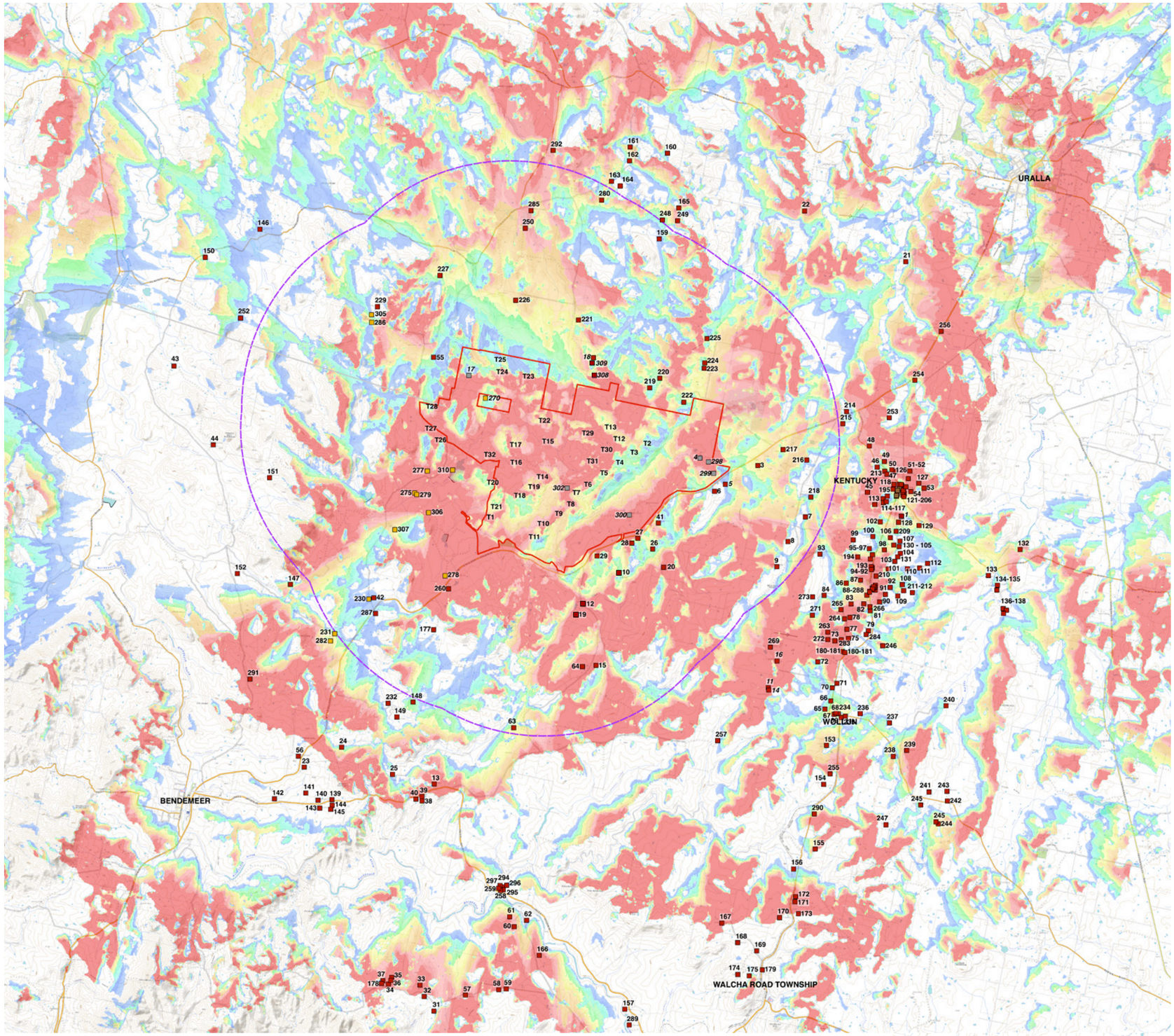
7.2 Summary of Zone of Visual Influence Analysis

The results of the Zone of Visual Influence are as follows:

- Due to the undulating topography that characterises the landscape, the ZVI illustrates there are limited opportunities to view the project in its entirety. Areas that have been identified as having potential to view the Project in its entirety are generally isolated, and it is likely intervening vegetation would reduce the potential to view all of the turbines.
- The ZVI indicates high visibility from New England Highway, however further assessment and field work dense vegetation to the north of the Highway will screen views to the Project.
- The Project will not be visible from Bendemeer, Uralla, Walcha Road Townships.
- Views may be available from Kentucky, Kentucky South and Wollun. Further assessment was undertaken in these towns and has found that the Project is generally screened by vegetation from these townships.
- Views to the Project will be screened by topography from large areas of land to the west of the Project Area.
- The ZVI indicates views to the Project are limited from areas in excess of 8 kilometres due to topography.

It is important to reiterate the ZVI is based on a worst case scenario assessment with no vegetation or structures. Ground truthing during field work will ascertain potential visibility taking into account structures and vegetation. The ZVI figures have been utilised to identify areas which require additional analysis.

7.0 Zone of Visual Influence



Zone of Visual Influence (ZVI)
Blade Tip Height 260m

Thunderbolt Energy Hub - Stage 1

LEGEND

- Project Area Boundary
- Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- 8,000 m from nearest turbine

ZVI Legend:

- 1 - < 6
- 6 - < 12
- 12 - < 18
- 18 - < 24
- 24 - < 30
- 30 - 32

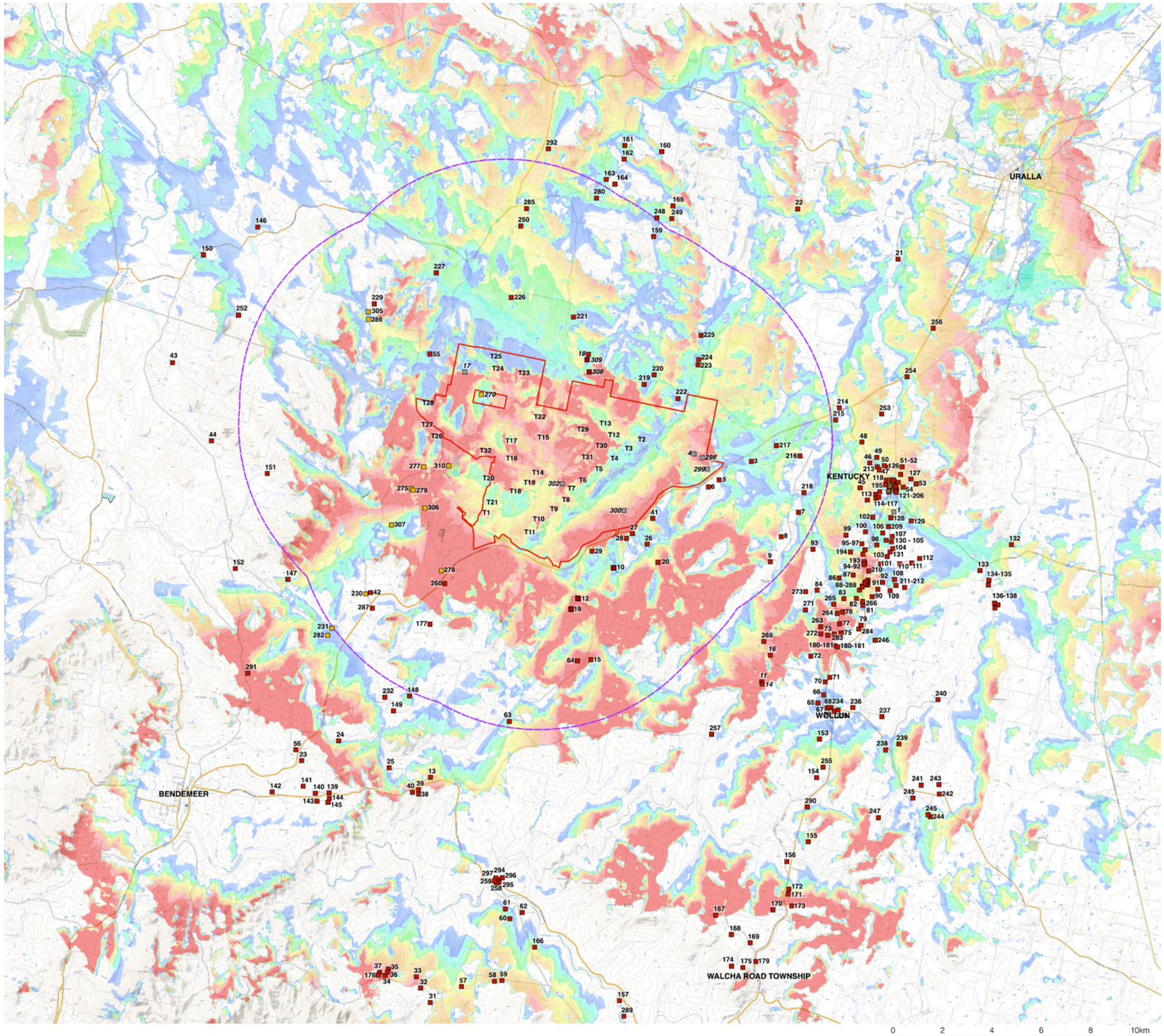
Note:

The ZVI is a preliminary assessment tool that represents a bare ground scenario - i.e. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

N

***Figure 14** Zone of Theoretical Visibility - Blade tip (260 metres)*

7.0 Zone of Visual Influence



Zone of Visual Influence (ZVI)
Hub Height 170 m

Thunderbolt Energy Hub - Stage 1

LEGEND

- Project Area Boundary
- Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Non-associated Dwelling (No Development Consent)
- 8,000 m from nearest turbine

ZVI Legend:

- 1 - < 6
- 6 - < 12
- 12 - < 18
- 18 - < 24
- 24 - < 30
- 30 - 32

Note:

The ZVI is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

N

***Figure 15** Zone of Visual Influence - Maximum Hub Height (170 metres)*

8.0 Viewpoint Analysis

8.1 Overview of Public Viewpoint Analysis

In accordance with the Bulletin: *'all key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed'.*

A total of 23 viewpoints were taken from public locations. Viewpoints have been carefully selected to be representative of the range of views within the Study Area. Selected viewpoint assessment locations are shown on **Figure 16**.

Public Viewpoint Selection Process

The selection of public viewpoints is generally informed by the results of the ZVI, topographical maps, field work observations and other relevant influences such as access, nearby representative residences, landscape character and the popularity of vantage points.

Public viewpoints are selected to illustrate a combination of the following;

- viewpoints identified by the community in community consultation phase of the scoping paper,
- present landscape character types,
- areas of potentially high landscape or scenic value,
- range of distances,
- varying aspects and elevations,
- varying extent of wind farm visibility (full and partial visibility), and
- sequential views along specific routes.

It is important to note that viewpoints for this LVIA study have been taken predominantly accessible public land (roads, rest areas and lookouts) which were identified as having a potentially high visual impact through the desktop review process. The viewpoint locations assessed for the Project have included key viewpoints identified through the extensive community engagement throughout the development, most of which were recorded in the PVIA prepared by Umwelt.

The Bulletin states: *where relatively close clustering of houses belonging to different landowners or occupants occur, representative viewpoints may be selected and assessed in lieu of every single dwelling in the following types of areas:*

- rural residential clusters;
- rural villages; and
- urban residential and commercial areas.

8.2 Viewpoint Analysis Methodology

Once the viewpoints had been selected, panoramic photographs are taken in accordance with the standards outlined in the *Scottish Natural Heritage Visual Representation of Wind Farms Guidance Version 2.2.*

Photographs used for viewpoints are taken on a level tripod at a height of 150cm (to represent eye level). Photographs were taken with a Canon EOS 5D Mark III Full Frame digital SLR through a 50mm fixed focal lens which closely represents the central field of vision of the human eye. Parameters for the photography is provided in **Table 7.**

The visual impact of the viewpoint was assessed both on site and through a desktop assessment utilised with the topographic and aerial information to ensure accuracy.

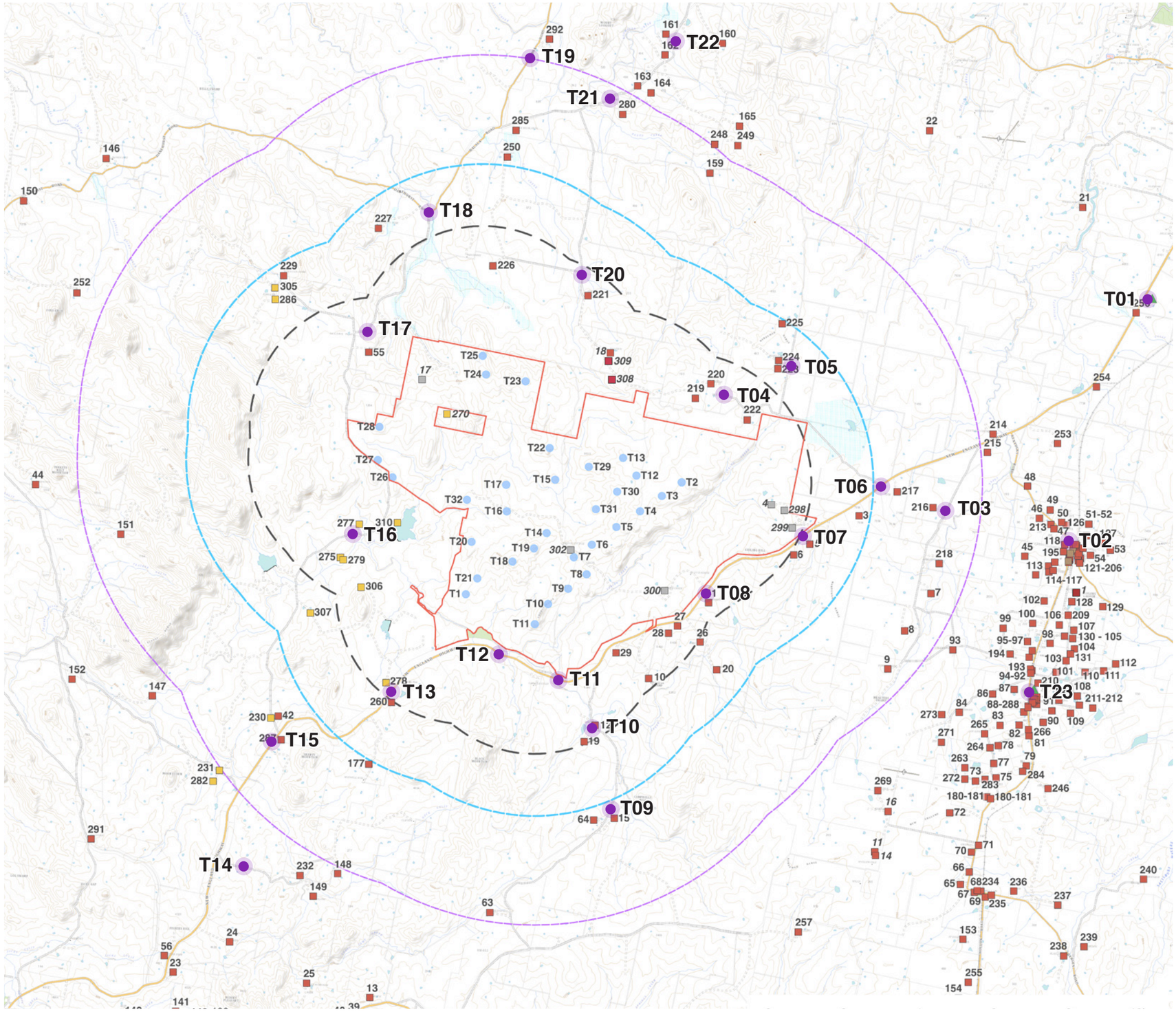
The locations of the viewpoints have been identified in **Figure 16** and the general viewing direction of each viewpoint is identified on the map on each viewpoint.

Public viewpoint analysis prepared for the Project has been included as Appendix B.

Photography Specifications:	
Camera Make and Model:	**Canon EOS 5D Mark IV Full Frame Digital SLR**
Lens:	**EF50mm f/1.2L USM**
Focal Length:	**50mm f/0**
Aperture Setting:	**f/6.3 - 10**
Tripod Height:	**150cm (to represent eye level)**

Table 7. Photography Specifications

8.0 Viewpoint Analysis



Viewpoint Analysis Locations

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Area Boundary
- Proposed WTG Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Viewpoint Analysis Location (Public Location)

  Refer to Appendix B
- 3,450 m from turbine (Black Line of Visual Magnitude)
- 5,100 m from turbine (Blue Line of Visual Magnitude)
- 8,000 m from turbine

***Figure 16** Viewpoint Analysis Locations*

8.0 Viewpoint Analysis

8.3 Visual Influence Zone (VIZ)

In accordance with the Bulletin, Visual Influence Zones have been established from the Project Area from dwellings and key viewpoints. This establishes the relative landscape significance against which the potential impacts of wind turbines may be assessed. The Visibility Distance Zone, Viewer Sensitivity Level and Scenic Quality Class of each viewpoint have been assessed which, when combined, result in an overall Visual Influence Zone (see **Figure 17** below and refer to tables in **Appendix E**). An evaluation using the corresponding visual performance objectives (see *Table 2 of the Visual Assessment Bulletin*) has been included for each viewpoint.

For each viewpoint, the potential visual impact was analysed through the use of a combination of the 3D terrain modelling, topographic maps and on site analysis.

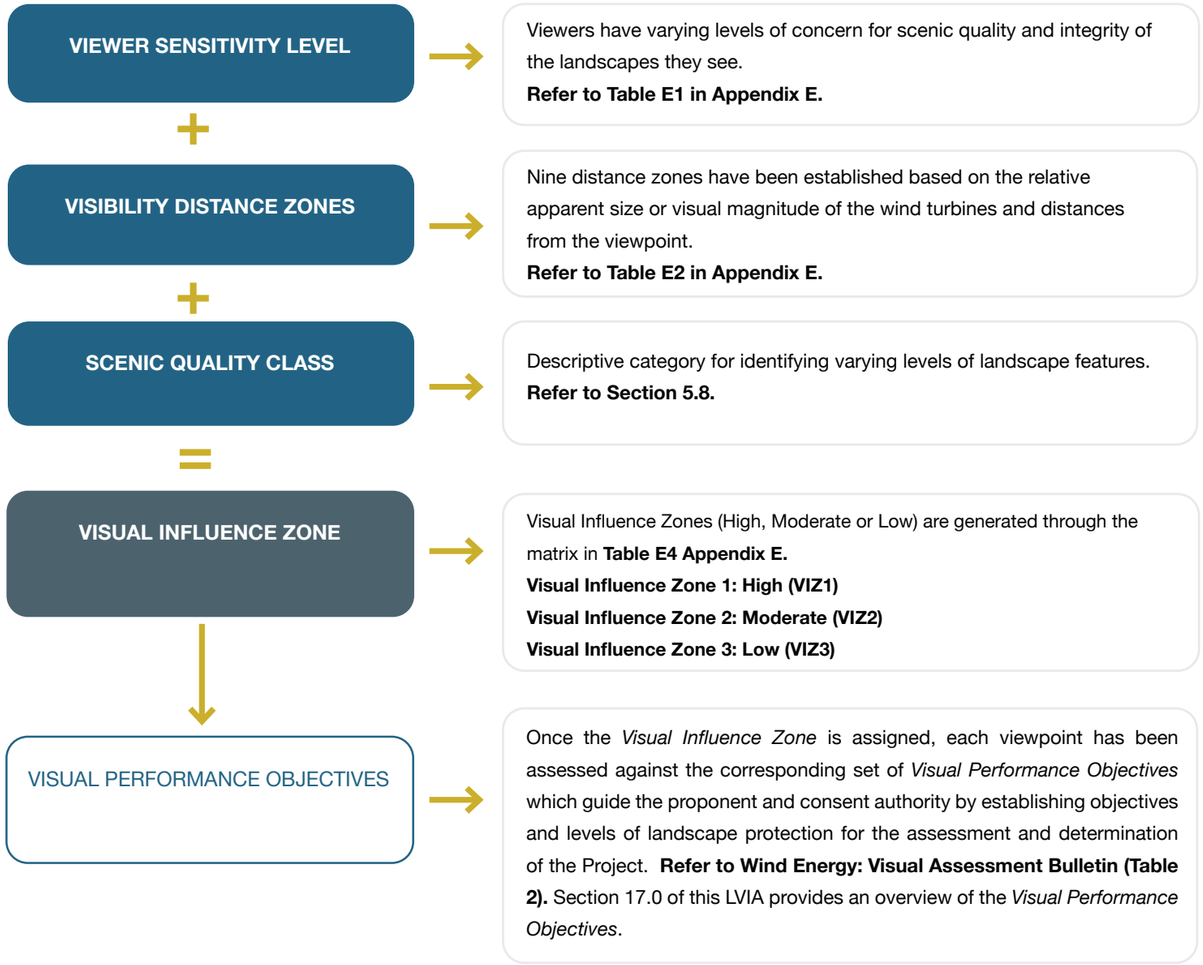


***Figure 17:** Summary of methodology for determining Visual Influence Zone (VIZ)*

8.4 Summary of Viewpoint Analysis

The **23** viewpoints assessed for the purpose of this LVIA were taken from varying distances and locations surrounding the Project. Each viewpoint was assigned a Visual Influence Zone (VIZ) based on their view sensitivity level, distance zone and scenic quality class combinations (refer to the methodology in **Section 8.3** and **Appendix E**). In accordance with the objectives of the Bulletin, each viewpoint was assessed against the objectives for the VIZ. The following provides a brief overview of the viewpoint analysis which is located in **Appendix B**. Photomontages have been undertaken from selected public viewpoints to illustrate the potential visual impacts refer to **Section 9.0** and **Appendix C**.

Visual Influence Zone 1 (VIZ1):
In accordance with the methodology, there are no publicly accessible viewpoints identified as VIZ1.

Visual Influence Zone 2 (VIZ2):
In accordance with the methodology, four (4) viewpoints were rated as VIZ2. This is mainly due to the close proximity of the viewpoint to the Project. An assessment of the performance objectives has been undertaken for each viewpoint with a VIZ2 rating (T11, T12, T13 and T16). Refer to Viewpoint Analysis - **Appendix B**. The assessment of the four (4) viewpoints with a VIZ2 rating presented in Appendix B demonstrate the Project can be undertaken in accordance with the performance objectives for a VIZ2. The Project will not impact upon key landscape features or alter the scenic quality of the landscape at these viewpoints.

Visual Influence Zone 3 (VIZ3):
The majority of viewpoints assessed were rated as VIZ3 in accordance with the methodology in the Bulletin. This is generally due to the low viewer sensitivity level and / or distance to the Project. There are no visual performance objectives for VIZ3.

9.0 Photomontages & Wire Frame Diagrams

9.1 Overview of Photomontages and Wire Frame Diagrams

The Bulletin states: *"Photomontages shall be prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.1 December 2014 guidelines, noting they are generally consistent with the Land and Environment Court's Photomontage Policy. The visual assessment needs to include a concise description of the complete methodology used to create any photomontages presented in the visual assessment".*

9.1.1 Photomontages

A photomontage combines a photograph of an existing view with a computer-rendered image of a proposed development. Photomontages are used to illustrate the likely view of a proposed development as it would be seen in a photograph (not as it would appear to the human eye in the field).

Although photomontages are based on a photograph of the existing landscape, it is important to stress that they are not a substitute to visiting a viewpoint in the field. They are only one tool to aid assessment. They provide a two-dimensional image that can be compared with an actual view of the landscape to provide information, such as the scale and potential appearance of a proposed development. ***Photomontages prepared for the Project have been included as Appendix C.***

9.1.2 Wire Frame Diagrams

A wire frame is a computed generated image based on a digital terrain model, that indicate the 3D shape of the landscape in combination with additional elements. They are a valuable tool in the wind farm LVIA process as they allow the assessor to compare the position and scale of the turbines to the existing view of a landscape (Scottish Natural Heritage, 2017). Wire frame images can be seen as a worst case scenario as they do not take into account factors such as vegetation, building structures. A wire frame diagram has been prepared from each photomontage location in accordance with the requirements of the *Scottish Natural Heritage Visual Representation of Wind Farms.*

Wire frame diagrams have been utilised in this LVIA to assist in the assessment of the Project from inaccessible locations. In instances where access to a private property was not granted, wire frame diagrams have been utilised as an assessment tool to provide a worst case scenario view of the proposal.

Wire frame images have also been utilised as a substitute for photomontages in areas where dense vegetation limits the capacity to align photographs accurately or the Project would not be visible (ie. due to dense vegetation).

9.2 Photomontage Selection Process

Six (6) public viewpoints and **15** private locations have been selected for the preparation of photomontages to best illustrate the potential appearance of the Project from varying distances and public locations with differing views (refer to **Figure 18**).

Public Photomontage Locations:

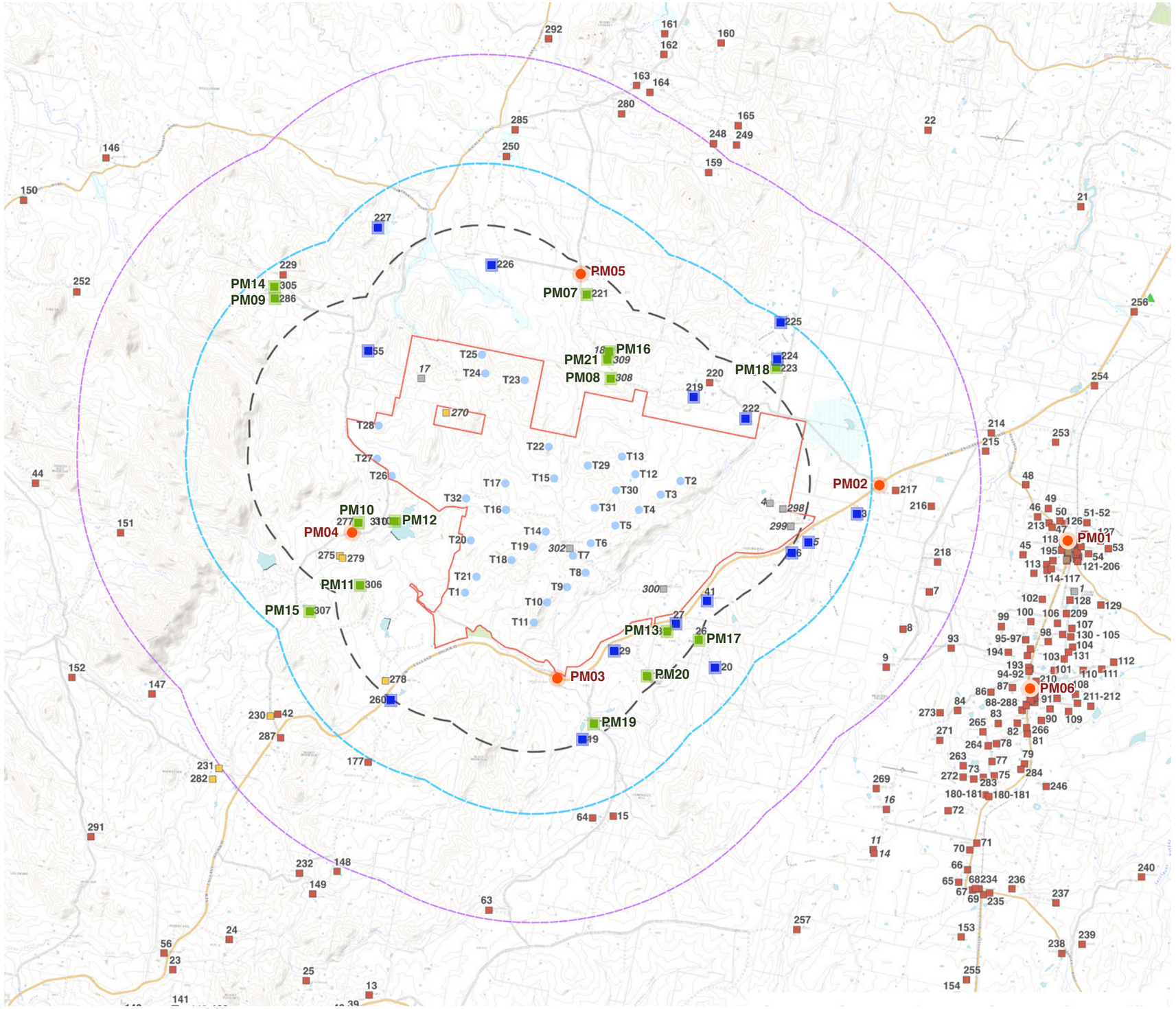
A total of **six (6)** public viewpoint locations selected for the preparation of visual photomontages are based on feedback received from the community. Exact photomontage locations were selected on site to represent a worst case scenario for the viewpoint location. Localised screening factors such as vegetation were avoided (where possible) to ensure maximum exposure to the Project. The public viewpoint locations selected for the preparation of photomontages are consistent with viewpoints identified in the Preliminary Visual Impact Assessment undertaken by Umwelt (November, 2020).

Private Photomontage Locations:

15 photomontages have been prepared from private properties. The locations selected were based on those within close proximity to the Project. Although effort was made to undertake site assessments from all dwellings within 5,100 metres, access to some properties was not granted. In some cases, wire frame diagrams have been utilised to illustrate potential visual impacts from dwellings where no access was available or where the Project would not be visible due to vegetation.

Please note: Photomontages prepared from some private properties have been removed from the public report at the request of the landowners. These private property photomontages have been provided to DPE to inform the assessment of the Project.

9.0 Photomontages & Wire Frame Diagrams



Photomontage and Wire Frame Diagram Locations

Thunderbolts Energy Hub - Stage 1

LEGEND:

- Project Boundary
- Proposed 250m Turbine Location
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling
- Photomontage from Public Location
  (Refer to Appendix C)
- Photomontage from Private Location
  (Refer to Appendix C)
  Note: Some private photomontages have been removed from the public report at the request of landowners.
- Wire Frame Diagram from Private Location
  (Refer to Appendix D)
- 3,450 m from turbine (Black Line of Visual Magnitude)
- 5,100 m from turbine (Blue Line of Visual Magnitude)
- 8,000 m from turbine

N

***Figure 18** Photomontage and Wire Frame Diagram Locations*

9.0 Photomontages & Wire Frame Diagrams

9.3 Photomontage Development Methodology

The process for generating the photomontages involves computer generation of a wire frame perspective view of the WTGs and the topography from each viewpoint. As per the requirements of the *Wind Energy: Visual Assessment Bulletin*, photomontages have been prepared in accordance with the *Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.2 February 2017*. The process for photomontage development is demonstrated in ***Figure 19***.

The photomontages are based on a worst case scenario of a maximum turbine tip height of 260 m with a hub height of 170 m and rotor diameter of 180 m, without the inclusion of the proposed mitigation methods.

Moir Landscape Architecture have prepared the photomontages using the most current available version of *Wind Pro* software using the following process:

Step 1: Develop 3D Model

Detailed 3D model of the Site is developed in *Wind Pro*. The wind turbines and associated infrastructure (substations, transmission lines, wind masts etc.) are modelled and sited in the 3D model to scale.

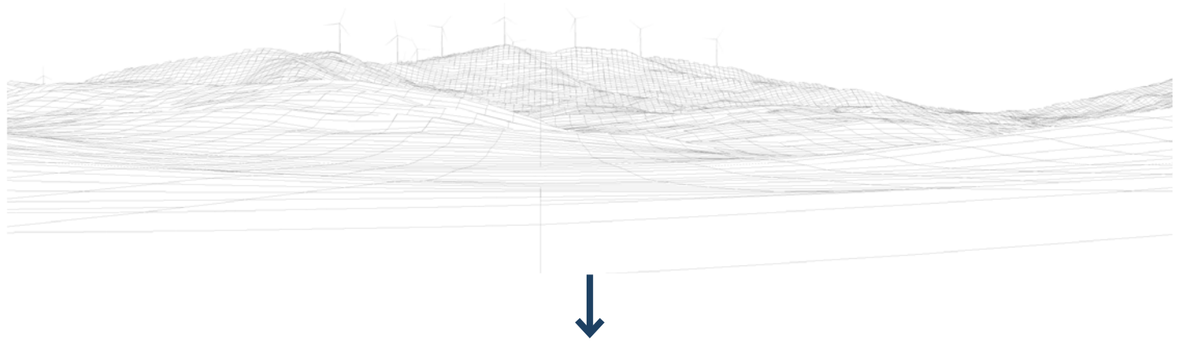
Step 2: Align Photograph and Model

The digital panorama is imported into Wind Pro and Exchangeable Image File Format (EXIF) properties of the file are inserted automatically defining all relevant visualization information as e.g. type of camera lens used, field of view for panoramas, the position and direction. Topography, control points, obstacle objects, existing wind masts can be used as reference to calibrate the camera model very precisely.

Step 3: Render Photomontage

The software calculates the position of the sun based on the time and date of photograph and renders the wind turbines in accordance with the specific weather conditions and position of the sun. Once rendered, detailed removal of intervening elements (such as vegetation) is undertaken to provide an accurate representation of the Project.

Step 1: Develop 3D Model



Step 2: Align photograph and model

Step 3: Render Photomontage

***Figure 19* Photomontage Development Process (Source: Moir LA, Hills of Gold Wind Farm)**

9.0 Photomontages & Wire Frame Diagrams

9.4 Photomontage Limitations

Visualisations in themselves can never provide the full picture in terms of potential impacts; they only inform the assessment process by which judgements are made. Visualisations of wind farms have a number of limitations which you should be aware of when using them to form a judgement on a wind farm proposal. These include:

- The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate;
- A static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;
- A visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image. *Source: Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.2 February 2017.*

9.5 Blue Sky Comparison Photomontages

The Scottish Natural Heritage Guidelines state: *One of the most significant difficulties of photographing wind farms, in contrast to other types of development, is that they often appear on the skyline where there can be little contrast between the light-coloured turbines and a light-coloured sky. It is therefore essential that all baseline photographs are taken in good visibility. This will generally mean clear skies, in suitably clear air to allow sufficient contrast between the different elements within the landscape. This is particularly important for long-range views where poor light and atmospheric conditions such as haze or cloud can reduce the clarity of the view, or for views where the turbines are predominantly viewed against the sky.* ***Images 13 - 15*** have been included to illustrate the variations to turbine visibility (of operating wind farms) based on differing times of the day and sky conditions.

Moir Landscape Architecture undertook base photography for the Project over a series of three (3) site visits. Great effort was made to ensure clear sky conditions for each trip to Site, however some variations to the sky conditions may appear in the viewpoints and photomontages.

At the request of the DPIE, Moir LA have produced 'Blue Sky Comparison Photomontages' for each of the photomontages prepared. Blue Sky has been superimposed onto the original photograph to provide an alternate view of the Project against a differing weather condition (refer to ***Appendix C***).

Image 13. Photo of Gullen Range Wind Farm at dusk, looking in a east direction with sun on turbines

Image 14. Photo of Gullen Range Wind Farm at dusk, looking in a west direction with sun on turbines

Image 15. Photo of Crudine Ridge Wind Farm at midday, looking in a north direction

10.0 Dwelling Assessments

10.1 Overview of Dwelling Assessment

The Bulletin states: "*all key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed"* and "*the black and blue lines are not determinative of acceptability. Instead, they provide a basis for the assessment to be undertaken. There may be reasons why the proposed turbine will not have the impact as identified by (the visual magnitude thresholds) and detailed justification can be provided for proposed turbines... for example ground truthing may identify that existing vegetation or topography will screen views to a proposed turbine".*

The Preliminary Assessment Tools (***Section 6.0***) defined the visual catchment and identified non-associated residences within the Study Area which require further assessment. These include:

- ***16*** non-associated dwellings within 3,450 metres of the nearest turbine (refer to ***Table 10***). Of these 16 non-associated dwellings, three (3) were uninhabited (Dwelling 220, 308 and 309).
- ***11*** non-associated dwellings within 3,450 - 5,100 metres of the nearest turbine (refer to ***Table 12***).

Since commencing the assessment process three (3) landowners associated with ten (10) dwellings have entered into neighbour agreements with Neon and are now classified as 'Associated Dwellings'. The assessments undertaken from these dwellings have been included in the report (refer to ***Table 11*** and ***Table 13***).

10.2 Study Method for Dwelling Assessment

Table 8 provides an overview of the study method for undertaking the dwelling assessment for each dwelling identified within the visual catchment.

10.2.1 Dwellings within 3,450 metres of the nearest turbine (Black Line of Visual Magnitude)

With the advice of Moir LA, Neoen offered on-site visual assessments from all private properties within 3,450 metres of the WTGs. Access was granted by nine (9) of the landowners, and Moir LA attended these properties between *7th and 8th of October 2021* to undertake a detailed site inspection.

The purpose of the site inspection was to undertake photographic assessments from areas of potential concern identified by the landowner. While on Site, Moir LA's team ground truthed information identified through the desktop assessment.

Where access was not granted to the property, Moir LA have undertaken a desktop assessment utilising 3D modelling and the most current available aerial imagery. Assumptions have been made on the height of vegetation based on character assessments.

An overview of the visual assessment for each of these 16 non-associated dwellings has been included in ***Table 10*** and detailed assessments have been included in ***Appendix D*** and summarised in ***Section 10.4.***

10.2.2 Dwellings within 3,450 - 5,100 metres of the nearest turbine

A total of 11 non-associated dwellings were identified within 3,450 - 5,100 metres of a proposed turbine, access was permitted to eight (8) dwellings. An overview of the visual assessment for each of these dwellings has been outlined in ***Table 12*** detailed desktop assessments have been included in ***Appendix D*** and summarised in ***Section 10.4***.

10.2.3 Dwellings in excess of 5,100 metres of the nearest turbine

In addition to the detailed assessment of dwellings identified within the visual catchment, Moir LA undertook an extensive Viewpoint Analysis which provides representative visual assessments from dwellings in excess of 5,100 metres of the Project (refer to ***Appendix B***). The Bulletin states: *where relatively close clustering of houses belonging to different landowners or occupants occur, representative viewpoints may be selected and assessed in lieu of every single dwelling in the following types of areas:*

- *rural residential clusters;*
- *rural villages; and*
- *urban residential and commercial areas.*

Please note: Photos taken from private property have been removed from the public report at the request of the landowners.

10.0 Dwelling Assessments

Study Method	Process
Step 1: Application of Preliminary Assessment Tools	Preliminary Assessment Tools were applied in accordance with the Bulletin from each dwelling to assess the following two parameters: - Visual Magnitude (identify the number of turbines within blue and black lines) - Multiple 60° Sector Assessment (identify the number of 60° sectors based on a 2D assessment).
Step 2. 3D Assessment (based on topography alone)	Using 3D modelling, Moir LA identified turbines which will not be visible from the dwelling due to topography. As a result the extent of visibility is generally decreased when compared to the 2D assessment. The application of the Preliminary Assessment Tools are updated to account for 3D modelling.
Step 3. Aerial Imagery	Information on the extent of visibility extracted from the 3D model is then overlaid onto a recent aerial image of the dwelling and its surrounds. This provides a detailed assessment of the direction and extent of potentially visible turbines and identifies any intervening elements (such as structures, wind break planting or vegetation) which may reduce the potential visibility.
Step 4. Site Inspection	Where access was granted, Moir LA attended the property to undertake a site inspection to ground truth potential screening factors that were identified on aerial imagery. This included photographic assessment from the dwelling. During the site inspection Moir LA identified potential intervening elements including vegetation and structures. Where multiple dwellings are located on a property, Moir LA generally undertook an assessment from inhabited dwellings or from those that the landowner identified as their highest concern.
Step 5: Photomontage / Wire frame diagrams	Where potential impacts were identified, photomontages or wire frames diagrams were prepared from dwellings. Where multiple dwellings are located on a property, Moir LA have selected representative locations to illustrate potential impacts from the dwellings.
Step 6. Evaluation of VIZ Objectives	In accordance with the Bulletin, the Visual Influence Zone was defined and the relevant objectives were evaluated for each dwelling based on the assessment.
Step 7. Visual Effect Rating	A visual impact rating is applied to each dwelling with regards to the parameters outlined in ***Section 10.3***.
Step 8. Consideration of mitigation methods	For non-associated dwellings where by the Project has the potential to cause a moderate or high visual impact, mitigation methods have been suggested. ***Refer to Section 15.***

Table 8. Dwelling Assessment Process

10.0 Dwelling Assessments

10.3 Visual Impact Rating Methodology

The Bulletin states: *The Department adopts the widely accepted and commonly utilised approach that visual impact can be determined from a combination of receiver sensitivity and the magnitude of visual effect. This approach is documented in numerous Australian and international guidelines, and is considered to be industry best practice.*

In addition to assessing against the visual performance objectives outlined in the Bulletin, Moir LA have developed a framework for defining and rating the level of visual effect from each dwelling.

The framework in **Table 9** has been prepared with regards to the third edition of the *Guidelines for Landscape and Visual Impact Assessment* (GLVIA3), *Residential Visual Amenity Assessment* (RVAA) and Moir LA's extensive professional experience in undertaking LVIA's for wind energy projects.

Published in 2013, the GLVIA3 is well established as providing 'best practice guidance' when undertaking Landscape and Visual Impact Assessment (LVIA). RVAA is a stage beyond LVIA and focusses exclusively on private views and private visual amenity. Considerations outlined in the RVVA which provide a framework for describing and evaluating the predicted magnitude of visual change and related visual amenity effects include:

- *Distance of property from the proposed development having regard to its size / scale and location relative to the property (e.g. on higher or lower ground);*
- *Type and nature of the available views (e.g. panoramic, open, framed, enclosed, focused etc.) and how they may be affected, having regard to seasonal and diurnal variations;*
- *Direction of view / aspect of property affected, having regard to both the main / primary and peripheral / secondary views from the property;*
- *Extent to which development / landscape changes would be visible from the property (or parts of) having regard to views from principal rooms, the domestic curtilage (i.e. garden) and the private access route, taking into account seasonal and diurnal variations;*
- *Scale of change in views having regard to such factors as the loss or addition of features and compositional changes including the proportion of view occupied by the development, taking account of seasonal and diurnal variations;*
- *Degree of contrast or integration of new features or changes in the landscape compared to the existing situation in terms of form, scale and mass, line, height, colour and texture, having regard to seasonal and diurnal variations;*
- *Duration and nature of the changes, whether temporary or permanent, intermittent or continuous, reversible or irreversible etc.; and*
- *Mitigation opportunities – consider implications of both embedded and potential further mitigation.*

(Source: RVVA, 2019).

VISUAL IMPACT RATING				
	NIL	**LOW**	**MODERATE**	**HIGH**
Distance	The project will not be visible.	Turbines may be visible in distance or very partially visible in the foreground.	Turbines maybe visible in the middle ground or a small number may be visible in the near ground.	Turbines are highly visible in the foreground.
Type of views		Views from the dwelling are not focused on the Project.	Views from the dwelling are not focused entirely on the Project.	Views are focused directly towards the Project.
Direction of view		The Project may be visible in peripheral views or form a very minor element in primary views.	The Project may be visible from, yet will not dominate primary views.	The Project will be highly visible and has the potential to be a dominant element in primary views from the property.
Extent of visibility		The Project may be partially visible or fragmented.	The Project may be visible from the dwelling yet will not significantly alter the existing visual character.	The Project has the potential to significantly alter the existing visual character when viewed from the dwelling.
Scale of change		The Project may be visible yet will not change to the existing visual character.	The Project has the potential to become a noticeable element in the view, yet will not overly diminish the existing visual character.	The Project has the potential to alter the existing visual character.
Degree of contrast		The Project will have a low level of contrast with the existing landscape.	The Project will result in a moderate level of contrast with the existing landscape.	The scale of the Project will result in a high level of contrast with the existing landscape.
Duration of change		Changes are temporary.	Changes to the landscape have the potential to be reduced over time (with the employment of. mitigation methods).	Changes to the landscape are continuous and / or irreversible.
Mitigation Options		Existing screening factors contribute to reducing the potential visibility.	Some existing screening factors may contribute to fragmenting the Project or there is opportunity to screen the Project.	Limited opportunities to screen the Project.

Table 9. Visual Impact Rating Methodology

10.0 Dwelling Assessments

Summary of Non-associated Dwellings located within 3,450m of nearest turbine (Black Line of Visual Magnitude)

ID	Location / Address:	Distance to nearest turbine:	Nearest turbine:	Number of turbines within 3,450m (Black line):	Turbines within 3,450m (Black line):	Theoretical number of 60º Sectors:	Number of 60º sectors:	Number of visible turbines:	Visual Influence Zone:	Visual Impact Rating:	MLA Comments:
Dwellings:		**Based on 2D Assessment:**					**Based on Desktop / Site Assessment:**				
27	*6456, New England Highway, Kentucky*	**2.78 km**	**T8**	***Six (6)***	*T4, T5, T6, T7, T8, T9*	***Two (2)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Negligible***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.1. Note: Photo from Site has been removed at the request of the landowner.***
28	*6400 New England Highway, Kentucky*	**2.68 km**	**T8**	***Seven (7)***	*T4, T5, T6, T7, T8, T9, T10*	***Two (2)***	***Nil***	**32 Turbines** *32 visible at hub 0 blades visible*	***VIZ2***	***Low***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.2. Note: Photo from Site has been removed at the request of the landowner.***
29	*6290 New England Highway, Kentucky*	**2.13 km**	**T9**	***Seven (7)***	*T5, T6, T7, T8, T9, T10, T11*	***Two (2)***	***One (1)***	**20 Turbines:** *16 visible at hub 4 blades visible*	***VIZ2***	***Low***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.3 Note: Photo from Site has been removed at the request of the landowner.***
41	*New England Highway, Kentucky*	**3.04 km**	**T4**	***Six (6)***	*T2, T3, T4, T5, T6, T8*	***Two (2)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Negligible***	***Desktop Assessment: Refer to Appendix D.4.***
55	*1264 Green Valley Road, Balala*	**2.01 km**	**T28**	***Five (5)***	*T24, T25, T26, T27, T28*	***Two (2)***	***One (1)***	**16 Turbines:** *9 visible at hub 7 blades visible*	***VIZ2***	***Low***	***Desktop Assessment: Refer to Appendix D.5***
18	*Dalveen Road, Balala*	**2.38 km**	**T23**	***Seven (7)***	*T12, T13, T22, T23, T24, T25, T29*	***Two (2)***	***Two (2)***	**18 Turbines:** *10 visible at hub 8 blades visible*	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.6 . Note: Photo from Site has been removed at the request of the landowner.***
219	*185 Borgers Road, Kentucky*	**2.48 km**	**T13**	***Seven (7)***	*T2, T3, T4, T12, T15, T29, T30*	***Two (2)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Nil***	***Site inspection undertaken 8th October 2021. Refer to Appendix D.7. Note: Photo from Site has been removed at the request of the landowner.***
220	*185 Borgers Road, Kentucky*	**2.73 km**	**T2**	***Five (5)***	*T2, T3, T12, T13, T14*	**Two (2)**	**One (1)**	**12 Turbines** *6 visible at hub 6 blades visible*	***VIZ2***	***Negligible***	Dwelling 220 is located on the same property as Dwelling 219. A visual site inspection was undertaken on the 8th of October 2021. The house is surrounded by wind break planting, and vegetation will screen views to the Project. The inspection and discussion with the landowner concluded Dwelling 220 was uninhabitable. The dwelling is currently dilapidated and the owner did not voice concerns over the visual impact at this location. Moir LA undertook a site inspection from the adjoining Dwelling (219) which is the main residence on the property.
221	*255 Dalveen Road, Balala*	**2.82 km**	**T24**	***Three (3)***	*T24, T25, T26*	***Two (2)***	***One (1)***	**3 Turbines visible**	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.8. Note: Photo from Site has been removed at the request of the landowner.***
222	*Borgers Road, Kentucky*	**2.40 km**	**T2**	***Four (4)***	*T2, T3, T12, T13*	***One (1)***	***One (1)***	**7 Turbines:** *3 visible at hub 4 blades visible*	***VIZ2***	***Negligible***	***Desktop Assessment: Refer to Appendix D.9.***
226	*570 Allinghams Road, Balala*	**2.41km**	**T25**	***Three (3)***	*T23, T24, T25*	***Two (2)***	***Two (2)***	**22 Turbines:** *14 visible at hub 8 blades visible*	***VIZ2***	***Moderate***	***Desktop Assessment: Refer to Appendix D.10***
10	*6362 New England Highway, Kentucky*	**3.206 km**	**T9**	***Four (4)***	*T8, T9, T10, T11*	***Two (2)***	***Two (2)***	**18 Turbines:** *12 visible at hub 6 blades visible*	***VIZ2***	***Low***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.26. Note: Photo from Site has been removed at the request of the landowner.***
12	*151 Rimbanda Road, Kentucky*	**3.129 km**	**T11**	***One (1)***	*T11*	***Two (2)***	***Two (2)***	**32 Turbines:** *31 visible at hub 1 blade visible*	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.27 Note: Photo from Site has been removed at the request of the landowner.***
19	*162 Rimbanda Road, Kentucky*	**3.39 km**	**T11**	***One (1)***	*T11*	***One (1)***	***One (1)***	**32 Turbines:** *32 visible at hub 0 blades visible*	***VIZ2***	***Moderate***	***Desktop Assessment: Refer to Appendix D.28 Note: Photo from Site has been removed at the request of the landowner.***

***Table 10* Overview of assessment of Non-associated Dwellings within 3,450 metres**

10.0 Dwelling Assessments

Summary of Non-associated Dwellings located within 3,450m of nearest turbine (Black Line of Visual Magnitude)											
ID	Location / Address:	Distance to nearest turbine:	Nearest turbine:	Number of turbines within 3,450m (Black line):	Turbines within 3,450m (Black line):	Theoretical number of 60º Sectors:	Number of 60º sectors:	Number of visible turbines:	Visual Influence Zone:	Visual Impact Rating:	MLA Comments:
Dwellings:		**Based on 2D Assessment:**					**Based on Desktop / Site Assessment:**				
308	*Dalveen Road, Kentucky*	**2.09 km**	**T13**	***Ten (10)***	*T2, T3, T12, T13, T15, T22, T23, T24, T29, T30*	**Three (3)**	**Two (2)**	**25 Turbines:** *15 visible at hub 10 blades visible*	***VIZ2***	***Low***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.30 Note: Photo from Site has been removed at the request of the landowner.***
309	*Dalveen Road, Kentucky*	**2.29 km**	**T23**	***Seven (7)***	*T12, T13, T22, T23, T24, T25, T29*	**Three (3)**	**Two (2)**	**30 Turbines:** *22 visible at hub 8 blades visible*	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.31 Note: Photo from Site has been removed at the request of the landowner.***

Table 10 Overview of assessment of Non-associated Dwellings within 3,450 metres (continued)

10.0 Dwelling Assessments

Summary of Associated Dwellings located within 3,450m of nearest turbine (Black Line of Visual Magnitude)											
ID	Location / Address:	Distance to nearest turbine:	Nearest turbine:	Number of turbines within 3,450m (Black line):	Turbines within 3,450m (Black line):	Theoretical number of 60º Sectors:	Number of 60º sectors:	Number of visible turbines:	Visual Influence Zone:	Visual Impact Rating:	MLA Comments:
Dwellings:		**Based on 2D Assessment:**					**Based on Desktop / Site Assessment:**				
270	*1212 Green Valley Road, Kentucky*	**1.475 km**	**T24**	***11***	*T15, T16, T17, T22, T23, T24, T25, T36, T27, T28, T32*	**Four (4)**	**Nil**	**Nil**	***VIZ1***	***Negligible***	Vegetation screens views to the Project. ****Neoen had a negotiated agreement in place with the landowner at the time of the field work, no inspection was required.***
275	*554 Green Valley Road, Bendemeer*	**2.54 km**	**T26**	***Three (3)***	*T1, T26, T27*	**Two (2)**	**Two (2)**	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ2***	***Moderate***	A site inspection undertaken 7th October 2021, the house is located on the same property as Dwelling 306, 307 and 310. The house is orientated to the north east towards the Project. Vegetation in the foreground is likely to screen views to some WTGs associated with the Project. The house is currently uninhabitable. ****Neoen now have a negotiated agreement in place with the landowner.*** ***Note: Photo from Site has been removed at the request of the landowner.***
277	*655 Green Valley Road, Bendemeer*	**1.53 km**	**T26**	***Seven (7)***	*T1, T20, T21, T26, T27, T28, T32*	***Two (2)***	***Two (2)***	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ1***	***High***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.11*** ****Neoen now have a negotiated agreement in place with the landowner.***
279	*554 Green Valley Road, Bendemeer*	**2.55 km**	**T26**	***Three (3)***	*T1, T26, T27*	**Two (2)**	**Two (2)**	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ2***	***Moderate***	A site inspection undertaken 7th October 2021, the house is located adjacent to Dwelling 275, and appeared to be a shed. The house is orientated to the north east towards the Project. Vegetation in the foreground is likely to screen views to some WTGs associated with the Project. The house is currently uninhabitable. ****Neoen now have a negotiated agreement in place with the landowner.***
306	*554 Green Valley Road, Bendemeer*	**2.79 km**	**T1**	***Ten (10)***	*T1, T16, T17, T18, T20, T21, T26, T27, T28, T32*	***Two (2)***	***Two (2)***	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.12*** ****Neoen now have a negotiated agreement in place with the landowner.*** ***Note: Photo from Site has been removed at the request of the landowner.***
310	*554 Green Valley Road, Bendemeer*	**1.30 km**	**T1**	***Five (5)***	*T1, T20, T21, T26, T27*	***Two (2)***	***Two (2)***	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ1***	***High***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.13*** ****Neoen now have a negotiated agreement in place with the landowner.*** ***Note: Photo from Site has been removed at the request of the landowner.***
278	*554 Green Valley Road, Bendemeer*	**3.15 km**	**T1**	***One (1)***	*T1*	**Two (2)**	**Two (2)**	**32 Turbines:** *32 visible at hub* *0 blades visible*	***VIZ2***	***Low***	House is currently derelict and uninhabitable. A desktop assessment was undertaken of the dwelling indicating up to 32 turbines have the potential to be visible to the north and north east. Existing vegetation to the north east of the dwelling is likely to screen views to the WTGs to the north east. The visual impact rating has been assessed as low. ****Neoen now have a negotiated agreement in place with the landowner.***

Table 11 ***Overview of assessment of Associated Dwellings within 3,450 metres***

10.0 Dwelling Assessments

Summary of non-associated receptors located within 3,450 - 5,100 m of nearest turbine (Between Black & Blue Line of Visual Magnitude)											
ID	Location / Address:	Distance to nearest turbine:	Nearest turbine:	Number of turbines within 5,100 m (Blue line):	Turbines within 5,100m (Blue line):	Theoretical number of 60º Sectors:	Number of 60º sectors:	Number of visible turbines:	Visual Influence Zone:	Visual Impact Rating:	MLA Comments:
Dwellings:		**Based on 2D Assessment:**					**Based on Desktop / Site Assessment:**				
3	*New England Highway, Kentucky*	**4.80 km**	**T2**	***One (1)***	*T2*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Nil***	***Site inspection undertaken 8th October 2021. Refer to Appendix D.14 Note: Photo from Site has been removed at the request of the landowner.***
5	*New England Highway, Kentucky*	**3.78 km**	**T2**	***Four (4)***	*T2, T3, T4, T12*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Nil***	***Site inspection undertaken 8th October 2021. Refer to Appendix D.15 Note: Photo from Site has been removed at the request of the landowner.***
6	*New England Highway, Kentucky*	**3.55 km**	**T2**	***Six (6)***	*T2, T3, T4, T5, T12, T30*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Nil***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.16 Note: Photo from Site has been removed at the request of the landowner.***
20	*New England Highway, Kentucky*	**4.29 km**	**T8**	***Ten (10)***	*T2, T3, T4, T5, T6, T7, T8, T9, T10, T11*	***Two (2)***	***Two (2)***	**32 Turbines:** *32 visible at hub 0 blades visible*	***VIZ2***	***Moderate***	***Desktop Assessment. Refer to Appendix D.29***
26	*New England Highway, Kentucky*	**3.51 km**	**T8**	***14***	*T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12 T14, T30, T31*	***Two (2)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Low***	***Site inspection undertaken 7th October 2021. Refer to Appendix D.17 Note: Photo from Site has been removed at the request of the landowner.***
223	*481 Glenburnie Road, Kentucky*	**3.96 km**	**T2**	***Four (4)***	*T2, T3, T12, T13*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ2***	***Negligible***	***Site inspection undertaken 8th October 2021. Refer to Appendix D.18***
224	*483 Glenburnie Road, Kentucky*	**4.14 km**	**T2**	***Four (4)***	*T2, T3, T12, T13*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ3***	***Negligible***	***Desktop Assessment. Refer to Appendix D.19***
225	*663 Glenburnie Road, Kentucky*	**4.99 km**	**T2**	***One (1)***	*T2*	***One (1)***	***Nil***	**Turbines screened by vegetation**	***VIZ3***	***Negligible***	***Desktop Assessment. Refer to Appendix D.20***
227	*21 Danehurst Road, Balala*	**4.35 km**	**T25**	***Two (2)***	*T24, T25*	***One (1)***	***One (1)***	***11 Turbines***	***VIZ2***	***Low***	***Desktop Assessment. Refer to Appendix D.21***
229	*202 Biralee Road, Bendemeer*	**4.76 km**	**T28**	***One (1)***	*T28*	***One (1)***	***Nil***	***Nil***	***VIZ2***	***Nil***	***No further assessment required.***
260	*5556 New England Road, Bendemeer*	**3.50 km**	**T1**	***Six (6)***	*T1, T10, T11, T18, T20, T21*	***Two (2)***	***Two (2)***	**32 Turbines:** *32 visible at hub 0 blades visible*	***VIZ2***	***Low***	***Desktop Assessment. Refer to Appendix D.22***

Table 12 Overview of assessment of Non-associated Dwellings between 3,450 - 5,100 metres

10.0 Dwelling Assessments

Summary of non-associated receptors located within 3,450 - 5,100 m of nearest turbine (Between Black & Blue Line of Visual Magnitude)											
ID	Location / Address:	Distance to nearest turbine:	Nearest turbine:	Number of turbines within 5,100 m (Blue line):	Turbines within 5,100m (Blue line):	Theoretical number of 60º Sectors:	Number of 60º sectors:	Number of visible turbines:	Visual Influence Zone:	Visual Impact Rating:	MLA Comments:
Dwellings:		**Based on 2D Assessment:**					**Based on Desktop / Site Assessment:**				
286	*219 Biralee Road, Bendemeer*	**4.38 km**	**T28**	***Two (2)***	*T27, T28*	***One (1)***	***One (1)***	**12 Turbines:** *4 visible at hub* *8 blades visible*	***VIZ3***	***Negligible***	***Site inspection undertaken 7th October 2021.*** ***Refer to Appendix D.23*** ****Neoen now have a negotiated agreement in place with the landowner.***
305	*219 Biralee Road, Bendemeer*	**4.63 km**	**T28**	***One (1)***	*T28*	***One (1)***	***One (1)***	**24 Turbines:** *20 visible at hub* *4 blades visible*	***VIZ3***	***Negligible***	***Site inspection undertaken 7th October 2021.*** ***Refer to Appendix D.24*** ****Neoen now have a negotiated agreement in place with the landowner.***
307	*380 Green Valley Road, Bendemeer*	**4.13 km**	**T1**	***Five (5)***	*T1, T20, T21, T26, T27*	***Two (2)***	***Two (2)***	**23 Turbines:** *23 visible at hub* *0 blades visible*	***VIZ2***	***Moderate***	***Site inspection undertaken 7th October 2021.*** ***Refer to Appendix D.25*** ****Neoen now have a negotiated agreement in place with the landowner.*** ***Note: Photo from Site has been removed at the request of the landowner.***

Table 13 ***Overview of assessment of Associated Dwellings between 3,450 - 5,100 metres***

10.0 Dwelling Assessments

10.4 Summary of Dwelling Assessments

The Visual Influence Zone has been determined for each of the non-associated dwellings within the blue line of visual magnitude (5,100 m) in accordance with the Bulletin.

10.4.1 Dwellings within 3,450 metres

16 non-associated dwellings are located within 3,450 m of the nearest turbine. Of the 16 non-associated all were rated as Visual Influence Zone 2 (VIZ2).

Visual Influence Zone 1 (VIZ1) Dwellings:

Two (2) associated dwellings have been determined as VIZ1, Dwelling 277 and Dwelling 310 (refer to **Table 12**). In accordance with the Bulletin the performance objectives are to *'avoid turbines or provide detailed justification of turbines below the blue line'.*

Generally, the determination of the VIZ1 rating for these two (2) dwellings is due to being sited within 2,000 m of the nearest turbine. The visual impact rating has been applied to each of the dwellings and determined the visual impact would be rated as high for both of the dwellings.

It is important to note these two (2) dwellings have entered into negotiated agreements with Neoen. To aid these discussions, Moir LA provided photomontages from these dwellings and Neoen have discussed the anticipated visual impacts and discussed proposed mitigation options with both landowners of Dwelling 277 and 310.

Dwelling 310 is currently uninhabited. Due to the location on the lake, no practical mitigation measures would achieve a reduced visual impact from this dwelling. The landowner has been made aware of the anticipated visual impact and has entered into a negotiated agreement with Neoen.

Mitigation measures have been outlined and discussed with the landowner (and provided in this LVIA) to reduce the potential visual impacts from Dwelling 277 (see detailed dwelling assessments - **Appendix D**).

Visual Influence Zone 2 (VIZ2) Dwellings within 3,450 m:

16 non-associated dwellings located within 3,450 m (black line of visual magnitude) have a VIZ2 rating. The visual performance objectives for a VIZ2 receptor (within 3,450 m) state: '*Manage impacts as far as practicable, justify residual impacts, and describe proposed mitigation measures below the black line'.*

- Five (5) non-associated dwellings within 3,450 m were rated as having no views or a negligible visual impact: Dwellings 27, 41, 219, 220 and 222.
- Five (5) non-associated dwellings within 3,450 m were rated as having a low visual impact: Dwellings 10, 28, 29, 55, and 308.
- Six (6) non-associated dwellings were rated as having a moderate visual impact: 12, 18, 19, 221, 226 and 309.

It is anticipated once established, mitigation measures can achieve a reduction in the potential visual impact rating from all non-associated dwellings with a moderate visual impact rating. Refer to detailed dwelling assessments - **Appendix D** and **Mitigation Measures - Section 15.0**.

10.4.2 Dwellings within 3,450 - 5,100 metres

Eleven (11) non-associated dwellings have been assessed between 3,450 - 5,100 metres of the nearest turbine. Of the 11 non-associated dwellings assessed nine (9) were rated as having a Visual Influence Zone 1 (VIZ2) and two (2) were rated as Visual Influence Zone 3 (VIZ3).

Visual Influence Zone 2 (VIZ2) Dwellings between 3,450 - 5,100m:

Nine (9) non-associated dwellings are located between the black and blue line of visual magnitude (3,450 - 5,100 m) have been assessed as VIZ2. The visual performance objectives for a VIZ2 receptor at this distance state the propnent must: *'consider screening between the blue line and the black line'.*

Of the nine (9) dwellings with a VIZ2 rating within 3,450 - 5,100 m:

- Five (5) non-associated dwellings have been assessed as having a visual impact rating of nil or negligible: Dwellings 3, 5, 6, 223 and 229.
- Three (3) non-associated dwellings have been assessed as having a low visual impact rating: Dwellings 26, 227 and 260.
- One (1) non-associated dwelling has been assessed as having a moderate visual impact rating: Dwelling 20.

Mitigation measures have been provided for Dwelling 20 (moderate visual impact rating). It is anticipated once established, mitigation can achieve a reduction in the potential visual impact rating from Dwelling 20. Refer to detailed dwelling assessments - **Appendix D** and **Mitigation Measures - Section 15.0**.

Visual Influence Zone 3 (VIZ3) Dwellings between 3,450 - 5,100m:

10.0 Dwelling Assessments

Two (2) dwellings have been assessed as Visual Influence Zone 3. There are no performance objectives for VIZ3 receptors. Both dwellings (Dwellings 224 and 225) have negligible visual impacts.

10.4.2 Dwellings in excess of 5,100 metres

Dwellings in excess of 5,100 metres from the nearest WTG have the potential to view the Project. The Viewpoint Analysis (refer to **Section 8.0**) and photomontages prepared from public viewpoints seek to assist the Department and landowners in determining potential visual impacts from dwellings in excess of 5,100 metres of the Project.

11.0 Cumulative Visual Impact Assessment

11.1 Overview of Cumulative Visual Impacts

The Bulletin states: "*The visual assessment must assess, in accordance with the SEARs, the overall and broader landscape impacts of the proposed wind energy project. It will also address potential cumulative impacts of wind energy projects in the region (the proposed wind energy project, as well as existing and approved projects).*"

Cumulative landscape and visual effects result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it) or actions that occurred in the past, present or are likely to occur in the foreseeable future (Landscape Institute et al, 2008). Cumulative effects may also affect the way a landscape is experienced and can be positive or negative. Where they comprise benefits, they may be considered to form part of the mitigation measures.

The Draft Planning NSW Guidelines state that *"Cumulative impacts may result from a number of activities with similar impacts interacting with the environment in a region. They may also be caused by the synergistic and antagonistic effects of different individual impacts interacting with each other and may be due to temporal or spatial characteristics of the activities impacts."*

It is important the Project considers the potential cumulative effects on the immediate and broader regional context it forms part of.

A cumulative impact assessment has several dimensions:

- The impact of the wind farm, when added to the combined impacts of all other existing developments and environmental characteristics of the area.
- The impact of this development in the context of the potential for development of wind energy developments in the local, regional and national context.
- The impact of developments which are ancillary to or otherwise associated with the proposed wind farm eg. the development of transmission lines.
- The potential for future development of wind farms in the region.

11.2 Nearby Wind Farm Projects

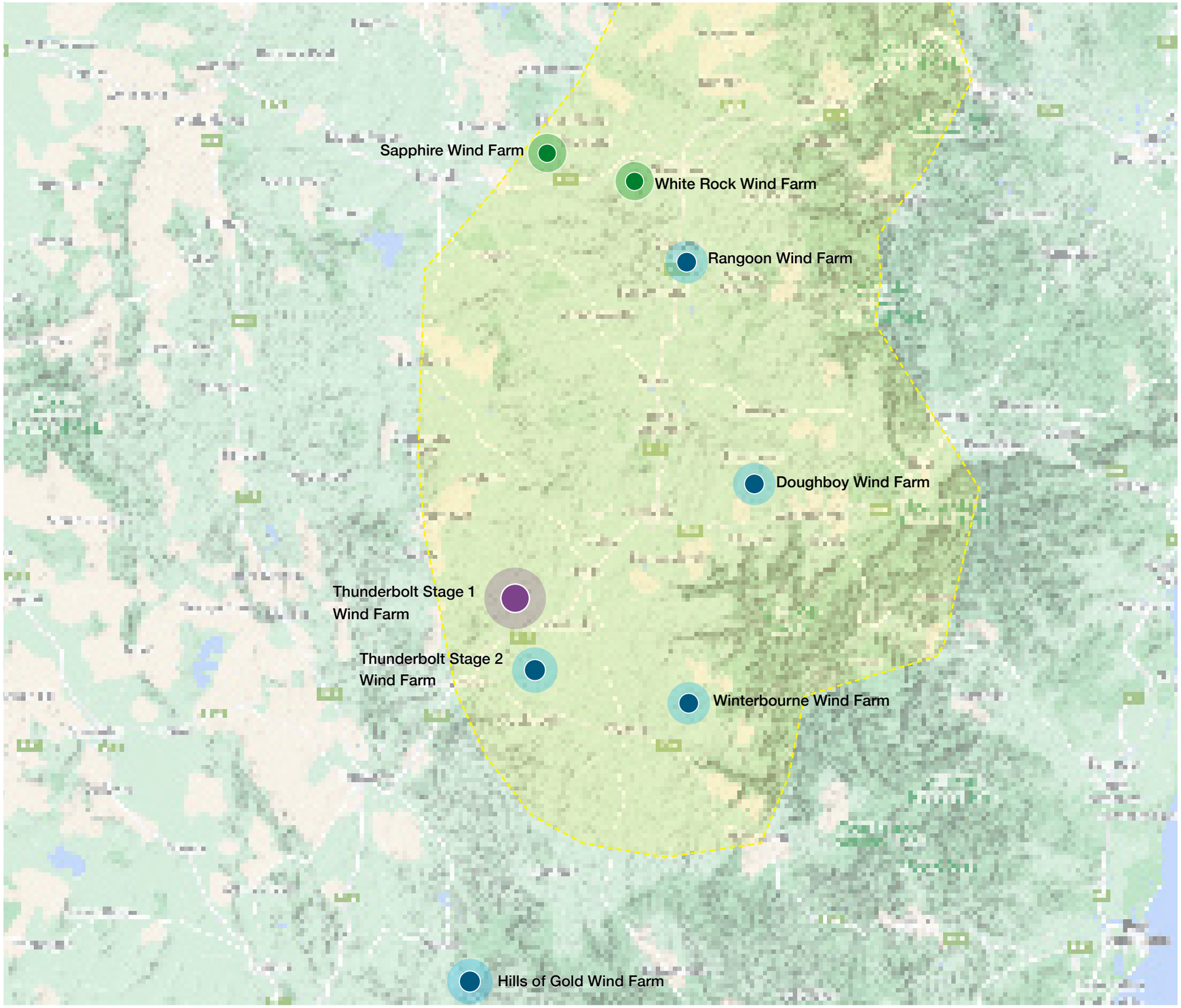
The New South Wales Government have identified three (3) key Renewable Energy Zones (REZ) in the State's Central-West Orana, New England and South-West regions. The purpose of the REZ is to deliver affordable egergy generation to help replace the State's existing power stations as they close over the coming decades (NSW, DPIE). The Project is located within the New England Renewable Energy Zone (REZ). The REZ has been identified by the NSW Government (indicated on ***Figure 20***).

There are seven (7) proposed and constructed wind farms within 110 kilometres of the Project. These are listed in ***Table 14*** and shown on ***Figure 20.***

Project	Distance to nearest turbine (Approximate):	Project Size: *Estimated	Planning Status
Operational Wind Farms:			
Sapphire Wind Farm	***109 km North***	***75 Turbines***	Operational
White Rock Wind Farm	***98 km NNE***	***119 Turbines***	Operational
Proposed Wind Farms:			
Ragoon Wind Farm	***82 km NNE***	****25 Turbines***	SEARs issued: August 2020
Doughboy Wind Farm	***74 km ENE***	****52 Turbines***	SEARs issued: October 2020
Winterbourne Wind Farm	***27 km South East***	****126 Turbines***	SEARs issued: September 2020
Hills of Gold Wind Farm	***84 km South***	****70 Turbines***	Response to submissions

Table 14 Summary of Nearby Wind Farm Projects

11.0 Cumulative Visual Impact Assessment



Nearby Wind Farms

LEGEND:

- Thunderbolt Wind Farm Project Boundary
- New England Renewable Energy Zone (REZ)
- Thunderbolt Stage 1 Wind Farm
- Proposed Wind Farm
- Operational Wind Farm

N

Figure 20** **Nearby Wind Farm Projects

11.0 Cumulative Visual Impact Assessment

11.3 Cumulative Impact of Thunderbolt Energy Hub - Stage 2

Thunderbolt Energy Hub - Stage 2 will form part of a separate future development assessment and approval process(es) and subject to further design would include further renewable energy generation capacity (wind and solar) located to the south of the New England Highway.

Due to the relatively close proximity, there are likely to be opportunities to view Stages 1 and 2 of the Thunderbolt Energy Hub Project simultaneously from nearby public and private viewpoints. As Stage 2 has not yet been prepared and submitted, the Visual Assessment Bulletin does not require a detailed cumulative impact assessment. The extent of potential cumulative impacts will therefore be assessed in more detail as part of the development application for the Stage 2.

It is important to note the Visual Assessment Bulletin states: *The cumulative landscape and visual impacts must be considered having regard to* ***existing and approved wind energy projects*** *(with turbines) located within eight kilometres of the proposed wind energy project.* There are no approved wind energy projects within 8 kilometres of the Project.

11.4 Cumulative Impact on the Broader Landscape Character

The Project is located on the southern edge of the land defined as the New England REZ (refer to ***Figure 20***). The existing landscape character of the region allows for optimum harvest of wind energy due to elevated topography, expanses of uninhabited land and minimal obstructions in the landscape. These characteristics are beneficial to the output of wind energy and it is inevitable that overtime this will be utilised for the development of wind farm projects.

The re-occurrence of wind farms within a region has the potential to alter the perception of the overall landscape character irrespective of being viewed in a single viewshed. As wind farm developments prevail it is important to determine whether the effect of multiple wind farms and other major infrastructure within the region would combine to become the dominant visual element, altering the perception of the general landscape character.

The potential cumulative visual impact must also be considered in relation to the potential visual impact when viewed sequentially. If a number of wind farms are viewed in succession as a traveller moves through the landscape (eg. motorist travel routes or walking tracks) this may result in a change in the overall perception of the landscape character. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (EPHC, 2010). The Project Area is located within a largely isolated area of land, setback from the New England Highway. There are very limited opportunities to view the Project along the New England Highway due to dense vegetation, speed and direction of travel. Due to the limited visibility of the Project, it is unlikely the perception of the regions broad landscape character will be altered as a result of the Project.

12.0 Associated Infrastructure Assessment

12.1 Overview of Associated Infrastructure

The Bulletin states: *"the assessment of visual impacts from all ancillary facilities and infrastructure will be required."*

In addition to the proposed wind turbines, the associated infrastructure (as described in ***Section 3.4*** of this report) is likely to contrast with the existing visual landscape. Due to the large scale and elevated siting of the proposed wind farm, access roads, transmission lines and other ancillary structures have the potential to alter the existing visual landscape. An overview of the potential visual impact resulting from associated infrastructure and project components is provided in this section of the report.

12.2 Access Roads

Access roads are proposed on site between the wind turbines and connecting to existing arterial roads. Access to the Project Area is proposed via the existing land owner access point off New England Highway. The access point is proposed to be upgraded as part of the Project.

Approximately 50 km of internal access roads will be constructed to provide access to the proposed WTG locations. This includes upgrades to some existing access tracks currently formed within the Project Area and the establishment of new access tracks. The layout of the proposed access road is shown on to ***Figure 21*** with micro-siting of the roads to be undertaken as part of the detailed design and construction process within the development corridor. The road surface width will typically range from 6-9m with additional works required for cut and fill batters and drainage structures (culverts etc.). The access roads and tracks will be maintained during the construction and operational phases of the Project providing access across the site.

Generally, the internal roads have been sited to reduce potential vegetation loss and limit earth work requirements. Due to the existing agricultural land use of the Study Area, farm roads traversing the landscape form a significant part of the existing landscape character. The proposed access roads are likely to be viewed as part of the existing character of the landscape. Mitigation measures for reducing residual visual impact resulting from the construction of access roads include:

- *Where possible utilise or upgrade existing roads, trails or tracks to provide access to the proposed turbines to reduce the need for new roads.*
- *Allow for the provision for down sizing roads or restoring roads to existing condition following construction where possible.*
- *Any new roads must minimise cut and fill and avoid the loss of vegetation.*
- *Utilise local materials where possible and practical.*

12.3 Transmission Lines

12.3.1 Internal Electrical Cables

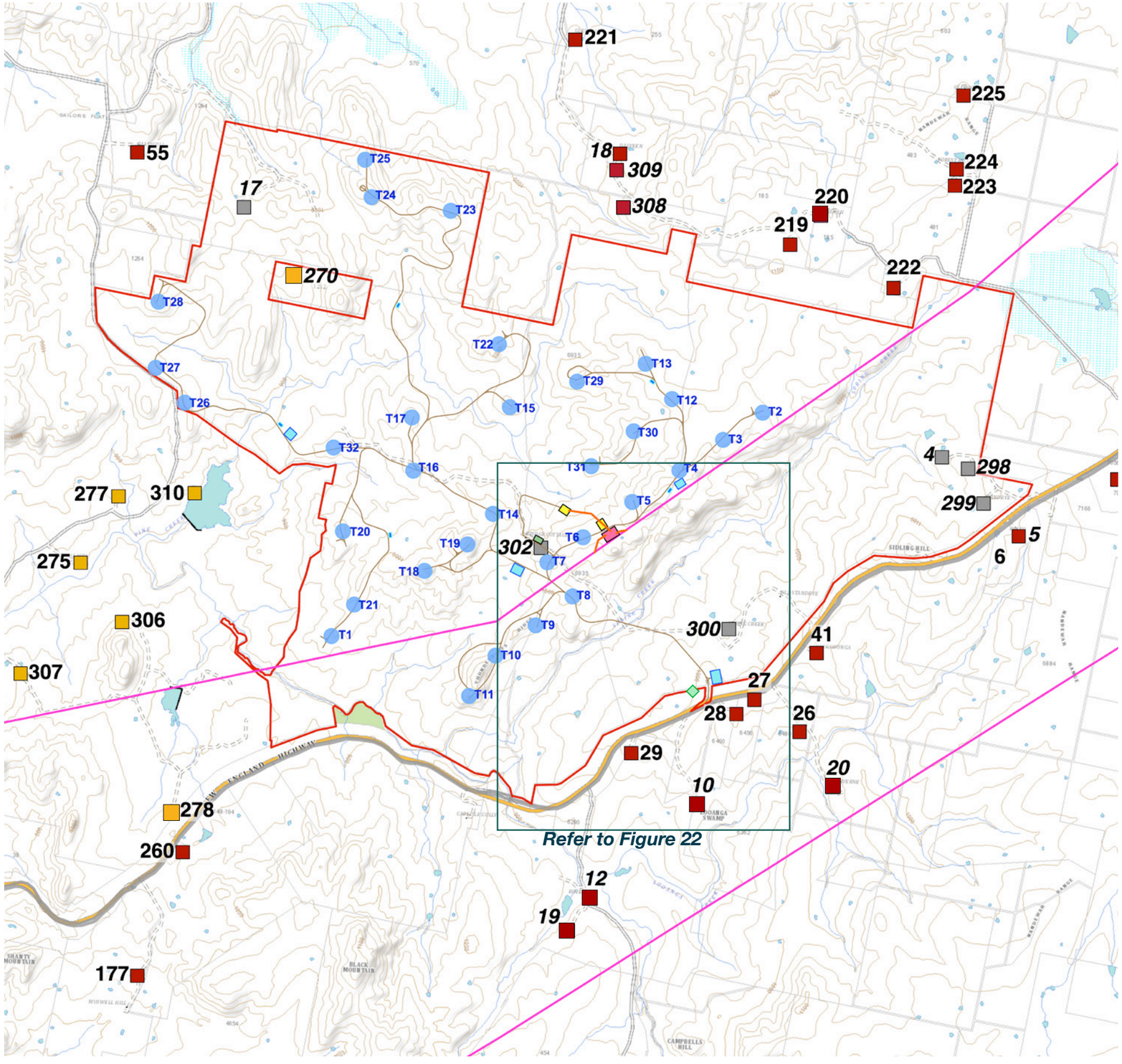
Each of the turbines will be connected to an onsite substation via a system comprising a network of underground and overhead electrical cables, at 33 kV, reticulating power from each WTG to the Collection Substations. An overhead 330kV transmission line is proposed between the substation and switching station. Due to the short distance and relatively isolated location, visibility of the 330kV transmission line is likely to be limited. The proposed internal electrical cables are in keeping with the scale and appearance of existing powerlines which are an existing element in the landscape.

Proposed mitigation methods to be considered during detailed design phase include:

- *Where possible underground cabling is to be used to connect wind turbines to the electricity grid.*
- *Utilise existing transmission lines where possible.*
- *The route for any proposed overhead transmission lines should be chosen to reduce visibility from surrounding areas.*
- *Plan route to minimise vegetation loss.*
- *Use of subtle colours and a low reflectivity surface treatment on power poles to ensure that glint is minimised.*

With these design considerations, the potential visual impact resulting from the transmission lines is anticipated to be ***negligible.***

12.0 Associated Infrastructure Assessment



Associated Infrastructure

Thunderbolt Energy Hub - Stage 1

LEGEND:

- Project Boundary
- Proposed 260m Turbine Location
- Existing 330 kV Transmission Line
- Proposed 330 kV Transmission Line
- Substation location options
- Switching Station
- O & M Facility
- Site Access Point
- Batching Plant
- Laydown Area
- Associated Dwelling (Host Landowner)
- Associated Landowner Dwelling
- Non-associated Dwelling

Figure 21** **Associated Infrastructure

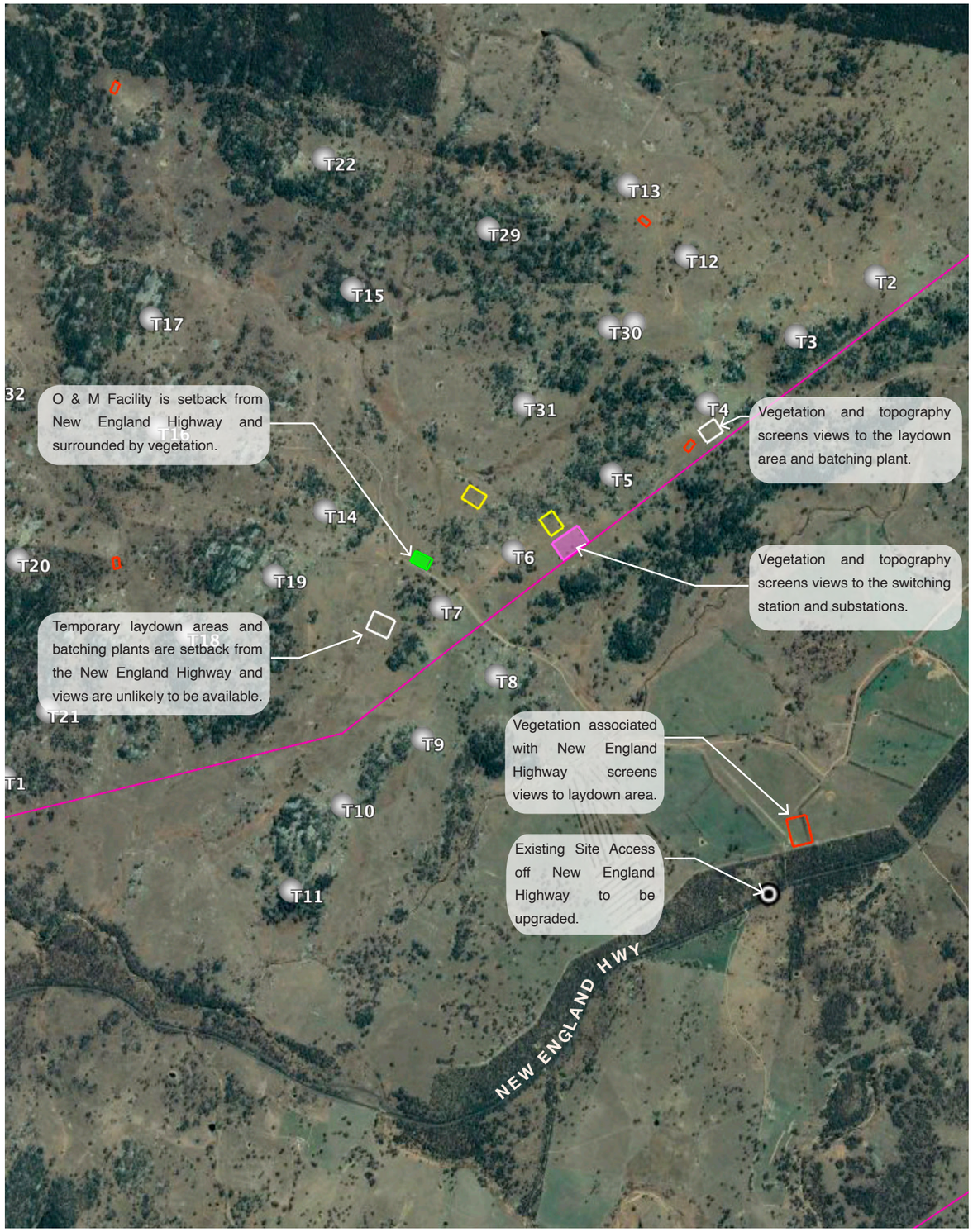


Figure 22 ***Associated Infrastructure***

12.4 Switching Station

A switching station (approximately 200 m x 130 m) will be included as part of the electrical reticulation network. The switching station will connect the Project transmission line to the existing 330 kV transmission lines, from the proposed onsite substation.

The nearest non-associated dwellings are 2.9 kilometres south of the switching station (Dwelling 27, 28 and 29). Opportunities to view the switching station are unavailable due to dense vegetation associated with the New England Highway to the north of the dwellings.

12.5 Ancillary Structures

12.5.1 Substation

The Project will include one substation located at one of two sites (refer to ***Figure 22***). Two site options have been included to provide flexibility in the final detailed design process and approval is sought for both options, with only one site to be used. Both sites have been assessed in this EIS. The substation will include a range of electrical equipment to manage and control the supply of electricity.

There are no non-associated dwellings within 2,000 m of the proposed substation locations. Due to the isolated location, within the Project Area the potential visual impact has been rated as ***negligible***.

12.5.2 Site Operations and Maintenance Facility (O&M)

A permanent site operations and maintenance facility will be constructed to support the ongoing operation of the wind farm. The operations and maintenance facility will be used in an ongoing basis to support maintenance and repair activities associated with the operations phase of the Project. This will include an office with staff amenities (kitchenette, toilets, shower), car park, workshop/shed and laydown/temporary storage area. The facility will have a footprint of approximately 1 ha.

The smaller scale of ancillary structures including the proposed substation and site compound have the ability to be screened by topography, existing vegetation or proposed screening vegetation. The following mitigation measures would assist in reducing any residual visual impacts:

- *Siting to ensure minimal vegetation loss.*
- *Consideration should be given to controlling the type and colour of building materials used. Where possible a recessive colour palette is to be used which blends into the existing landscape (see*

*example provided in **Image 16**).*

- *Avoidance of unnecessary lighting, signage on fences, logos etc.*
- *Any proposed buildings to be sympathetic to existing architectural elements in the landscape.*
- *Minimise cut and fill and loss of existing vegetation throughout the construction process.*
- *Boundary screen planting is an effective mitigation method which could be utilised to ameliorate potential visual impacts resulting from the construction of ancillary structures with a small vertical scale such as collector substations, switching stations and the operations facilities building. Due to the negligible impact of the ancillary structures, screen planting is not deemed necessary.*

*Image 16. **Example of a building colour palette sympathetic to the surroundings***

12.5.3 Meteorological Monitoring Masts

One (1) 80m meteorological monitoring mast is currently located within the Project Area to record wind speed and other meteorological data. An additional six (6) monitoring masts will be erected (up to 170m high) located in proximity to the proposed WTGs within the development corridor. All masts will be designed and constructed to the appropriate aviation safety specifications.

12.6 Summary of Visual Impacts - Associated Infrastructure

Table 15 provides an summary of the potential visual impacts resulting from each component.

Component:	Location:	Distance to nearest non-associated dwelling:	Visual Impact Rating:
Permanent Ancillary Structures			
Switching Station	***Within Project Site***	***2.9 km (Dwelling 27, 28 & 29)***	Nil
Substation	***2 x Locations ithin Project Site***	***> 2km***	Nil
Meteorological Masts	***Within Project Site***	***> 2km***	Negligible
Transmission Lines			
High voltage (330 kV) power line	***Within Project Site***	***> 2km***	Nil
Temporary Facilities			
Batching Plant	***4 x Locations***	***> 2km***	Negligible
Laydown Area	***Within Project Site***	***> 2km***	Negligible
Access Roads and Upgrades			
Internal Access Roads	***Within Project Site***	***Varies***	Negligible

Table 15. Overview of potential visual impacts associated with Ancillary Structures

13.0 Night Lighting Assessment

13.1 Overview of Night Lighting

The following section of the report provides an assessment of the visual impacts of potential night lighting of the Project. Night lighting has the potential to result in the alteration of the night time landscape character of the region. Potential light sources include:

- Aviation Hazard Lighting (AHL) on nacelle of wind turbines (height of up to 170 metres AGL)
- Night lighting for safety and security on ancillary structures.

It is important to note **no WTG lighting is proposed**. The Aviation Impact Assessment indicates that the WTGs will not require obstacle lighting to maintain an acceptable level of safety to aircraft. Civil Aviation Safety Authority (CASA) will provide recommendations on aviation lighting requirements post exhibition.

13.1.1 Dark Sky Planning Guidelines

The Dark Sky Planning Guidelines have been developed by the Department of Planning and Environment (June 2016) provide guidelines for lighting practices that support the maintenance of a dark sky and improve lighting practice. The guidelines are related to projects within 200 kilometres of the Siding Spring Observatory, and provide relevant guidance to reduce potential light pollution. Although the Project is located in excess of 200 kms of the Siding Spring Observatory (near Coonabarabran, NSW) the guidelines can be applied to lighting design for Aviation Hazard Lighting and Ancillary Infrastructure for the Project.

13.2 Overview of Aviation Hazard Lighting

The Aviation Impact Assessment recommends no lighting is required. The requirement of aviation hazard lighting (AHL) on wind turbines for the Project is subject to the advice of the Civil Aviation Safety Authority (CASA). It is noted that the turbines proposed for the Project have a maximum tip height of 260m and CASA generally recommends night lighting if an obstacle exceeds 150 metres above ground level.

Although this is subject to detailed design, the potential CASA requirements for lighting could include:

- Two flashing red medium intensity obstacle lights should be provided per turbine where required.
- The light fixtures should be mounted sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and are at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction.
- Sufficient individual wind turbines should be lit to indicate the extent of the group of turbines.
- The interval between obstacle lighted turbines should not exceed 900m, and the most prominent (highest for the terrain) turbine(s) should be lit. (CASA, 2004).

As the intensity and location of proposed obstacle lights are relatively unknown at this stage, representative photomontages of the proposed obstacle lighting of the Project have not been included in this report.

Representative images of aviation lighting (installed in August 2020) on turbines at Biala Wind Farm have been included to best illustrate the potential visual appearance of aviation lighting. Photographs of the aviation lighting at varying distances and times have been included in this report. Following consultation with NSW Department of Planning, Industry and Environment and other relevant authorities, the Biala Wind Farm aviation hazard lighting were turned off on 4th of June 2021, less than 12 months after installation.

Images 17 - 22 illustrate the effect of night lighting on a dark rural landscape at intervals after sunset.

Image 17. View towards Biala Wind Farm - 1.75 Kilometres from turbine at 6:35pm (45 minutes after sunset)

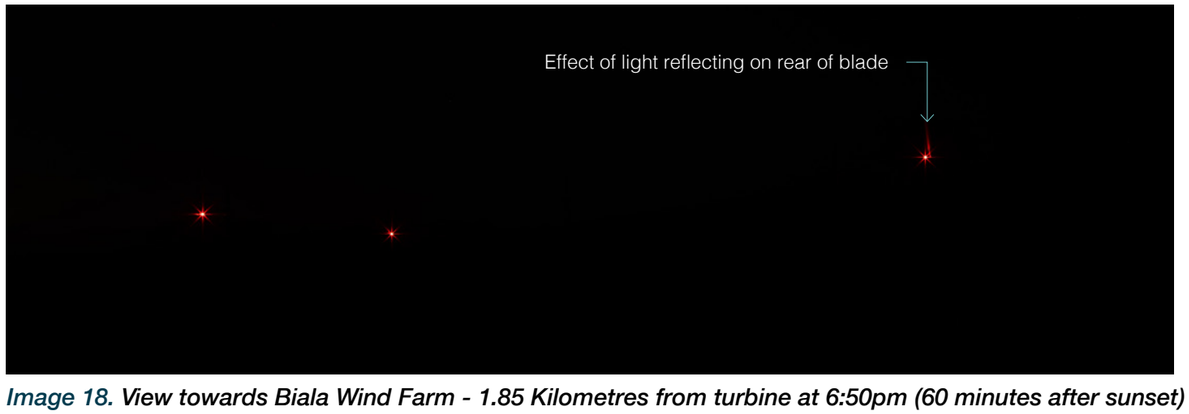


Image 18. View towards Biala Wind Farm - 1.85 Kilometres from turbine at 6:50pm (60 minutes after sunset)

13.0 Night Lighting Assessment

Image 19. View towards Biala Wind Farm - 3.5 Kilometres from turbine

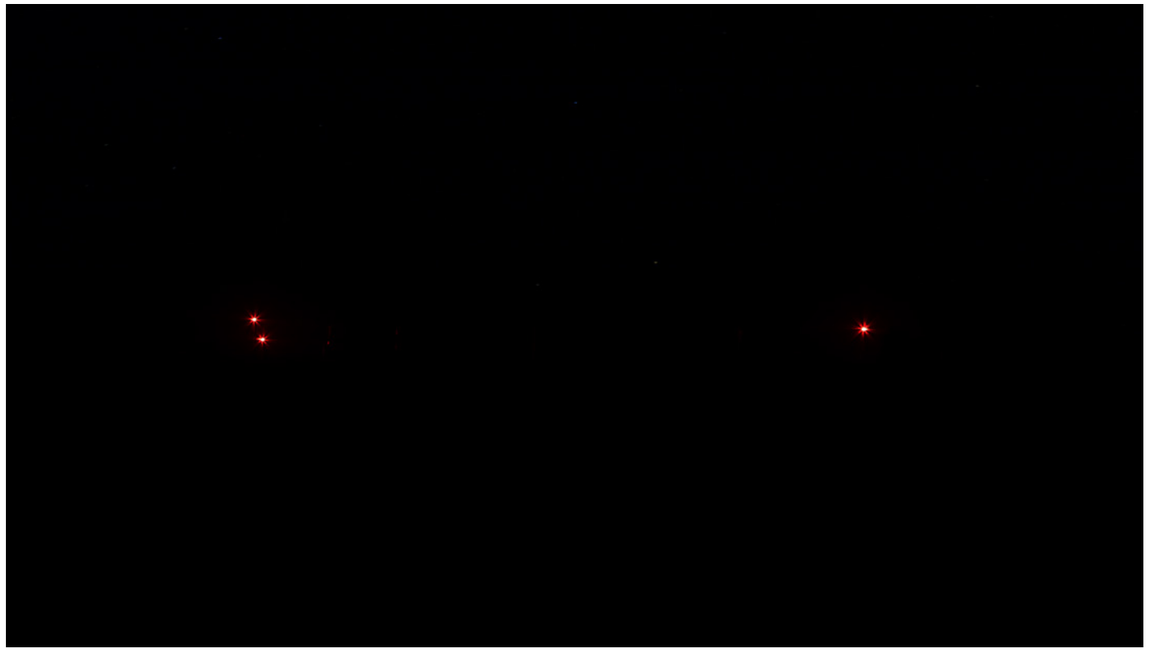


Image 20. View at night towards Biala Wind Farm - 3.5 Kilometres from turbine

Image 21. View towards Biala Wind Farm - 8.5 Kilometres from turbine

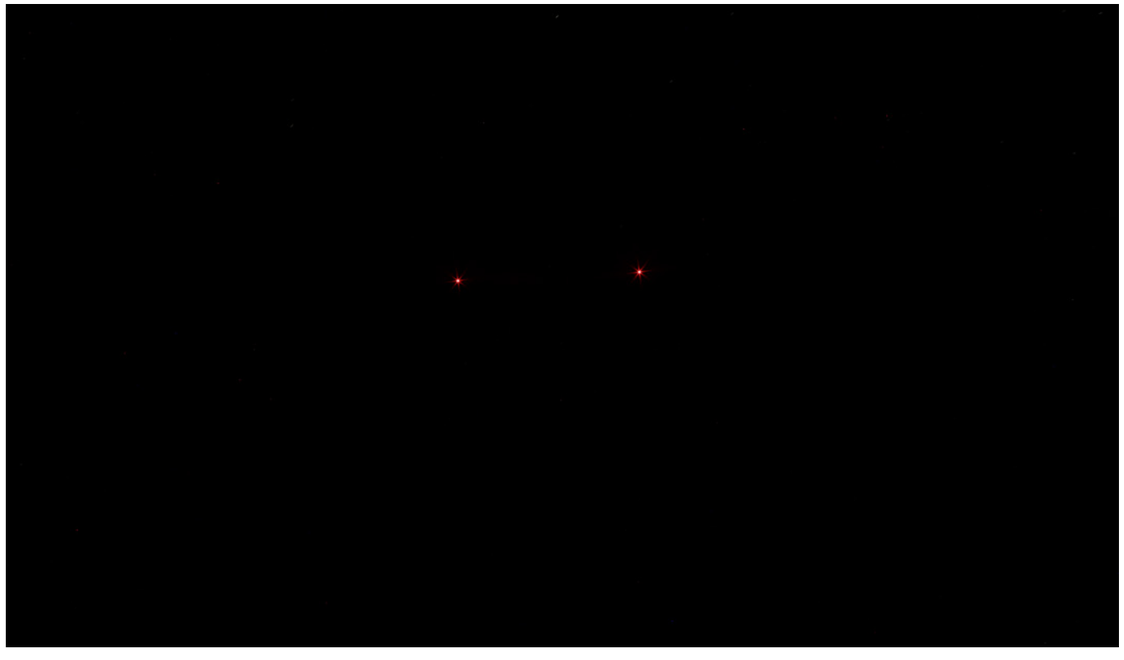


Image 22. View at night towards Biala Wind Farm - 8.5 Kilometres from turbine

13.0 Night Lighting Assessment

13.2.1 Overview of potential visual impacts from Aviation Hazard Lighting

Night lighting of turbines and associated infrastructure has the potential to extend the visual effect into the night time. Aviation hazard lighting has the potential to be visible from distances in excess of 20 kilometres (Scottish Natural Heritage). However, the distance depends on a number of variables, including light intensity, topography, vegetation coverage and climatic conditions.

Due to the relatively isolated location of the Project, very little existing sources of lighting are present in the night time landscape of the Study Area. Some existing lighting associated with homesteads and motor vehicles is dispersed around the Study Area. Isolated receptors within the Study Area experience a dark night sky with minimal light sources. The impact of night lighting is unlikely to be experienced from inside of a dwelling as internal lights reflect on windows and limit views to the exterior at night time.

The highest visual impact is likely to be people who experience the night landscape outdoors. Dark sky is a valued quality of the rural landscape, due to the lack of light pollution. Aviation lighting has the potential to impact on receptors who view the landscape at night, in particular night-sky enthusiasts, photographers, star gazers, campers and some land owners with potential visibility of the turbine hubs.

The visual impact of potential aviation lighting could be reduced by employing mitigation methods outlined in ***Section 13.3***. Considering the high elevation of the turbines and the implementation of shields, the source of visible light is likely to be reduced to ambient lighting as opposed to direct visibility of the light itself when viewed from a close proximity.

The Uungula Wind Farm (located to the east of Wellington in NSW) was approved in May 2021 with a recommendation to include low intensity aviation lighting (200 candela) which is considerably lower than the 2,000 candela required by international standards.

13.3 Recommendations to mitigate Aviation Hazard Lighting

The Bulletin states: *If such lighting is required, the CASA guidelines recommend that to minimise visual impacts "obstacle lights may be partially shielded, provided it does not compromise their operational effectiveness. Where obstacle lighting is provided, lights should operate at night, and at times of reduced visibility. All obstacle lights on a wind farm should be turned on simultaneously and off simultaneously." The lights should be fully shielded from the view of any dwelling within. As part of the assessment of visual impacts of wind energy projects, the Department will consider whether any obstacle lighting required is likely to result in any significant increase in visual impacts.*

To assist in the amelioration of the effect of Aviation Hazards Lighting on wind turbines the following should be applied:

- If used, aviation lights are generally required to be spaced over the array, particularly at the extremities. They are not required on every tower. Where possible, careful consideration of turbines upon which aviation lighting is installed to avoid unnecessary impact upon residences.
- Treatment of the rear of blades with a non-reflective coating to reduce reflection off the rotating blade at night.
- Use of the lowest candela intensity allowed by CASA.
- According to the CASA requirements, shielding may be provided to restrict the downward spill of light to the ground plane by ensuring that no more than 5% of the nominal light intensity should be emitted at or below 5° below horizontal.
- No light should be emitted at or below 10° below horizontal.

An example of how aviation lighting can effectively shield the emission of light has been provided from Dwelling 310 (within approximately 2 kilometres of the nearest turbine). Refer to ***Figure 23.***

Overtime as wind farm development has occurred throughout New South Wales, there are precedents for the review of the requirement of aviation lightings on a number of wind farms post-construction. The Biala Wind Farm aviation lights were operational for less than 12 months (installed in August 2020 and switched off in June 2021). In the Upper Lachlan Shire, on November 1, 2010 Cullerin Wind Farm, owned by Origin Energy, switched off turbine aviation lighting after guidelines set out by CASA were withdrawn. Requirement of aviation lighting for Crookwell 2 Wind Farm was reviewed by CASA in 2019 and allowed to be turned off (Crookwell Gazette, 2019).

It is important to reiterate the recommendations of the Aviation Impact Assessment suggest no obstacle lighting will be required for the Project to maintain an acceptable level of safety to aircraft.

13.0 Night Lighting Assessment

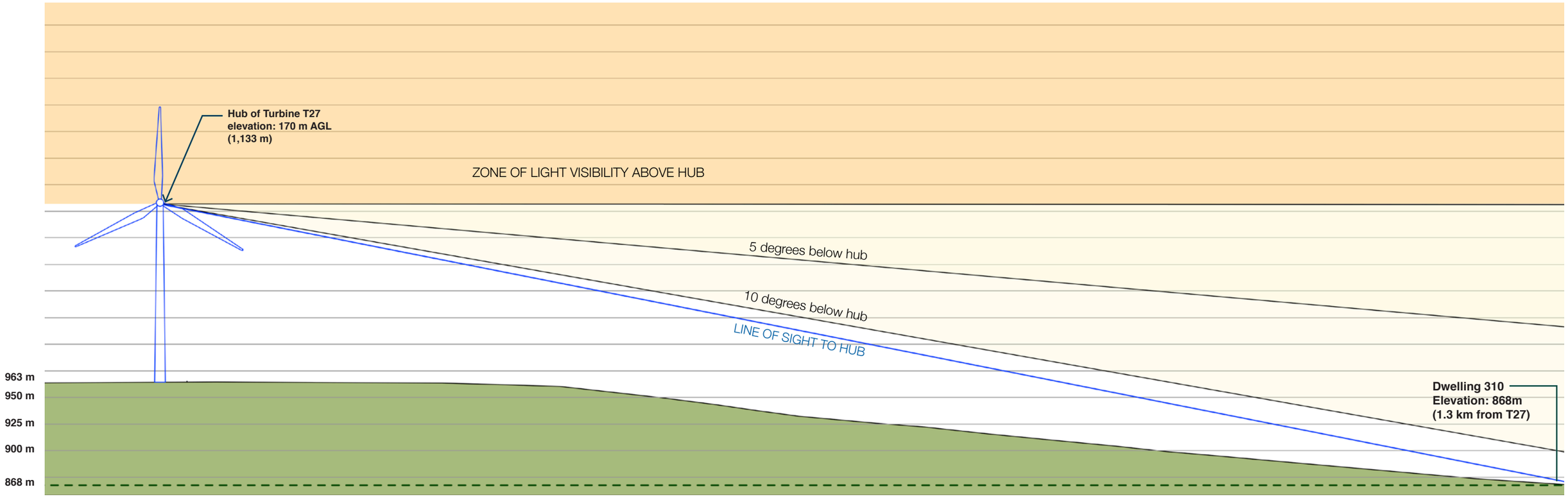


Figure 23 ***Example of effectiveness of Aviation Shielding at Dwelling 310 (Dwelling approximately 1.3 km from nearest turbine - T27)***

13.0 Night Lighting Assessment

13.4 Potential Impacts of Lighting Associated with Ancillary Infrastructure

In addition to aviation hazard lighting on wind turbines, night lighting is likely to be required on ancillary infrastructure including switching stations, collector substations and facilities buildings. At this stage of the Project, the location and type of lighting required on the proposed substations and facilities buildings is to be confirmed. The light sources are limited to low-level lighting for security, night time maintenance and emergency purposes. There will be no permanently illuminated lighting installed.

The proposed ancillary infrastructures have been carefully sited to minimise visibility from existing residences and publicly accessible viewpoints. It is unlikely the proposed night lighting associated with the ancillary infrastructure would create a noticeable impact on the existing night time landscape.

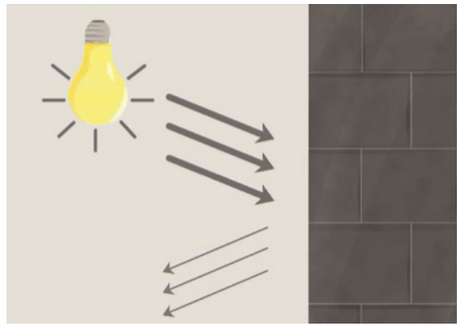
The following principles will be incorporated into lighting design during the detailed design phase of the switching station, substation, O&M Facility and any other structures requiring lighting. If design principles are incorporated into the night lighting for Ancillary Infrastructure, it is likely there will be no visual impacts resulting from night lighting of Ancillary Structures.

1. Control the level of lighting:

- Only use lighting for areas that require lighting ie. paths, building entry points.
- Reduce the duration of lighting:
    - Switch off lighting when not required
    - Consider the use of sensors to activate lighting and timers to switch off lighting

2. Lighting Design:

- Use the lowest intensity required for the job
- Use energy efficient bulbs and warm colours
- Direct light downwards
- Ensure lights are not directed at reflective surfaces
- Use non-reflective dark coloured surfaces to reduce reflection of lighting (**Figure 24**)
- Keep lights close to the ground and / or directed downwards (**Figure 25**)
- Use light shield fittings to avoid light spill (refer to **Figure 26**).

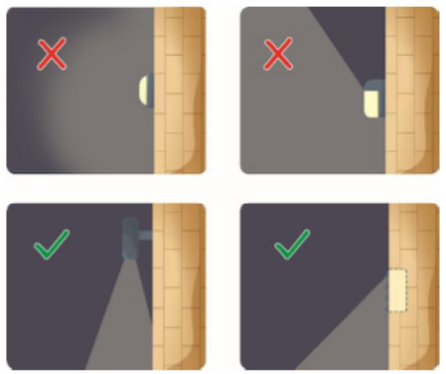


Non-reflective dark coloured surfaces:

In accordance with the recommendations of the LVIA, the O & M Building and any other structures are to be painted in a dark, non-reflective paint to reduce reflectivity from lighting and remain sympathetic to the surrounding landscape.

Figure 24. Surface Reflectivity

Source: Department of Environment and Energy National *Light Pollution Guidelines for Wildlife* (2020)



Downward lighting:

Where possible lights are to be directed downwards.

Figure 25. Downward Lighting

Source: Department of Environment and Energy *National Light Pollution Guidelines for Wildlife* (2020)

Use of Lighting Shields:

Where necessary for safety, lighting should be fully or partially shielded to prevent light spill into surrounding areas.

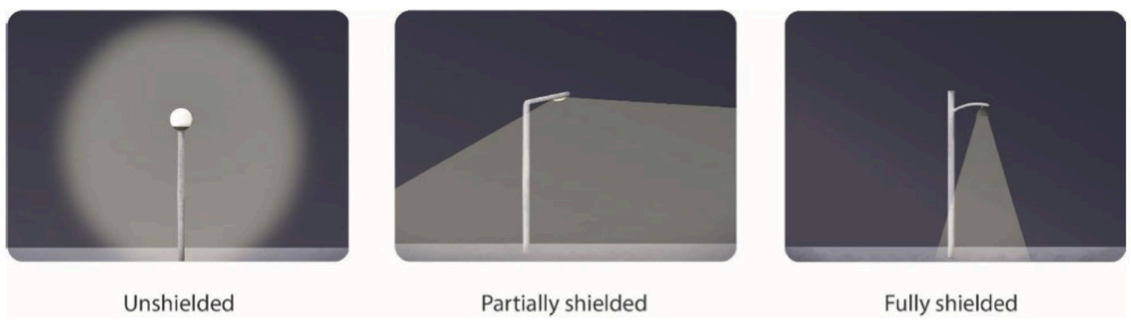


Figure 26. Light Shielding

Source: Department of Environment and Energy *National Light Pollution Guidelines for Wildlife (2020)*

14.0 Visual Impacts on Landscape Character

14.1 Overview of Visual Impacts on Landscape Character

The Project is to be located within a predominantly rural landscape that has not been identified as significant or rare. The broad landscape character is dominated by established rural land which consists primarily of modified undulating hills. Generally, the Scenic Quality Classes of the Landscape Character Units (LCU) within the Study Area have been rated as low and moderate (refer to Section 5.0).

There is little doubt that the Project, regardless of how visible it actually is, would become a feature of the area. However, the degree to which the existing landscape character and significance is altered as a result of the Project, is determined by the dominance of the proposal in relation to the existing landscape features. The assessment undertaken from public viewpoints and private dwellings has determined the dominance of the Project is low. This is largely due to existing vegetation and topography screening the Project from public and private locations.

It is anticipated the character of areas which are valued for their landscape quality and utilised for recreation and tourism will remain intact. Regionally, significant landscape features identified in the Visual Baseline Study (***Section 5.0*** of this report), would remain dominant features of the landscape and it is unlikely the Project would degrade the scenic value of these landscape features.

14.2 Overview of the Visual Impact on LCUs

Table 17 provides an overview of the assessment of the potential visual impacts on the existing landscape character of the local area for each Landscape Character Unit (LCU) as characterised in ***Section 5.0*** of this report. An evaluation of the potential visual impacts has been undertaken using the visual performance objectives as outlined in the Bulletin.

Table 16 provides a summary of the findings.

Of the five (5) LCU's identified and assessed, the Project is likely to be visible from all, to varying degrees. Due to the undulating topography surrounding the Project Area, there are limited opportunities to view the Project in its entirety.

14.0 Visual Impacts on Landscape Character

Summary of Visual Impacts of Landscape Character Units			
LCU:	**Scenic Quality Rating:**	**Assessment of Potential Visual Impact:**	**Refer to:**
LCU01 Densely Vegetated Hills	**Moderate** *Refer to Appendix A1*	The LCU is generally characterised by densely vegetated and undulating land to the north, west and south west of the Project Area. A number of high points, ridges and ranges are located within this LCU, forming key features in the landscape. The LCU is largely unimhabited and views from within the LCU are generally limited to a small number of private properties and roads through the LCU. An assessment of the impact on the LCU has been aided by the Zone of Visual Influence and on site ground truthing of vegetation. The assessment determined dense vegetation and undulating hills which characterise the LCU will limit views to the Project from the majority of dwellings and publicly accessible roads within the LCU. As a result, the scenic quality of the LCU will remain intact. The key features of the LCU are the densely vegetated hills and ranges which provided a backdrop to views from the surrounding areas. The Project is unlikely to disrupt views to the LCU.	• ***Refer to Viewpoints T21 & T22***
LCU02 Partially Vegetated Hills	**Moderate** *Refer to Appendix A2*	The LCU is characterised by the partially vegetated hills within and surrounding the Project Area. Generally, the landscape character of the LCU will remain intact, with the exception to the land located within the Project Area. Generally, views towards the LCU are largely limited to roads which are typically contained by dense vegetation (particularly on the New England Highway and Green Valley Road). Where views are available, the undulating character of the LCU limits opportunities to view the Project in its entirety. Views to the Project will be available from private property within the Project Areas and its immediate surrounds. The Project will alter the character within Project Area, however the majority of impacted private land is associated with the Project through host landowner or negotiated agreements.	• ***Refer to Viewpoints T15, T16, T18, T20***
LCU03 New England Pastures	**Low** *Refer to Appendix A3*	The Project is unlikely to result in any alterations to the scenic integrity of the New England Pastures LCU. Views to the Project will be largely contained by topography to the east of the Project Site or vegetation associated with roadsides. Where views are available these will be in the distance. The LCU is largely uninhabited and utilised for agricultural purposes. A small number of dwellings located within the LCU have been assessed and the impacts have been determined as negligible or low due to intervening vegetation. The Project is unlikely to alter the scenic integrity of the LCU.	• ***Refer to Viewpoints T05, T06 and Photomontage 02.***
LCU04 Oxley Pastures	**Moderate** *Refer to Appendix A4*	The LCU is located to the south of the Project Area and characterised as the undulating pastures between the New England Highway and Oxley Highway. Land in this LCU is largely inaccessible to the public. A number of dwellings accessed off the New England Highway are located along the northern edge of the LCU. Dwellings along the New England Highway are generally orientated to the south to take advantage of expansive views across the LCU. Views to the Project to the north are completely screened or significantly limited by vegetation associated with the New England Highway. Views to the Project from the Oxley Pastures LCU are therefore limited and the scenic integrity of the LCU will remain intact.	• ***Refer to Viewpoints T07, T08, T09, T10, T11, T13, T14, T15, T19 and Photomontage 03.***
LCU05 Kentucky	**Low** *Refer to Appendix A5*	The LCU is defined as the rural land within and surrounding Kentucky and Kentucky South. The LCU is the most populated of the LCU's and located to the south east of the Project Area. The LCU is generally in excess of 8 kilometres of the WTGs. Visibility to the Project Area from the Kentucky LCU is limited by a combination of topgoraphy, distance and intervening elements such as vegetation and structures. Although the proposed wind turbines are likely to be discernible from some areas within the LCU, the Project will not dominate the visual catchment of the Kentucky LCU.Due to the distance, the Project will form a minor element in the overall visual landscape. The landscape elements which contribute to the scenic quality of the LCU will remain unchanged as a result of the proposal.	• ***Refer to Viewpoint T02 & T23 and Photomontage 01.***

Table 16. Summary of Visual Impacts on Landscape Character Units

15.0 Mitigation Methods

15.1 Overview of Mitigation Methods

This section of the report provides recommendations which seek to achieve a better visual integration of the proposal and the existing visual character at both local and regional scales. The mitigation measures attempt to lessen the visual impact of the proposed wind farm whilst enhancing the visual character of the surrounding environment.

Mitigation measures are best considered as two separate phases. These include:

- Primary measures that form part of the development of the wind farm design through an interactive process;
- Secondary measures designed to specifically address the remaining (residual) negative (adverse) effects of the final development proposals (The Landscape Institute et al 2008).

It is important to note that the mitigation methods proposed in this report are made notwithstanding issues raised by other consultants (eg. engineering, ecology, geology etc.). During the planning and design phase of a wind farm mitigation strategies should also be considered to lessen the visual impact of the proposal. This is by no means an exhaustive list, however the adoption of these recommendations will assist considerably in ensuring the proposal contributes positively to the visual quality and character of the area.

Mitigation methods considered for associated infrastructure has been included in ***Section 13.0***.

15.2 Project Layout and Design

The design of the proposed wind farm is a primary measure of mitigation. The general principles employed through the project design phase can significantly reduce the visual impact. These include siting, access, layout and other principles which directly impact the appearance of the proposed development. General guidelines for the design development of the Project have been outlined in the following section.

15.2.1 Wind Farm Layout and Size

The layout and size of the wind farm is a significant factor in the visual impact on the landscape. According to Stanton (1995) the intrusiveness of a wind farm is not directly proportional to the number of turbines in an array, and instead, more a factor of design feature. For example, large wind farms may appear less dominating than a smaller project when the large wind farm is subdivided into several visually comprehensible units.

It is suggested that fewer and more widely spaced turbines present a more pleasing appearance than tightly packed arrays (URBIS, 2009). The following principles should guide the design process of the wind farm:

- Controlling the location of different turbine types, densities and layout geometry to minimise the visual impacts.
- The lines of turbines should reflect the contours of the natural landscape as best as possible.
- Ensure the turbines are evenly spaced to give a regular pattern creating a better balance within the landscape.

It is important to note that as a result of community consultation during the development period, the Project has undergone many changes. The above design principles have been considered in the siting of the proposed turbines to provide a balanced appearance along the ridgelines.

15.2.2 Wind Turbine Design and Colouring

Turbine design and colouring are an important factor. The turbines will have a matte white finish and consist of three blades which is consistent with the current turbine models being considered.

The important factors to achieving a visual consistency through the landscape include:

- Uniformity in the colour, design, rotational speed, height and rotor diameter.
- The use of simple muted colours and non-reflective materials to reduce distant visibility and avoid drawing the eye.
- Blades, nacelle and tower to appear as the same colour.
- Avoidance of unnecessary lighting, signage, logos etc.

15.0 Mitigation Methods

15.3 Mitigation Methods - Residences

In accordance with the Bulletin, a detailed assessment of dwellings identified within the visual catchment has been undertaken and (where possible) mitigation methods have been recommended to assist in reducing any residual impacts.

Of the ***27*** non-associated dwellings assessed within the blue line of visual magnitude (5,100 m from the nearest turbine) a total of seven (7) non-associated dwellings residences were identified through the visual assessment as having the potential for a moderate visual impact. Mitigation measures have been suggested for the seven (7) non-associated dwellings with a moderate impact.

Application of mitigation methods as described in this section of the report could reduce the potential visual impact rating. ***Table 17*** provides an overview of the potential mitigation options.

Screen planting was identified as a potential mitigation measure for all seven (7) non-associated dwellings.

Mitigation measures have been proposed for four (4) associated dwellings with a moderate visual impact rating (Dwellings: 275, 279, 307 and 306). Proposed mitigation measures have been included in the dwelling assessments in ***Appendix D*** and will be undertaken in consultation with the associated landowners. An example of mitigation measures proposed for Dwelling 306 is presented in ***Figure 28*** and ***Figure 29***.

Two (2) associated dwellings were assessed as having a high visual impact rating (310 and 277). Mitigation measures have been recommended in the dwelling assessment (refer to ***Appendix D***) for Dwelling 277 (and illustrated in ***Figure 30*** and ***Figure 31***). Due to its location on the lake, mitigation measures are not available for Dwelling 310, however this has been acknowledged by the landowner prior to entering into a negotiated agreement.

Summary of Proposed Mitigation Measures: Dwellings within Black Line of Visual Magnitude				
Dwelling:	***Visual Impact Rating (without mitigation):***	***Proposed Mitigation Measures:***	***Estimated Time Frame:***	***Visual Impact Rating (with mitigation measures implemented):***
12	***Moderate***	**Screen Planting:** Screen planting to the north west of the dwelling.	***2 - 5 Years***	***Negligible - Low***
19	***Moderate***	**Screen Planting:** Screen planting to the north west of the dwelling.	***2 - 5 Years***	***Negligible - Low***
18	***Moderate***	**Screen Planting:** Scattered screen planting to the south west of the dwelling.	***2 - 5 Years***	***Negligible***
221	***Moderate***	**Screen Planting:** Scattered screen planting to the south west of the dwelling.	***2 - 5 Years***	***Negligible***
226	***Moderate***	**Screen Planting:** Screen planting to the south east of the dwelling.	***2 - 5 Years***	***Negligible***
309	***Moderate***	**Screen Planting:** Screen planting to the south east of the dwelling.	***2 - 5 Years***	***Negligible - Low***
Summary of Proposed Mitigation Measures: Dwellings between Black and Blue Line of Visual Magnitude				
20	***Moderate***	**Screen Planting:** Screen planting to the north west of the dwelling.	***2 - 5 Years***	***Negligible - Low***

Table 17: ***Overview of mitigation measures identified for non-associated dwellings within 5,100 m***

15.0 Mitigation Methods

15.3.1 Residence Screen Planting

In circumstances where residences are subject to a level of visual impact, screen planting is an option proposed to assist in mitigating views of turbines from residential properties. As the viewing location of the proposal would be generally fixed there is opportunity to significantly reduce potential visual impact from the proposal.

In order to achieve visual screening planting between the intrusive element and the homestead, tree planting could be undertaken in consultation with the relevant landowners to ensure that desirable views are not inadvertently eroded or lost in the effort to mitigate views of the turbines.

An example of how screen planting could be used to mitigate potential views towards visible WTGs from **Dwelling 277** illustrated in ***Figure 27***. Note this is an example only and a detailed analysis would be required to determine the extent of visibility, existing planting and orientation of the residence.

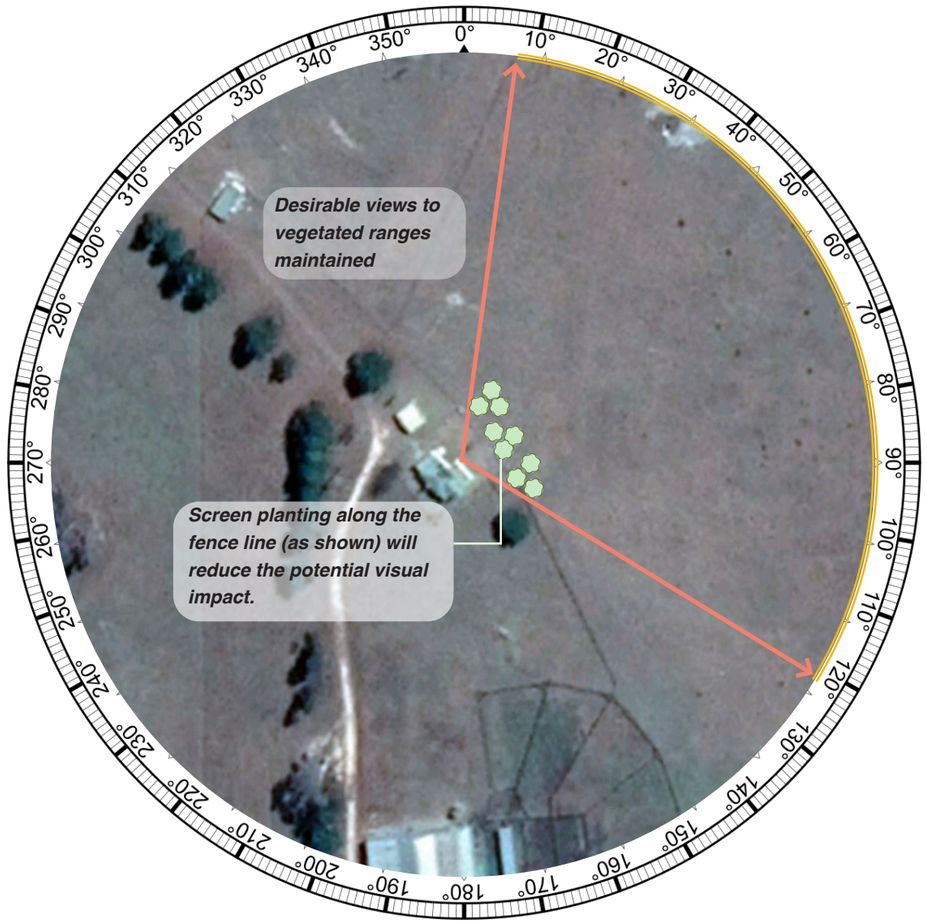


Figure 27 ***Example of mitigation principles (Dwelling 277)***

15.3.2 Residence Supplementary Planting

Due to the vegetated character of areas surrounding the Project Area the Project is likely to be fragmented or screened by vegetation from a number of dwellings. Where turbines are located close to the dwelling or existing intervening vegetation is thin, supplementary planting is a mitigation method that has been identified. Supplementary planting in keeping with the existing landscape character would further reduce potential visibility and ensure longevity of the intervening vegetation.

Existing scattered vegetation obstructs views towards some wind turbines from this location. Existing vegetation is scattered in the middle ground. Where screening may be required from a static position (ie. kitchen / living room window) screen planting sited away from the residence ensures desirable views across land are retained where possible, whilst selectively screening views to WTGs.

Two photomontages (one with and one without mitigation) have been prepared from Dwelling 277 (refer to **Figure 28** and **Figure 29**) to illustrate how the mitigation measures can be employed to reduce the visual impact.

15.0 Mitigation Methods

***Figure 28** Proposed View from Dwelling 277*

***Figure 29** Proposed View from Dwelling 277 with mitigation measures implemented*

15.0 Mitigation Methods

15.4 Landscaping Principles

Visual screen planting is a beneficial mitigation method used to assist in reducing the visual impact of the wind farm and associated infrastructure. Landscaping and screen planting can also be utilised to significantly reduce the effect of shadow flicker on both roads and residences.

The existing character of the landscape allows for a variety of methods of landscaping and visual screening which will remain in keeping with the landscape character. General guidelines to adhere to when planning for landscaping and visual screening include:

- Planting is recommended post construction in consultation with the landowner.
- Planting should remain in keeping with existing landscape character.
- Species selection is to be typical of the area.
- Planting layout should avoid screening views of the broader landscape.
- Avoid the clearing of existing vegetation. Where appropriate reinstate any lost vegetation.
- Allow natural vegetation to regrow over any areas of disturbance.

Locally native plant species are preferred, as they help to preserve the landscape character and scenic quality of the area as well as building habitat for local fauna. Native species are also well-suited to local conditions (ie. soil, climate, etc.) and will build on the existing vegetation assemblages in the area.

16.0 Evaluation of Visual Performance Objectives

16.1 Overview of Visual Performance Objectives

In accordance with the Bulletin, "*the visual assessment requires an evaluation of the proposed wind energy project and its various components, turbines and ancillary facilities against the visual performance objectives of the Project (refer to Table 2 of the Bulletin), using a combination of desktop and field evaluations. The visual performance objectives are used as a framework for evaluation that enables potential impacts and management options to be considered objectively, against the varying levels of landscape significance established by the baseline study. Application of the visual performance objectives will allow for a transparent and robust assessment process.*"

The following tables provides a brief summary of the evaluation of each of the visual performance objectives and identifies the relevant sections of the LVIA where visual performance objectives are addressed.

Visual Magnitude - Visual Performance Objectives		
Visual Influence Zone 1 Objectives:	**Visual Influence Zone 2 Objectives:**	**Visual Influence Zone 3 Objectives:**
Avoid turbines or provide detailed justification of turbines below the blue line (5,100 m for Thunderbolts WF)	*Manage impacts as far as practicable, justify residual impacts, and describe proposed mitigation measures below the black line (3,450 m for Thunderbolts WF). Consider screening between the blue line and the black line.*	*Consider screening below the black line (within 3,450 m).*

Summary of LVIA Evaluation

- ***Refer to Section 6.0 - Visual Magnitude***

Dwellings within 3,450 m (below the black line):

16 non-associated dwellings were identified within 3,450 metres of a proposed WTG.

Dwellings within 3,450 m - 5,100 m (between the blue and black line):

11 non-associated dwellings were identified between 3,450 - 5,100 metres of the nearest proposed WTG (between the black and blue line of visual magnitude).

VIZ1 Dwellings:

No non-associated dwellings within 5,100m were rated as having a Visual Influence Zone VIZ1.

Two (2) associated dwellings (Dwelling 310 and Dwelling 277): were assessed as being VIZ1 receptors.

- *Dwelling 310 is uninhabited and has a negotiated agreement in place with Neoen.*
- *Mitigation measures (in line with the recommendations in the Bulletin) would reduce the visual impact from Dwelling 277 and Neoen has a negotiated agreement in place with the landowner.*

VIZ2 Dwellings:

25 non-associated dwellings within 5,100m were rated as having a Visual Influence Zone VIZ2:

- *The assessment found that 18 of the non-associated dwellings with a VIZ2 rating would have no views, or a negligible to low visual impact.*
- *Seven (7) non-associated dwellings with a VIZ2 rating will be likely to have a moderate visual impact rating.*
- *Mitigation methods have been proposed for the non-associated dwellings with a moderate visual impact rating in accordance with the requirements of the Bulletin to reduce impacts to an acceptable level.*

VIZ3 Dwellings:

Two (2) dwellings have a VIZ3 rating. No turbines are located within the black line of these dwellings.

*Table 18. **Visual Magnitude - Evaluation of Visual Performance Objectives***

17.0 Evaluation of Visual Performance Objectives

Landscape Scenic Integrity

Visual Influence Zone 1 Objectives:	Visual Influence Zone 2 Objectives:	Visual Influence Zone 3 Objectives:
Wind turbines should not cause more than a low level modification of the visual catchment. Turbines are seen as either very small and/ or faint, or as of a size and colour contrast (under clear, haze-free atmospheric conditions) that they would not compete with major elements of the existing visual catchment.	*Wind turbines should not cause more than a low level modification of the visual catchment. Turbines are seen as either very small and/ or faint, or as of a size and colour contrast (under clear, haze-free atmospheric conditions) that they would not compete with major elements of the existing visual catchment.*	*No Visual Performance objective applies.*

Summary of LVIA Evaluation

Assessment Notes:

- The Visual Influence Zone (VIZ) was identified for 23 key viewpoint locations within the Study Area, where relevant for viewpoints rated as VIZ1 and VIZ2 the objectives were evaluated.
  Refer to Section 8.0 and Appendix B: Viewpoint Analysis

- The potential for the project to affect the Scenic Integrity of the existing landscape character was summarized for each Landscape Character Unit.
  Refer to Section 15.0.

- The LVIA concluded that whilst the Project is likely to be a visible element in the landscape, the scenic integrity of the existing landscape character is likely to remain intact.

Table 19. Landscape Scenic Integrity - Evaluation of Visual Performance Objectives

Key Feature Disruption

Visual Influence Zone 1 Objectives:	Visual Influence Zone 2 Objectives:	Visual Influence Zone 3 Objectives:
Avoid wind turbines or ancillary facilities that result in the removal or visual alteration/disruption of identified key landscape features. This includes any major or visually significant landform, waterform, vegetation or cultural features that have visual prominence or are focal points.	*Minimise impact of wind turbines or ancillary facilities that result in the removal or visual alteration/disruption of identified key landscape features. This includes any major or visually significant landform, waterform, vegetation or cultural features that have visual prominence or are focal points.*	*No Visual Performance objective applies.*

Summary of LVIA Evaluation

Assessment Notes:

- Key Landscape Features are identified in Section 5.0. The key features were identified through a combination of community consultation and landscape character assessment.
- The LVIA has assessed the key features of the area and it has been concluded that whilst the Project may impact views from some areas, key features identified through the landscape baseline study will remain the dominant features of the landscape. The Project is unlikely to result in major disruptions to the key landscape features.

Table 20. Key Feature Disruption - Evaluation of Visual Performance Objectives

17.0 Evaluation of Visual Performance Objectives

Multiple Wind Turbine Effects

Objectives (Applies to all Visual Influence Zones)

- *Avoid views to the proposed, existing and approved turbines within eight kilometres from Level 1 and Level 2 viewpoints, exceeding the following thresholds, or provide detailed justification:*
- *Level 1: (High Sensitivity) - Wind Turbines visible within the effective horizontal views of two or more 60º sectors.*
- *Level 2: (Moderate Sensitivity) - Wind Turbines visible within the effective horizontal views in three or more 60º sectors.*

Summary of LVIA Evaluation

Assessment Notes:

- All viewers identified using the Multiple Wind Turbine Effect Tool (based on 2D plan assessment) are Level 2 Sensitivity (Rural Dwelling). The Bulletin recommends further assessment to Rural Dwellings (Level 2 Sensitivity) identified as having the potential to view more than two (2) 60º sectors when using the Multiple Effect Tool. *Refer to Section 6.0: Preliminary Assessment Tools*

Summary of Assessment:

Based on a 2D Assessment:

- 28 non-associated dwellings have turbines located within up to one (1) 60 degree sector.
- 16 non-associated dwellings have turbines located in up to two (2) 60 degree sectors.
- Two (2) non-associated dwellings have turbines located in up to three (3) 60 degree sectors (Dwelling 308 and 309). Detailed assessment of these dwellings identified topography reduces the potential to view turbines and turbines are likely to be visible in up to one (1) 60 degree sector for Dwelling 308 and two (2) 60 degree sectors for Dwelling 309 which is deemed acceptable.

Table 21. Multiple Wind Turbine Effects - Evaluation of Visual Performance Objectives

Shadow Flicker and Blade Glint - Visual Performance Objectives

Objectives (Applies to all Visual Influence Zones)

- *Minimise shadow flicker to not more than 30 hours per year and utilise available mitigation options to minimise shadow flicker.*
- *Finish turbine blades with a low reflectivity surface treatment to ensure that blade glint is minimised.*

Summary of LVIA Evaluation

A Shadow Flicker Assessment was undertaken by DNV-GL

The Report concluded no non-associated dwellings will be subject to shadow flicker exceeding 30 hours per year.

Table 22. Shadow Flicker and Blade Glint - Evaluation of Visual Performance Objectives

17.0 Evaluation of Visual Performance Objectives

Aviation Hazard Lighting
Objectives (Applies to all Visual Influence Zones) *Objective Applies to all Visual Influence Zones* • ***Aviation Hazard Lighting (AHL) must meet the requirements of Australian Standard AS 4282 - 1997 and any prescribed or notified CASA requirement. Shield all AHL within 2 kilometres of any dwellings. Avoid strobe lighting.***
Summary of LVIA Evaluation
• The visual effect from night lighting has the potential to have a visual impact on receptors including motorists and residents in the area. • Mitigation methods have been outlined in Section 13.0. • Shielding will be installed on all turbines with aviation lighting to reduce impact for dwellings within 2 kilometres. An example has been provided to illustrate how effective shielding can be. *Refer to Section 13.0 Night Lighting Assessment*

*Table 23. **Aviation Hazard Lighting - Evaluation of Visual Performance Objectives***

17.0 Conclusion

It is inevitable that the placement of WTGs in a rural landscape will alter the existing landscape character of the area to some degree. The Project contrasts with the existing landscape character of the region which is typically rural, pastoral land with large expanses of vegetation.

With all visual impact assessments the objective is not to determine whether the Project is visible or not visible, but to determine how the Project will impact on the existing visual amenity, landscape character and scenic quality. If there is potential for negative impact, this impact, and any mitigation methods must be investigated in order to reduce the impact to an acceptable level.

Although this LVIA quantifies the visual impact of the proposed WTGs, the overall visual impact of the wind farm will vary greatly depending on the individual viewer's sensitivity to and acceptance of change. The sensitivity towards change varies greatly depending on the user's connection with the landscape. For example visitors to the area may perceive the wind farm as an interesting feature of the landscape. This may contrast with a resident who passes the wind farm daily who may have a more critical perception of the visual presence of the wind farm.

The visual impact of the WTGs are lessened as the distance of the vantage point from the Project Area is lengthened. The topography surrounding the wind turbines significantly alters the visibility of the proposed development from many vantage points. Within the local setting, a combination of the topography and local influences such as existing natural and introduced vegetation significantly reduce visibility towards the proposed WTGs.

The greatest visual effect is most likely to be felt by residents in the immediate vicinity of the wind farm. The LVIA concludes there are limited opportunities to view the Project from non-associated dwellings within 5,100 m of the Project. Of the 27 non-associated dwellings assessed, 20 are likely to have a no views to the Project or a negligible - low visual impact. Seven (7) non-associated dwellings are likely to have a moderate visual impact, and no dwellings have been assessed as having a high visual impact rating.

Mitigation methods incorporated into the design process in conjunction with landscape and visual screening will have a positive effect on reducing any visual impact of proposed wind farm from the non-associated dwellings identified as having a moderate or high visual impact. Through mitigation methods described it will be possible to significantly reduce the visual impact to an acceptable level at all non-associated dwellings.

Due to their simplicity in form (especially when compared to transmission lines, towers and associated infrastructure) wind turbines can be considered a temporary installation in the landscape due to their modular construction and relatively low impact during the construction phase. When implemented with appropriate environmental management, the development of wind farms can be undertaken with low impact on the surrounding environment whilst providing positive local, regional and national benefits.

On evaluation, it is the professional opinion of Moir Landscape Architecture that with mitigation measures implemented, the Project is compliant with the performance objectives as per the Visual Assessment Bulletin.

References

LITERATURE

Australian Wind Energy Association and the Australian Council of National Trusts (2005), Wind Farms and Landscape Values Stage One Final Report Identifying Issues, Pirion Printers, Canberra.

British National Wind Energy Association (1994), Best Practice Guidelines for Wind Energy Development, UK.

Civil Aviation Aviation Authority, Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome ADVISORY CIRCULAR AC 139.E-05 v1.0, May 2021

CSIRO (2012), Exploring Community Acceptance of Rural Wind Farms in Australia: A Snapshot

Department of Environment, Climate Change and Water NSW (2010), Community Attitudes to Wind Farms in NSW, Sydney.

Department of Planning and Environment, The Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring, June 2016

Environment Protection and Heritage Council (2010), National Wind Farm Development Guidelines- Draft, Adelaide.

Inclusive Engagement (May 2018), Hills of Gold Energy Project Community Consultation Report

Landscape Institute Residential Visual Amenity Assessment (RVAA) LI Technical Guidance Note 2/19.

Leonard, M. and Hammond, R. (1984) Landscape Character Types of Victoria, with Frames of Reference for Scenic Quality Assessment. Forests Commission of Victoria, Melbourne

McCabe, C (2019) Aircraft safety lighting switches off, Crookwell Gazette, October 24 2019

Natural England (June 2019) An approach to landscape sensitivity assessment – to inform spatial planning and land management.

NSW Department of Planning and Infrastructure (2011), Draft NSW Planning Guidelines: Wind Farms

NSW National Parks and Wildlife Service (2003) The Bioregions of New South Wales: their biodiversity, conservation and history NSW National Parks and Wildlife Service, Hurstville.

NSW Planning and Environment (December 2016), Wind Energy: Visual Assessment Bulletin For State significant wind energy development.

Office of Environment and Heritage NSW National Parks and Wildlife Services, Guidelines for developments adjoining land managed by the Office of Environment and Heritage

Scottish Natural Heritage (February 2017), Visual Representation of Wind Farms: Guidance Version 2.2.

The Landscape Institute and the institute of Environmental Management and Assessment (2002), Guidelines for Landscape and Visual Impact Assessment Second Edition, New York.

Australian Bureau of Statistics (2016). 2016 Census QuickStats: Bendemeer, Uralla, Kentucky. [online] quickstats.censusdata.abs.gov.au. [Accessed 17 Oct. 2021].

DPIE (2012). *New England North West Strategic Regional Land Use Plan*. [online] State of New South Wales through the Department of Planning and Infrastructure.

DPIE (2019). *eSPADE v2.0 | NSW Office of Environment & Heritage*. [online] Nsw.gov.au. Available at: https://www.environment.nsw.gov.au/eSpade2Webapp.

Energy NSW (2021). *Electricity Infrastructure Roadmap*. [online] Energy NSW. Available at: https://www.energy.nsw.gov.au/government-and-regulation/electricity-infrastructure-roadmap#-what-is-the-electricity-infrastructure-roadmap- [Accessed 3 Sep. 2021].

Energy NSW (2021). *Renewable Energy Zones*. [online] Energy NSW. Available at: https://www.energy.nsw.gov.au/renewables/renewable-energy-zones [Accessed 1 Sep. 2021].

NPWS (2003). The New England Tableland Bioregion. In: *The Bioregions of New South Wales – their biodiversity, conservation and history*. [online] NSW National Parks and Wildlife Service.

NPWS (2020). *Developments adjacent to NPWS lands: Guidelines for consent and planning authorities*. Sydney: National Parks and Wildlife Service, Department of Planning Industry and Environment.

NSW Government (2010). *Tamworth Regional Local Environmental Plan*. Available at: https://legislation.nsw.gov.au/view/html/inforce/current/epi-2011-0027.

NSW Government (2012). *Uralla Local Environmental Plan*. Available at: https://legislation.nsw.gov.au/view/html/inforce/current/epi-2012-0119.

NSW Office of Environment and Heritage (2014). *Watsons Creek National Park (CCA Zone 1) Statement of Management Intent*. [online] www.environment.nsw.gov.au. Sydney, NSW: NSW Office of Environment and Heritage.

NSW Planning and Environment (2016). *Wind Energy: Visual Assessment Bulletin For State significant wind energy development*. NSW Planning and Environment.

Reid, N. (2006). Wool production & biodiversity. *Land, Water & Wool Northern Tablelands*.

Uralla Visitor Information Centre (n.d.). *Captain Thunderbolt*. Uralla Shire Council.

References

The Australian Government Department of the Environment and Energy, National Light Pollution Guidelines for Wildlife: Including marina turtles, seabirds and migratory shorebirds, January 2020 Version 1.0 may also be considered during the detailed design phase.

MAPS

NSW Government Land and Property Information, Spatial Information Exchange SIX Maps, Accessed at: <http://maps.six.nsw.gov.au/> [Accessed between July 2021 – September 2021]

Google Earth Pro 2021 [Viewed July 2021 - September 2021] www.google.com/earth/index.html

NSW Department of Planning, Industry and Environment (2012). Reservation of bioregions in NSW. Available at: https://www.epa.nsw.gov.au/soe/soe2012/chapter5/map5.4.htm [Accessed 12 Oct. 2021].