Goyder North Renewable Energy Facility

Visual Assessment

Prepared for NEOEN Australia Pty Ltd 4 April 2024

GBD

Landscape Architecture

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GBD is a leading specialist in renewable energy landscape character and visual impact assessment, setting a course that others follow.

Servicing the renewable energy industry for over 18 years, GBD has gathered a wealth of unrivalled project experience in a variety of landscapes from Far North Queensland to western Tasmania.

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Green Bean Design Pty Ltd
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The methodology adopted and sources of information used are outlined in this report. GBD has made no independent verification of this information beyond the agreed scope of works and GBD assumes no responsibility for any inaccuracies or omissions.

No indications were found during our investigations that information contained in this report as provided to GBD was false.

This report was completed between October 2022 and April 2024 and is based on the conditions encountered and information reviewed at the time of preparation. GBD disclaims responsibility for any changes that may have occurred after this time. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners. © Green Bean Design Pty Ltd 2024.

Cover image: Photomontage view east to south east from Old Belcunda Road

DOCUMENT CONTROL

Project Name
Goyder North Renewable Energy Facility

Report Title
Visual Assessment

Project Number
22-311

Version Number:
V2

Status
Final Issue

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Date
4 April 2024

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Term	Definition
Battery Energy Storage System (BESS)	BESS are devices that enable energy from renewables, such as wind farms, to be stored and then released when the power is needed.
Cumulative effects	The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.
Human scale indicators	Natural landscape features or constructed elements that form relatable scaled visual characteristics based on human sensory capabilities.
Landscape	A visible area of the earth's surface defined by natural or human induced change with discernible characteristic of landform, land use and human cultural overlays.
Landscape character	A distinct and consistent pattern of elements in the landscape that create an area of landscape visually different from other areas.
Magnitude	A combination of the scale, extent and duration of an effect.
Mitigation	Measures, including any processes, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual effects of a development project.
Photomontage (Visualisation)	Computer simulation or other technique to illustrate the appearance of a development.
Sensitivity	Susceptibility of a receiver to a specific type of change.
Skyline	An outline of the land as defined against the sky.
Stacking	The visual effect of multiple wind turbine rotors overlapping within a view
Topographical variety	A various arrangement of forms and features of land surfaces.
Viewshed	The total landscape area seen from a location or path of travel
Visibility	A relative determination at which the proposal can be clearly discerned and described.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual effect	The change in character of an available view that results from a development or the changes in visual amenity of people living beyond the project.

Table 1 Glossary

Visual Assessment	A process of applied professional and methodical techniques to assess and determine the extent and nature of change to the composition of existing views that may result from a development.
View location	A place or situation from which a proposed development may be visible.
Visual receiver	Individual and/or defined groups of people who have the potential to be affected by a proposal.
Visual significance	A measure of the importance or gravity of the visual effect culminating from the degree of magnitude and receiver sensitivity.

Section 1. Executive summary

1.1 Introduction

This Visual Assessment has been prepared to consider potential visual effects associated with the proposed Goyder North Renewable Energy Facility (the Project) and to address various 'landscape' and 'scenic amenity' statutory requirements of the Government of South Australia (PlanSA) Planning and Design Code requirements and objectives as applicable to the Project.

1.2 Professional judgement in landscape and visual impact assessment

The process of landscape and visual assessment incorporates both qualitative and quantitative analysis; however, a determination of visual effect is ultimately based on an interpretation informed by professional judgement. The application of professional judgement is outlined in the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition 2013, which notes that professional judgement is a very important part of landscape and visual assessment. The Guideline notes that professional judgement is applied to several other environmental topics (e.g., ecology and cultural heritage) and that judgements made should be:

- Reasonable and based on clear and transparent methods
- Based on training and experience and
- Made, in general, by suitably qualified and experienced landscape professionals.

The Guideline notes that qualified and experienced landscape professionals may not agree on various aspects of a landscape and visual assessment which may arise from the application of different approaches or criteria; however, the core principals of receiver sensitivity and visual magnitude should provide some consistency in determinations of effects.

1.3 Landscape characteristics

This Visual Assessment has determined that landscape characteristics within and immediately surrounding the Project site, as well as characteristics within the wider landscape, are visually robust and defined by strong lineal forms and broadscale, consistent landscape patterns within the rural landscape.

Whilst recognising sensitivities and values applied to the landscape surrounding the Project site, the overall landscape characteristics within and surrounding the Project site are considered to exhibit characteristics which tend to result in a moderate low sensitivity to accommodate change.

Landscapes with a moderate low sensitivity include those associated with broad, simple patterns and consistent colour and texture. These landscape characteristics are also generally common within the perspective of the broader sub-regional landscape which supports several renewable energy projects.

Landscapes beyond the Project site display characteristics of moderate scenic value with occasional steeper rising landforms providing a higher degree of scenic values.

Landscape characteristics and the overall potential visibility of the Project have been illustrated in a series of panoramic photographs and in Zone of Theoretical Visibility (ZTV) diagrams. The ZTV diagrams demonstrate the screening influence of undulating landforms surrounding the Project site.

The Project would incorporate new built features into the landscape and create a visual landmark from elevated view locations, such as Mount Bryan, but the Project is not considered to significantly conflict with existing landscape characteristics.

1.4 Visual effects

Views toward the Project from the Burra and Mount Bryan townships (from dwellings and public spaces) would be largely screened by either landform and/or vegetation and result in moderate low visual effects where visible. Views from elevated sections of the Burra township would extend toward a small number of wind turbines within the south west portion of the Project site (around 10 wind turbines in total). The assessment of visual effects determined that most uninvolved dwellings are unlikely to have significant views toward ancillary electrical infrastructure including substations, battery energy storage systems (BESS) and the overhead transmission line (OTL). Views toward the Project site from other view locations including lookouts, Burra Mine site, heritage localities and road corridors would not result in significant visual effects.

1.5 Electrical infrastructure

An assessment of the proposed substations, BESS and the OTL determined that existing landscape characteristics, including tree cover and a low undulating landform along most of the proposed OTL easement, would have some capability to absorb smaller scale ancillary electrical infrastructure. Electrical infrastructure would not result in significant visual effects.

1.6 Nighttime obstacle lighting

An Aviation Impact Assessment (AIA) determined that wind monitoring towers be appropriately marked in accordance with applicable guidelines (excluding strobe lighting) noted in the AIA. The AIA further determined that the Project is a low risk to aviation activity and does not require night time obstacle lighting with no further mitigation required.

1.7 Cumulative visual effects

A cumulative assessment identified several operating wind farms within a 30 kilometre (km) sub-regional locality of the Project. This Visual Assessment determined that there would be some opportunities for direct and indirect visibility between the Project site and other wind farms (e.g. Goyder South and the Hallett Wind Farm group) within a broader landscape context; however, this would not result in significant cumulative visual effects due to distances between wind farm developments.

1.8 Mitigation

This Visual Assessment considered several strategies to mitigate potential visual effects from sensitive receiver locations. These include applying uniformity in wind turbine design and colour, as well as operational outcomes that have all wind turbines rotating in the same direction in accordance with the Planning and Design Code requirements. Visual mitigation would be largely achieved through distance between wind turbines and ancillary Project elements and sensitive receiver locations, as well as undulating landforms within and beyond the Project site.

1.9 Acceptability of landscape and visual effects

This Visual Assessment has assessed the potential landscape and visual effect of the Project against relevant policies and guidelines and has determined that, in our professional opinion, the Project is compliant with the requirements and objectives of the Planning and Design Code as applicable to ‘landscape’ and ‘scenic amenity’ and that the level of landscape and visual effects are acceptable.

Section 2. Introduction

2.1 Introduction

This Visual Assessment has been prepared to accompany an application to seek Development Authorisation for the Goyder North Renewable Energy Facility pursuant to the *Planning Development and Infrastructure Act*, 2016. Neoen is developing the Project as a part of its wider Goyder Renewable Zone concept. As a part of this concept, the Goyder South Hybrid Renewable Energy Facility (Goyder South) was granted Development Approval in 2021.

This report informs the assessment of the Project site for suitability for a wind farm development within the landscape surrounding the Project, as well as considering the potential extent and degree of visual effects on people living in and travelling through, the surrounding landscape and those visiting places around the Project site for recreation and tourism.

This Visual Assessment has been prepared by Andrew Homewood, Director and Principal Landscape Architect at Green Bean Design Pty Ltd (GBD). Andrew has over 30 years' experience in landscape architectural consulting, and over 18 years' experience in the preparation of Visual Assessment reports for wind farm projects, as well as other state significant projects including high voltage transmission lines, substations, and battery energy storage systems. Andrew has been commissioned to undertake visual assessment studies for over 60 large scale renewable energy projects across South Australia, Victoria, New South Wales, Queensland, and Tasmania.

This Visual Assessment has been prepared with reference to the Planning and Design Code Version 2023.5 (Date of Adoption: 30 March 2023).

In addition, this Visual Assessment has also considered landscape and visual assessment guidance set out in:

- Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute, and Institute of Environmental Management & Assessment, 2013
- Siting and Designing Wind Farms in the Landscape, Version 3a, NatureScot, August 2017 and
- Visual Representation of Wind Farms, Version 2.2, Scottish Natural Heritage, March 2017.

2.2 Previous studies

GBD prepared the Goyder South Hybrid Renewable Energy Facility Landscape and Visual Impact Assessment Report in June 2020 which included site inspections around the Goyder North Project site.

Section 3. The Planning and Design Code

3.1 Introduction

The Planning and Design Code is the single document that outlines planning requirements for all types of land use and planning impacts in South Australia. The Code is the basis for decision making for all forms of Code assessed development lodged under the PDI Act. The Code includes specific guidance based on overlays, zones, subzones and general policies. A 'renewable energy facility' is separately defined, with associated code policies relating to these developments contained in the Infrastructure and Renewable Energy Facilities module. For example, these policies detail performance measures in respect to the scale of development and setbacks from project boundaries, non-host dwellings and townships / more sensitive zones.

3.2 Code Assessed Development

Development types can be categorised as 'accepted', 'deemed-to-satisfy' or 'restricted' under the Planning and Design Code. If development does not fall within these three classifications, it will be 'performance assessed'. Generally, large-scale renewable energy facilities will be performance assessed in most areas. In certain zones or overlays, such facilities may be restricted and subject to a more rigorous level of assessment. More limited forms of development are sought in these areas due to their environmental sensitivity or landscape character (which includes the Hills Face Zone, Coastal Zone, Conservation Zone, Significant Landscape Protection Overlay, RAMSAR Wetlands Overlay and Barossa / McLaren Vale Protection Districts, amongst others). Restricted developments are generally not envisaged, unless accompanied by detailed justification, and are subject to an 'early no' decision with limited (internal) appeal rights.

3.3 Zones

Zones are the primary organising spatial layer in the Code. Zones provide guidance on what can happen in an area by setting out the policies and rules for certain classes of development. The Project site is predominantly located within the Rural Zone, with the southern connection to the grid at Bundey being in the Rural Intensive Enterprise Zone.

Rural Zone outcome:

The Rural Zone covers most of the incorporated areas of the state. It supports a wide range of primary production activities and provides opportunities for value-adding and the use of renewable energy sources, including wind/solar farms. The zone applies to vast areas of land between rural towns.

Rural Intensive Enterprise Zone outcome:

This Zone is a specialised economic and employment focussed zone that aims to facilitate and promote intensive agricultural production, processing facilities and supporting ancillary industries. The policy also supports the development of complimentary infrastructure projects.

3.4 Overlays

Planning and Design Code (P&D Code) Overlays are layers in the P&D Code under the Planning, Development and Infrastructure Act 2016 (PDI Act 2016). P&D Code Overlays identify areas where specific P&D Code policies are applicable or where an area may be subject to referrals.

Overlays are the primary mechanism to spatially express State Planning Policies as they pick up location-specific planning issues of state interest. Overlays can span multiple zones and subzones and more than one overlay can apply to the same area. Overlay policies take precedence over other Code policies. Overlay policies are only relevant as set out in the zone classification tables. Overlays contain Assessment Provisions and a Procedural Matters table that sets out statutory referrals that apply in the Overlay area.

3.4.1 Significant Landscape Protection Overlay

Overlay outcome

The Significant Landscape Protection Overlay seeks to conserve the natural and rural character and scenic and cultural qualities of significant landscapes.

The Significant Landscape Protection Overlay applies to significant landscapes of high value scenic or cultural qualities, such as the Flinders Ranges and Kangaroo Island coast.

3.4.2 Scenic Quality Overlay

Overlay outcome

The Scenic Quality Overlay seeks to ensure development complements natural and rural character, and areas of scenic value.

This Overlay typically applies in rural locations, such as the Productive Rural Landscape Zone. It applies to untouched/unspoilt scenic type landscapes that are considered scenically valuable, such as the Mount Lofty Ranges.

There are no Landscape Protection or Scenic Quality Overlays that occur within or surrounding the Project site. The nearest Landscape Protection Overlays are between 80km and 100km to the north west and south of the Project site. The nearest Scenic Quality Overlay is around 155km south west of the Project site.

3.5 General Development Policies

Development policies broadly relate to how a development should occur. These polices address the functional requirements for a development type or class, such as minimisation of overshadowing for a multi-storey building.

General development policies contain Assessment Provisions and are linked to specific development types as listed in a zone's Classification Table. The General Development Policies considered relevant to this Visual Assessment include:

- Design
- Infrastructure and Renewable Energy Facilities
- Interface between Land Uses

The Visual Assessment response to the Planning and Design Code is presented in **Section 10**.

Section 4. Methodology and report structure

4.1 Methodology

The Visual Assessment methodology adopts existing guidelines identified in this Visual Assessment introduction, and also on the assessment of a significant number of wind farms undertaken by GBD across South Australia, Victoria, New South Wales, Queensland and Tasmania.

Key principles of visual assessment consider a combination of:

- Receiver sensitivity (landscape or people) and
- Potential magnitude of visual effects.

For wind farm projects the magnitude of visual effects is primarily determined through:

- Distance between wind turbines and receiver locations
- Horizontal field of view occupied by wind turbine structures and
- Vertical field of view occupied by wind turbines.

The magnitude of horizontal and vertical fields of view are difficult to quantify against set criteria for potential visual effect and are often considered against the parameters of standard human eyesight. Whilst human eyesight can be objectified against horizontal and vertical field of view, it does not allow for the almost continual movement of receivers in a landscape setting as well as a natural inclination to scan distant horizons. Nevertheless, formulating a professional judgement on the visual scale of a wind turbine within a particular vista is necessary step in the visual assessment process.

It is important to understand the difference between visual assessment and landscape assessment and why both types of assessments are appropriate to include in this Visual Assessment. Visual assessments assess effects on viewers (people) caused by developments from selected viewpoints. Examples include a view of the development from a residential area where it will be seen by residents, a view from areas where it will be seen by people engaged in recreational activities or tourists visiting places or landscape features.

A visual assessment will determine the change to the view itself caused by the Project. It also determines how change will affect the experience of people who may be at a viewpoint, and how they might respond to the change. The effect of seeing a development on viewer experience depends in part on what the viewers are doing when viewing a particular landscape scene, and their response depends in part on who they are and how much they value the view. Enjoyment of a particular view is dependent on viewers, and in visual assessment, receptors are people, not the landscape.

Landscape assessment considers effects on physical elements and features that make up a landscape and the aesthetic, perceptual, and experiential aspects of that landscape that make it distinctive. These effects affect the "feel," "character," or "sense of place" of an area of landscape, rather than the composition of a view from a particular place. Landscape effects, in essence, are a measure of the degree of compatibility of the character of the development, which might be, for example, "industrial," with the character of the landscape it is in or is visible from, say, "wilderness" or "tranquil." The impact receptor is the potentially affected landscape.

The final assessment of potential landscape and visual effects combines sensitivity and magnitude of visual effects and is ultimately a process of professional judgement. Professional judgement applies knowledge, assessment skills and relevant experience within the context of existing guidelines and technical supplements. Professional judgements applied in this Visual Assessment are based on reasonable and defined criteria.

4.2 Site inspections

Site inspection works and photography were undertaken in August 2023.

4.3 Report structure

This Visual Assessment report been structured into 16 parts as follows:

Table 2 Report structure

Report Section	Description
1 Executive summary	This section provides an overview of the main findings of the Visual Assessment.
2 Introduction	This section provides an introductory section that describes the intent and purpose of the Visual Assessment in the context of planning requirements.
3 The Planning and Design Code	This section outlines the Planning and Design Code as relevant to this Visual Assessment.
4 Methodology and report structure	This section sets out the structure and methodology employed in the Visual Assessment preparation.
5 Project location and description	This section describes the regional and local position of the wind farm development relative to existing landscape features and places and describes the key visible components of the project.
6 Viewshed	This section identifies the area of land surrounding the wind farm Project site subject to detailed assessment in this Visual Assessment.
7 Panoramic photographs	This section illustrates the Visual Assessment with panorama photographs taken during the site inspection. The photographs are provided to illustrate the general appearance of typical landscape characteristics that surround the proposed wind turbines.
8 Landscape character assessment	This section describes the physical characteristics of the landscape surrounding the Project site and determines the overall sensitivity of the landscape to the wind farm development.
9 Zone of theoretical visibility and visual factors	This section identifies a theoretical area of the landscape from which the wind turbines may be visible within the

Table 2 Report structure

	viewshed and describes a range of factors which may influence the wind farm visibility within the viewshed.
10 Planning and Design Code, Zones and General Development Guidelines	This section addresses the Planning and Design Code as applicable to the Visual Assessment.
11 Key views, visual effect and mitigation	This section describes and determines the potential visual effect of the wind turbines on key public viewpoints within the project viewshed.
12 Night lighting	This section describes the potential effect of night lighting associated with the Project.
13 Cumulative assessment	This section describes the potential effect of alternate existing and/or known wind farm developments within proximity to the Project.
14 Pre-construction and construction	This section describes the activities associated with pre-construction and during construction which may create visual effects.
15 Mitigation	This section outlines potential mitigation measures to minimise visual effects arising from the proposed wind farm development.
16 Summary	Conclusions are drawn on the overall visual effect of the proposed project.

Section 5 Project location and description

5.1 Project location

The Project site is in the eastern portion of the Mount Lofty Ranges and wholly located within the Regional Council of Goyder and within the Mid North Region and the SA Murray-Darling Basin Natural Resource Management (NRM) Area.

From a transport and access perspective, the region is serviced by the Barrier highway and the Burra-Morgan Highway (Goyder Highway). This area is generally described as a transitional zone between cropping and pastoral country. It is noted that the Project is not located within a prescribed water resources area.

The southern Project boundary is approximately 5.5km north-east of the centre of Burra. It extends approximately 22km to the north, with the northern tip being approximately 10.2km north-west of the centre of Hallett. Its western-most boundary is also positioned approximately 4.4km east of the centre of the Mount Bryan township. It is approximately 14.5km east to west at its greatest width at the south of the site, tapering to its narrowest width of 3km in the northern portion. The land within the development site is generally privately owned and comprises predominantly dryland cropping and grazing. The Project locality is illustrated in **Figure 1**.

5.2 General Project description

The Project would comprise of the following key elements:

- A multi-stage wind farm of up to 135 turbines with a capacity of approximately 1000MW, a maximum hub height of 160m, a maximum blade length of 90m, and an overall maximum height (tip height) of 240m
- BESS facilities comprising a total of 900MW/3,600MWh within three fenced compounds, two of approximately 9.8ha and one of approximately 17.2ha
- Associated infrastructure for connection to the electricity grid including substations, access tracks, underground connection cabling and transmission lines
- Temporary construction compounds for wind components, including concrete batching plants; and
- Several meteorological masts (in addition to those already on site) to record wind speed and other meteorological data, both pre- and post- construction.

5.3 Temporary construction facilities

Temporary construction facilities would include:

- Up to three wind construction compounds (200m x 200m)
- Up to three battery construction compounds (150m x 150m)
- The construction compounds will include office, staff amenities, and carparking facilities
- Temporary batching plant facilities (150m x 150m)
- Temporary overhead transmission line construction compounds (150m x 150m)

- Temporary civil contractor compounds
- Other temporary construction areas including storage and laydown areas (150m x 150m); and
- Laydown areas will also be required at the base of each turbine.

5.4 Wind turbines

The specific elements of the wind turbines typically comprise:

- Concrete foundations
- A hybrid tubular tapering concrete and steel tower (with the same external colour finish)
- Nacelles at the top of the tower housing the gearbox and electrical generator
- Rotors comprising a hub (attached to the nacelle at around 160m above ground level) with three blades and
- Three composite material blades attached to each hub with a swept area around 25,434m^2.

Diagram 1 illustrates a typical wind turbine structure and names the key components most relevant to this Visual Assessment. **Diagram 1** is schematic only and is not drawn to scale or representative of the proposed Project wind turbine.

Diagram 1 – Typical wind turbine components and terminology (Image: ©GBD Pty Ltd 2022)

Not to scale

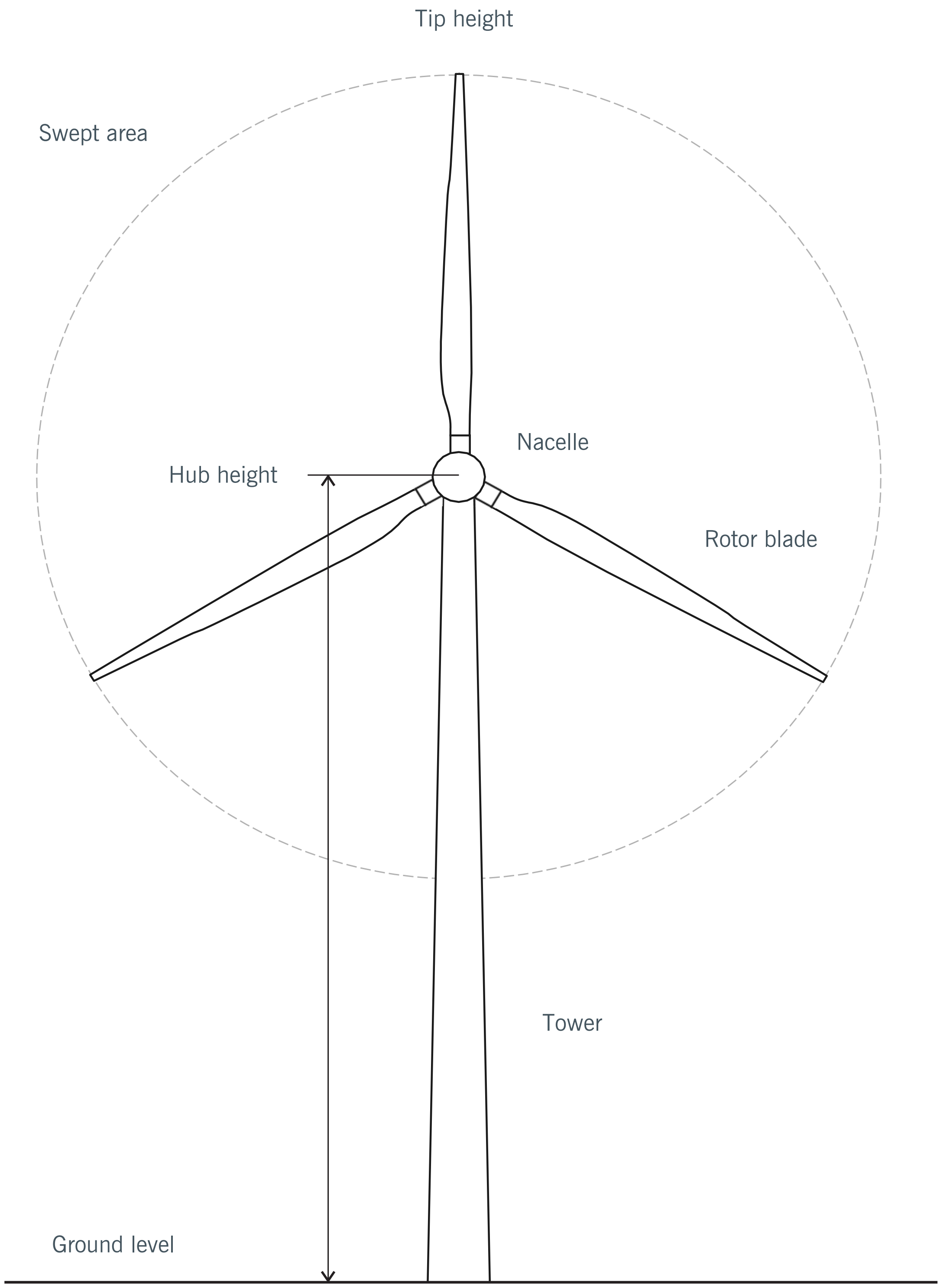


Figure 1
Project locality

GBD
Landscape architecture

Goyder North Renewable Energy Facility : Visual Impact Assessment

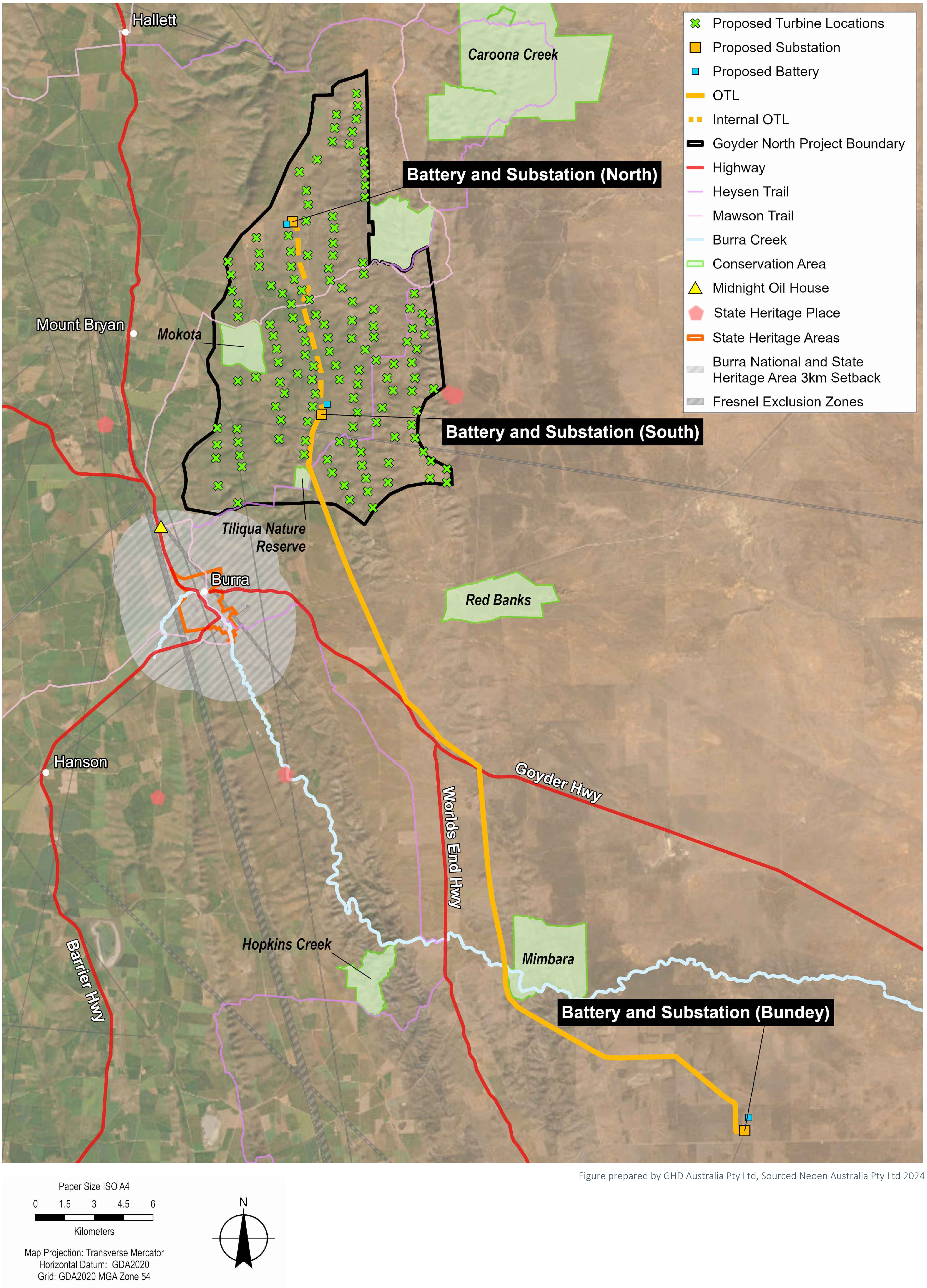


Figure prepared by GHD Australia Pty Ltd, Sourced Neoen Australia Pty Ltd 2024

5.5 Wind monitoring masts

Up to ten wind monitoring masts, to around 160m in height, would be installed on-site in addition to the existing 3 installed for the prior Mount Cone project. The permanent wind monitoring masts are expected to be of a guyed, narrow lattice or tubular steel design like the example as shown in **Plate 1**.

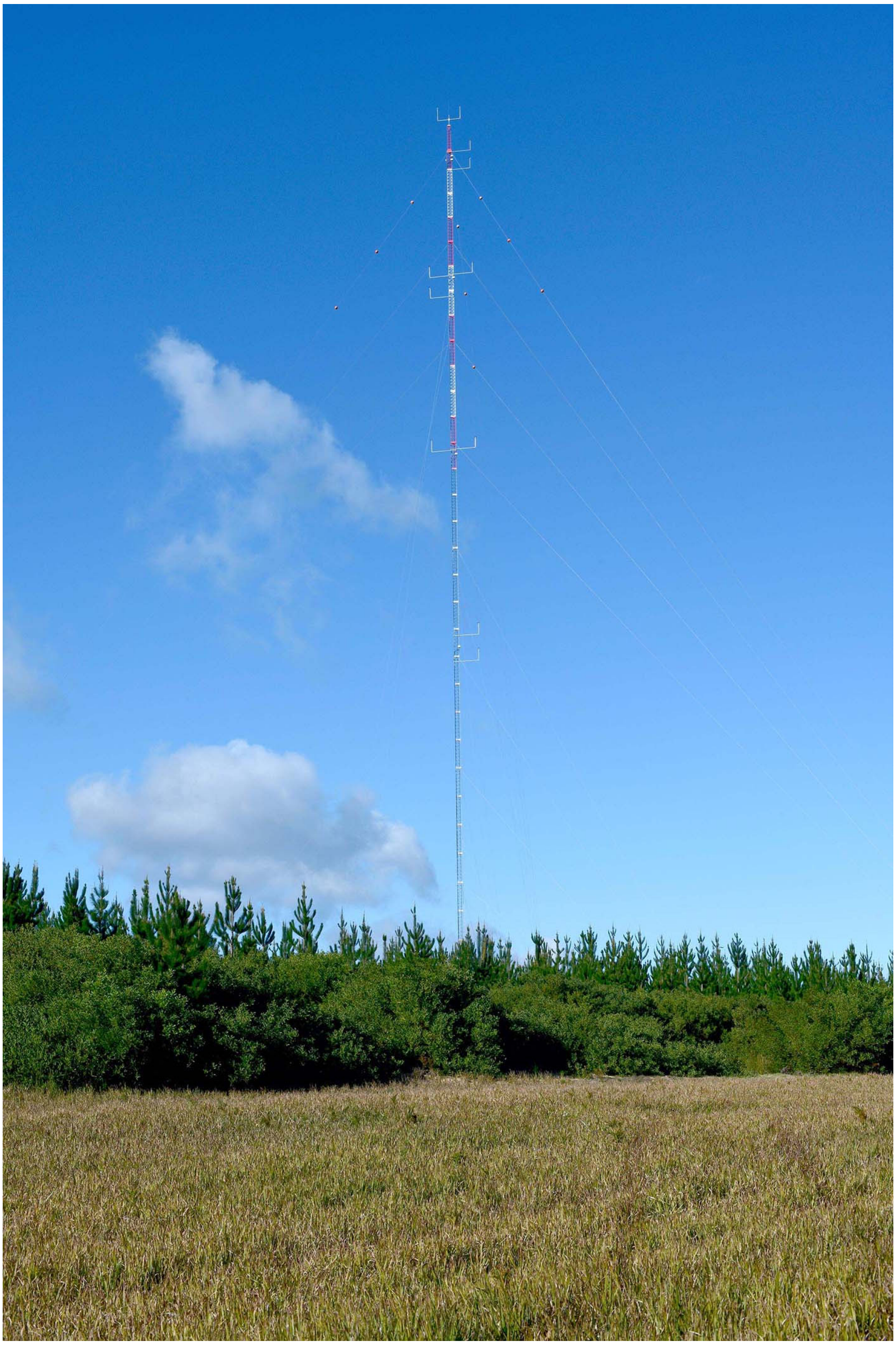


Plate 1 – Typical wind monitoring mast (Image: ©GBD 2021)

5.6 On-site access tracks

New on-site access tracks would be constructed to around 10m in width where existing access tracks are not present or not suitable for use and to provide access to wind turbine locations within the Project site during construction and operation. The on-site access tracks would be reduced to a minimum 6m width for the Project operational stage, or rehabilitated where no longer required.

Final road design would be subject to the detailed design of the wind farm and will be developed in consideration of site constraints, including minimising the potential for visual effect by considering the:

- Use of existing farm access tracks
- Overall length and extent
- Need for vegetation clearing
- Potential for erosion
- Extent of cut and fill and
- Potential to maximise rehabilitation at the completion of the construction phase.

5.7 Aviation Obstacle Lighting

The Proponent commissioned an Aviation Impact Assessment which was completed by Chiron Aviation Consultants Pty Ltd (December 2023). The AIA included a detailed consideration regarding obstacle lighting needs and requirements for the installation and operation of obstacle lighting. The AIA concluded that there will be a low level of aviation safety risk associated with the potential for an aircraft collision without obstacle lighting on the wind turbines. The AIA concluded that no obstacle lighting is required for wind turbines.

5.8 Electrical reticulation

The Project would require new electrical reticulation that involves the construction of underground and overhead cabling throughout the wind farm site and electrical substations. A new OTL to connect the Project to the existing transmission network is also proposed.

5.8.1 Substations and Operations & Maintenance Facilities

The proposed Project would include two Substation and Operation and Maintenance (O&M) facilities. The Project would also seek approval for the expansion of the new Bundey substation off Powerline Road which is owned and operated by ElectraNet.

The O&M facility would be used on an on-going basis to support maintenance and repair activities for the relevant portions of the Project. This includes an office with staff amenities (kitchenette, toilets, shower), car park, workshop/shed and laydown/temporary storage. Each proposed wind O&M facility has been co-located with the north and south substations to minimise footprint impacts. The O&M facility would be designed in detail to suit the requirements of the maintenance contractors.

5.8.2 Substation North

The Substation North site would be in the north-west sector of the Project site. It has been sited to avoid visual impact and native vegetation to minimise unnecessary ecological impact. The substation is also sited more than 50m from watercourses. The substation location is illustrated in **Figure 3**.

5.8.3 Substation South

The Substation South site would be in the central sector of the Project site. It has been sited to avoid visual impact and native vegetation to minimise unnecessary ecological impact. The substation is also sited more than 50m from watercourses. The substation location is illustrated in **Figure 3**.

5.8.4 Bundey Substation Expansion

This substation expansion has been sited in accordance with ElectraNet's plans to expand the Bundey Substation to allow for the connection of any future energy assets. Neoen are seeking development approval for the expansion of this site with the agreement of ElectraNet. The substation location is illustrated in **Figure 3**.

Plate 2 – Typical substation facility, Hornsdale SA (Image: GBD 2018)

5.8.5 BESS Facilities

Up to 3 BESS facilities would be in proximity to the two project substations and the grid connection infrastructure located adjacent to the ElectraNet substation at Bundey. These batteries have each been sited away from watercourses and located to minimise potential visual impacts.

The BESS would be located directly adjacent to the Bundey substation to reduce the likelihood of physical disruptions to the transmission line 'islanding' the batteries from the grid. Neoen has also proposed that some battery storage may be included at the Project substation sites should this better support the technical project and grid support outcomes.

The BESS facilities would incorporate a compound between approximately 10ha and 18ha with a 3m high security fence, containing BESS, switchyard and associated equipment, underground cabling and OTL connection, together with security CCTV cameras and lighting. Each BESS facility will also include operation and maintenance facilities.

Plate 3 – Typical battery storage facility, Hornsdale SA (Image supplied: Neoen Australia Pty Ltd 2017)

5.8.6 Overhead transmission line

The Project would include a double-circuit 275kV or 330kV OTL connecting the two substations and then extending from the southern substation to the grid substation at Bundey for a distance of approximately 57km.

The OTL would be similar to those that form the national grid network of transmission lines and would have an estimated total length of approximately 57km. The OTL would be supported by standard lattice or pole type towers around 65m in height and at intervals of 200-400m depending on terrain and elevation. The micro-siting approach will be applied to the location of the towers to minimise impacts.

Plate 4 – Main substation and operations centre, Murra Warra Wind Farm, Murra Warra VIC (Image: ©GBD 2022)

5.9 Construction

There are potential visual effects that could occur during the project construction phase. The wind farm construction phase is likely to occur over an extended period, although the extent and nature of pre-construction and construction activities will vary at different locations within the project area. An indicative time frame would include:

- 3 years to substantially commence Stage 1 (from the date of approval)
- 6 years to complete Stage 1 (from the date of approval)
- 9 years to substantially commence Stage 2 (from the date of approval)
- 12 years to complete Stage 2 (from the date of approval).

The key pre-construction and construction activities that will be visible from areas surrounding the proposed wind farm include:

- Various civil works to upgrade local roads and access points
- Construction compound buildings and facilities
- Construction facilities, including portable structures and laydown areas
- Various construction and directional signage

- Mobilisation of rock crushing equipment and concrete batching plants (if required)
- Excavation and earthworks and
- Various construction activities including erection of wind turbines, monitoring masts and terminal substation with associated electrical infrastructure works.

Construction activities, some of which will result in physical changes to the landscape, are generally temporary in nature and for the most part restricted to various discrete areas within or beyond the immediate wind farm Project site.

Plate 5 – Typical wind farm under construction (Image: ©GBD 2017)

Plate 6 – Site entry signage, Sapphire Wind Farm NSW (Image: ©GBD 2018)

5.10 Decommissioning

The proposed technology is expected to have an economic life of approximately 25-30 years. At the end of the lease term, a decision would be made whether to:

- decommission the project permanently or
- to remove the old infrastructure and seek to replace it with new, upgraded technology.

If the Project is to be upgraded, then a new development application would be lodged at that time. If the Project is permanently decommissioned, Neoen would take full responsibility for decommissioning and rehabilitation works. A decommissioning plan would be prepared and submitted to the relevant authority for approval.

Decommissioning would include the following:

- De-energising plant and equipment
- Dismantling and removal wind turbines, battery energy storage units and transmission lines, as well as all other aboveground buildings, foundations and equipment
- Rehabilitation of disturbed land; and
- Recycling of recyclable materials (including batteries).

Decommissioning of some elements may be subject to the landowner's discretion (such as access tracks).

The Project site and ancillary infrastructure locations are illustrated in **Figures 2** and **3**.

Figure 2
Project site and panorama locations

GBD
Landscape architecture

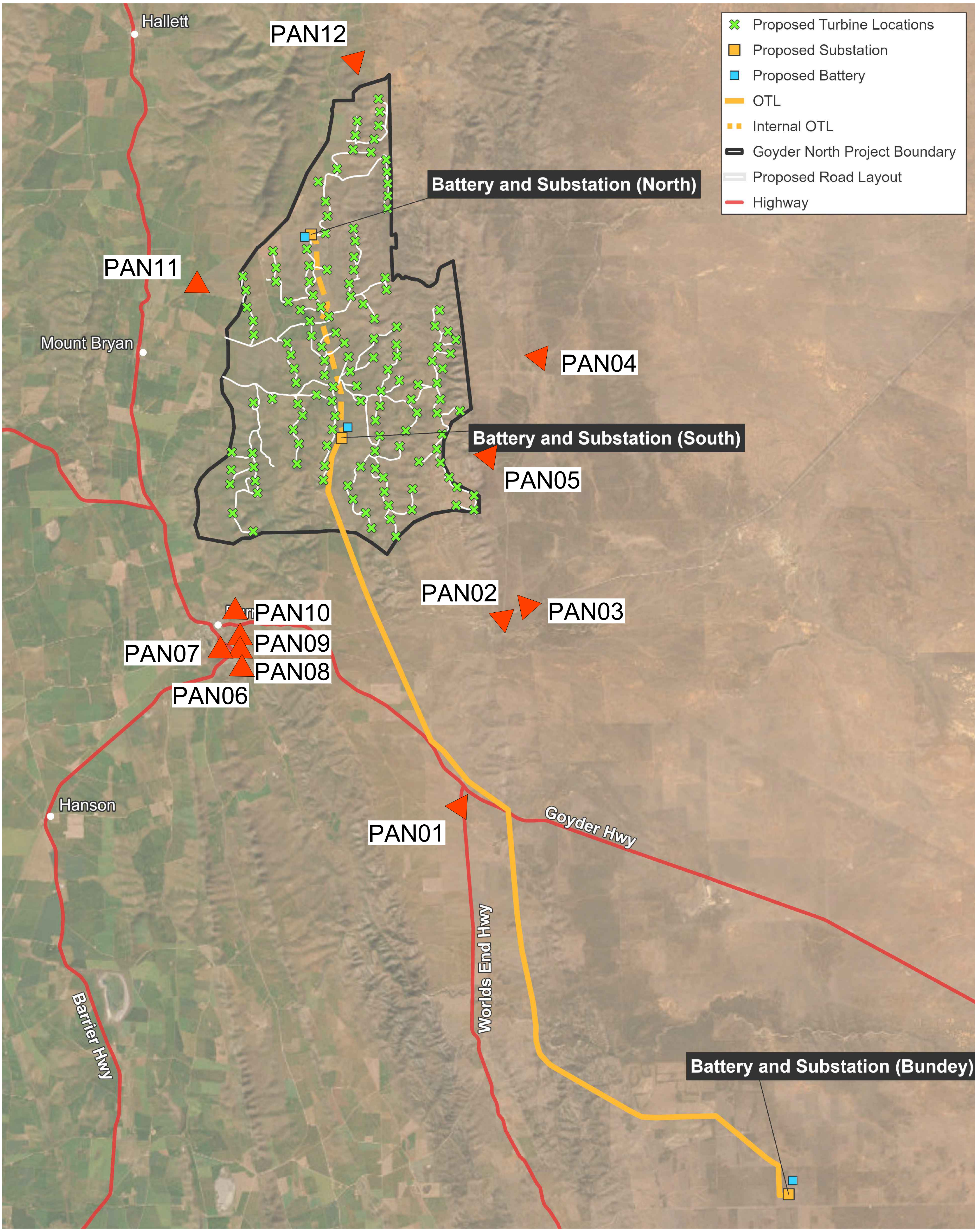


Figure prepared by GHD Australia Pty Ltd, Sourced Neoen Australia Pty Ltd 2024

Paper Size ISO A4
0 1.5 3 4.5 6
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 54

N

PAN04 Panorama photo location

Figure 3
Ancillary infrastructure locations

GBD
Landscape architecture

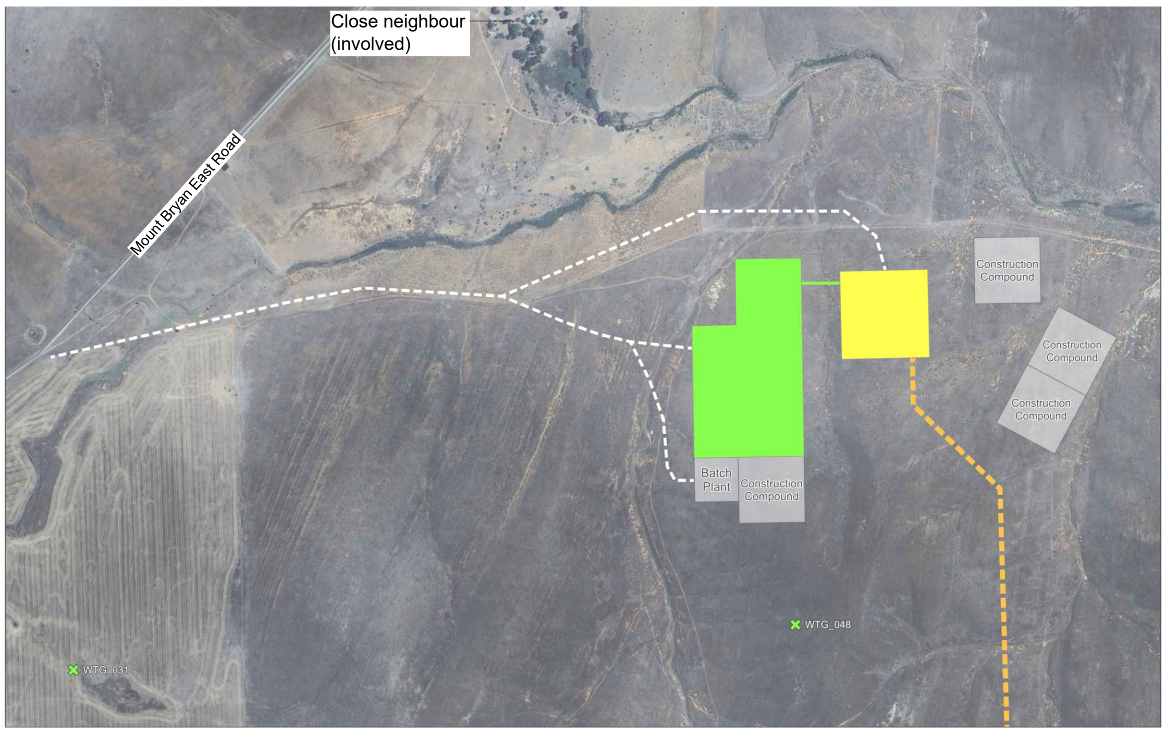


Figure source: Neoen Australia Pty Ltd

Proposed north substation, battery and temporary facilities

Figure source: Neoen Australia Pty Ltd

Proposed south substation, battery and temporary facilities

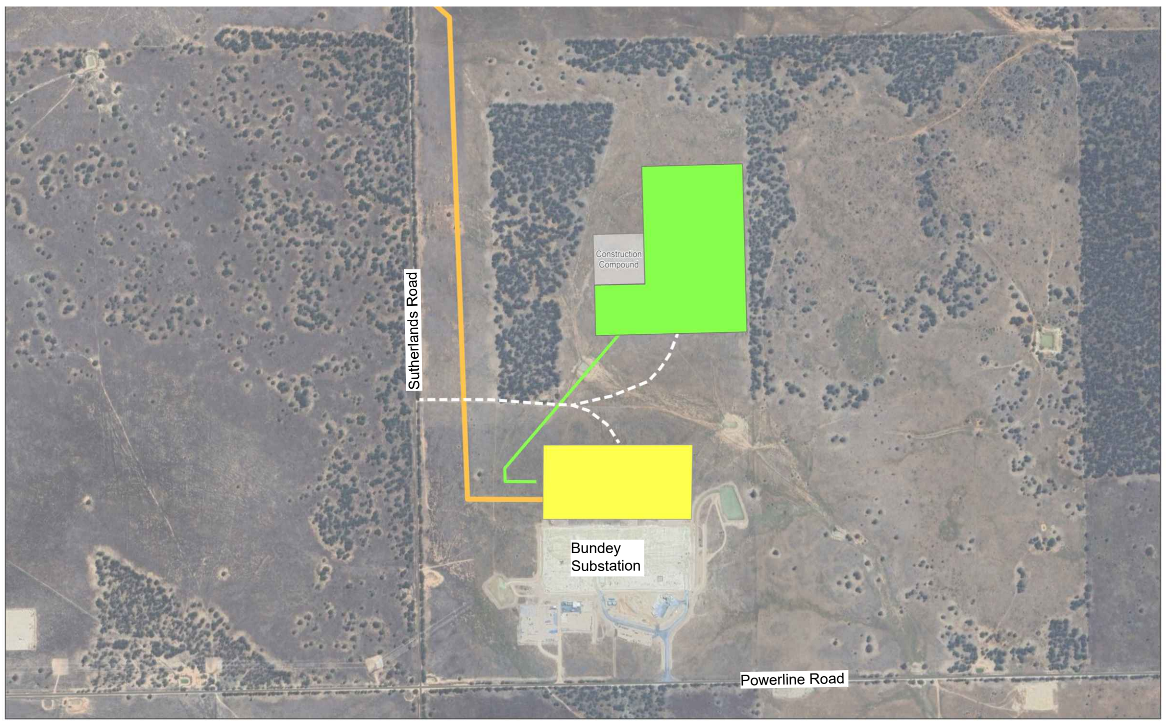


Figure source: Neoen Australia Pty Ltd

Bundy substation, proposed substation extension, battery and temporary facilities

Paper Size ISO A4

0 1.5 3 4.5 6

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 54

N

Permanent project infrastructure
- Battery
- Substation

Construction infrastructure

Proposed turbine locations

OTL

Internal OTL

Battery connection OTL

Proposed substation access from public roads

Public road

Parcel cadastre

Section 6. Viewshed

6.1 Viewshed

This Visual Assessment defines the viewshed as a geographic area surrounding the Project site where key project elements such as wind turbines, OTL, BESS and substations may be visible. Viewsheds can extend for long distances beyond wind farm sites, across mixed use areas including large tracts of unoccupied agricultural or natural landscapes. Viewsheds may include a range of key view locations subject to high, moderate or low visual effects.

The extent of viewshed will vary between wind farm projects and are influenced and informed by several criteria including the height of the wind turbines together with the nature, location and height of landform or vegetation that may limit and influence the extent of wind farm visibility.

The landform surrounding the project offers some variability in height (offering various degrees of screening) as illustrated in the ZTV diagrams. When combined with areas of tree cover, the potential for significant visual effects to occur beyond 8km is considered low.

It is important to note that wind turbines may be visible from landscape areas far beyond 8km and potentially up to 50km in ideal and extreme viewing conditions (Wind Turbine Visibility and Visual Impact Threshold Distances in Western Landscapes, Sullivan and Richmond May 2012). However, within the general parameters of normal human vision, a wind turbine at a maximum height of 240m to tip of rotor blade would occupy a relatively small proportion of a person’s field of view from distances more than 8km and result in a relatively lower level of perceived visual effects, and more so when tree cover is located within foreground to middle ground locations between a viewer and wind turbines.

Section 7. Panoramic photographs

7.1 Panoramic photographs

A series of individual and panorama digital photographs were taken during the site inspection to illustrate existing views near the Project and to give a sense of the overall site in its broader landscape setting and characteristics. Photo locations were selected to illustrate the variety of landforms and vegetation types found within the viewshed. The panorama photographs were digitally stitched together forming a segmented panorama image to provide a visual illustration of the existing view from each photo location. Photographs presented in this section are informative only and do not illustrate the appearance of the Project wind turbines; however, the general extent of potential wind turbine visibility has been illustrated on each of the panorama photographs.

The panorama photographs were taken with a Nikon D850 digital SLR camera with a full frame sensor and a prime 50mm focal length lens. The photographs were taken as a combination of hand held and tripod mounted images.

The panoramic photographs presented in this Visual Assessment have been annotated to identify local features within and beyond the Project site. The panorama photograph locations are illustrated in **Figure 2** and the photographs illustrated in **Figures 4** to **7**.

Worlds End Highway

Burra township beyond hills east of township

Views toward wind turbines screened by low undulating hills north of Goyder Highway

Goyder Highway

Views toward OTL extend along and above low undulating hills north of Goyder Highway before extending south, spanning highway toward the Bundey Substation site.

Panorama Location PAN01 - View north west to north east from the Worlds End Highway corridor

Views toward wind turbines would extend along steep sided and low undulating landforms north of the Eastern Road.

Views toward the OTL corridor would extend across generally level ground north toward the wind turbines and south substation site (not visible from the road corridor)

Panorama Location PAN02- View north west to north east from the Eastern Road corridor

Views toward the OTL corridor would extend across generally level ground south toward the Goyder Highway (not visible from the road corridor)

Distant views toward the Goyder South wind farm project under construction

Panorama Location PAN03- View south to south west from the Eastern Road corridor

Figure 4
Photo sheet 1

GBD
Landscape architecture

Caroona Road

Views would extend toward wind turbines along the eastern range of hills within the Project site

Views toward ancillary infrastructure including substations, BESS and OTL would be screened by landform.

Panorama Location PAN04 - View north to south west from the Caroona Road corridor

Mongolata Road

Views would extend toward wind turbines along the eastern range of hills within the Project site with some partial screening provided by rising landform

Views toward ancillary infrastructure including substations, BESS and OTL would be screened by landform.

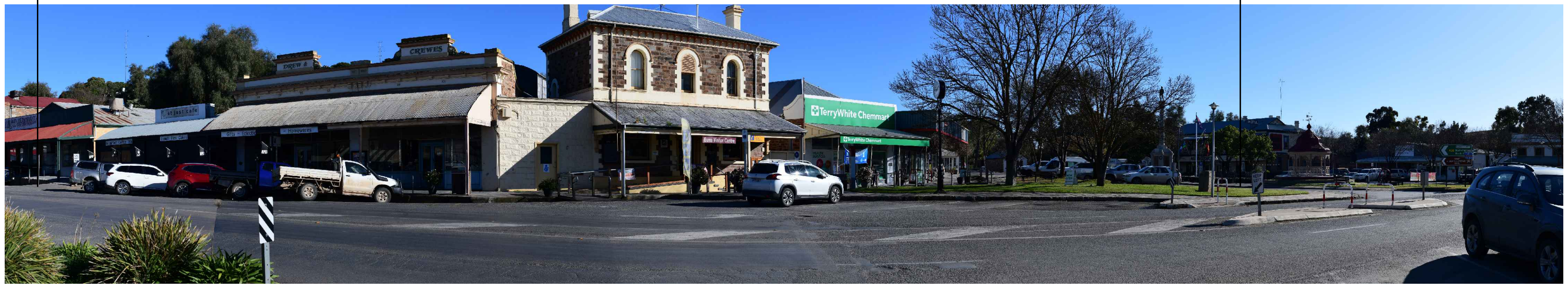
Panorama Location PAN05 - View south west to north west from the Mongolata Road corridor

Views from the Cemetery and more general areas with lower sections of the Burra township would be screened by a combination of landform and tree cover within the township

Panorama Location PAN06 - View north from the Burra General Cemetery

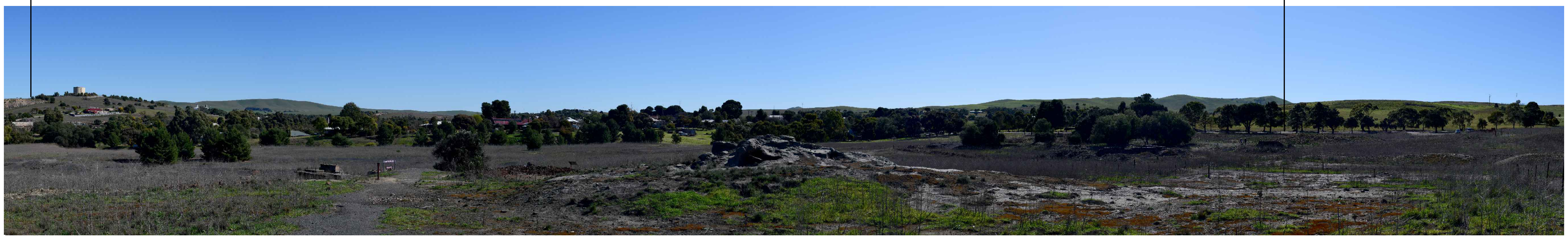
Figure 5
Photo sheet 2

GBD
Landscape architecture



Panorama Location PAN07 - View north west to north from Burra market square opposite Visitor Information Centre

Panorama Location PAN08 - View north west to north east from Barrier Highway outside St Joseph's Church



Panorama Location PAN09 - View north west to north east from the Burra Smelting Works (west of Smelts Road)

Figure 6
Photo sheet 3

Wellington Road within the
Hampton Village heritage precinct

Generally, views toward the Project site from the
Hampton Village heritage precinct would be screened by
landform rising to the north of the precinct

Panorama Location PAN10 - View north west to north east from Wellington Road (Hampton Village)

White Hill Road

Views would extend toward wind turbines on
steep sloping hills and ridgelines within the
west portion of the Project site

Mount Bryan E Road

Existing wind turbines within the
Hallett Wind Farm group at around
4km view distance

Panorama Location PAN11 - View north east to south east from Mount Bryan E Road

Dare Road

Views would extend toward wind turbines
on steep sloping hills and ridgelines within
the north portion of the Project site

Panorama Location PAN12 - View east to south east from Dare Road

Figure 6
Photo sheet 3

GBD
Landscape architecture

Section 8. Landscape Character Assessment

8.1 Landscape Character Area

As part of the Visual Assessment process it is important to understand the nature and sensitivity of different components of landscape character, and to identify them in a clear and consistent process. For this Visual Assessment, landscape character is defined as '*the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape'* (The Countryside Agency and Scottish Natural Heritage 2002). The pattern of elements includes characteristics such as landform, vegetation, land use and settlement.

This Visual Assessment has identified a singular Landscape Character Area (LCA), which generally occurs within the Project viewshed. The LCA represents an area that is relatively consistent and recognisable in terms of its key landscape elements and physical attributes, which includes a combination of topography/landform, vegetation/landcover, land use and built structures (including settlements and local road corridors).

The LCA is not defined as a discrete area, and characteristics within one section of the LCA may well occur within adjoining landscape surrounding the Project site.

8.2 Landscape character assessment

Understanding a particular landscape's key characteristics and principle visual features is important in defining regional distinctiveness and sense of place and to determine a region's sensitivity to change. The criteria applied in the determination of landscape character assessment and the ability of a landscape to accommodate change are outlined in **Table 3**. These criteria are based on established industry practice employed in the assessment of wind farm developments and have been adopted for numerous wind farm assessments across Australia and within South Australia.

The criteria are broadly outlined in the National Wind Farm Development Guidelines (Draft v2.4), Section 6.1 Landscape Character Units, and covered in more detail within the Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute and Institute of Environmental Management & Assessment, 2013 – Chapter 5 Assessment of landscape effects.

Whilst landscape character assessment is largely based on a systematic description and analysis of landscape characteristics, this Visual Assessment acknowledges that some individuals and other members of the local community may place different values on the local landscape.

Table 3 Criteria for the assessment of landscape character

Landscape Character Assessment Criteria

Characteristic	**Aspects indicating lower sensitivity to the wind farm development**	↔	**Aspects indicating higher sensitivity to the wind farm development**
Landform and scale: patterns, complexity and consistency	Large scale landform Simple Featureless Absence of strong topographical variety	↔	Small scale landform Distinctive and complex Human scale indicators Presence of strong topographical variety
Landcover: patterns, complexity and consistency	Simple Predictable Smooth, regular and uniform	↔	Complex Unpredictable Rugged and irregular
Settlement and human influence	Concentrated settlement pattern Presence of contemporary structures (e.g. utility, infrastructure or industrial elements)	↔	Dispersed settlement pattern Absence of modern development, presence of small scale, historic or vernacular settlement
Movement	Prominent movement, busy	↔	No evident movement, still
Rarity	Common or widely distributed example of landscape character area within a regional context	↔	Unique or limited example of landscape character area within a regional context
Intervisibility with adjacent landscapes	Limited views into or out of landscape Neighbouring landscapes of low sensitivity Weak connections, self-contained area and views Simple large-scale backdrops	↔	Prospects into and out from high ground or open landscape Neighbouring landscapes of high sensitivity Contributes to wider landscape Complex or distinctive backdrops

8.3 Landscape sensitivity

The scale of sensitivity for the landscape character area is described below and considered against each characteristic identified in **Table 3**.

The overall sensitivity for the landscape character area has been determined against the following ratings of Negligible through to High:

Negligible – where the characteristics of the landscape character area will not be impacted or visibly altered by the proposed Project.

Low – where most of the landscape character area characteristics are generally robust and will be less affected by the proposed Project. The degree to which the landscape may accommodate the Project will not significantly alter existing landscape character.

Moderate – where distinguishable characteristics of the landscape character area may be altered by the proposed Project, although the landscape character area may have the capability to absorb some change. The degree to which the landscape character area may accommodate the proposed Project will potentially result in the introduction of prominent elements to the landscape character area, which may be accommodated to some degree.

High – where key characteristics of the landscape may be impacted by the Project and could result in major and visually dominant alterations to perceived characteristics of the landscape character area, which may not be fully mitigated by existing landscape elements and features. The degree to which the landscape may accommodate the proposed Project will result in several perceived uncharacteristic and significant changes.

8.4 Landscape sensitivity assessment

The following section of this Visual Assessment provides an analysis of landscape sensitivity within the viewshed.

Table 4 – Landscape Sensitivity

<table>
<tr><td></td><td colspan="2">**Lower Sensitivity**</td><td>↔</td><td colspan="2">**Higher Sensitivity**</td></tr>
<tr><td></td><td>**Low**</td><td>**Low to Mod**</td><td>**Moderate**</td><td>**Mod to High**</td><td>**High**</td></tr>
<tr><td rowspan="2">Landform and Scale</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">The landform and morphology of the landscape within and immediately surrounding the Project site is relatively consistent with areas of gentle to moderately inclined landform extending around the Project site. There is an overall large scale to the broader landscape defined by patterns being more moderate in scale. Landscape features and stronger topographical elements beyond the Project site create a greater degree of complexity and more visually compartmentalised areas because of tree covered hills and gullies.</td></tr>
<tr><td rowspan="2">Landcover</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Landcover within the Project site is relatively simple and predictable, together with that of the immediate and surrounding landscape. Tree cover is generally limited within the viewshed, occurring within steeper gullies across the Project site or along drainage lines and intermittently along road corridors. European settlement established an agricultural presence which defines some of the contemporary farming areas within and beyond the Project site.</td></tr>
<tr><td rowspan="2">Settlement and human influence</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Settlement is generally dispersed within the rural landscape immediately beyond the Project site incorporating farmsteads and individual rural dwellings. There are small to moderate scale, historic or vernacular structures within the landscape including those associated with both the Burra and Mount Bryan townships and the historic Burra Mine site. Most historic built elements or features resultant from human interactions are visually contained by the proximate landform surrounding and screening the Burra township from extensive and distant views.</td></tr>
<tr><td rowspan="2">Movement</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Movement occurs within the townships and along local roads within urban areas and main roads leading to and away from Burra and Mount Bryan. Low to moderate frequency vehicular movements occur along sections of the Goyder and Barrier highways. Movement within the Project site is limited to occasional vehicles and farm traffic along local access tracks.</td></tr>
<tr><td rowspan="2">Rarity</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">The Project site and adjoining landscape are a relatively common landscape type (Rural Zone) within a regional context and do not tend to exhibit landscape features or elements which would only occur within the Project site.</td></tr>
</table>

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Mod	Moderate	Mod to High	High
Intervisibility			■		
	Areas of landscape surrounding the Project Site can allow for far distant and regional scale views. Whilst views can, depending on prevailing climatic conditions, extend toward portions of landscapes with a moderate to high visual sensitivity, the level of distant visibility is generally restricted to landform silhouettes. Whilst the wind turbines would be visible from some elevated areas, the distance between wind farm and distant elevated receiver locations would tend to render the Project wind turbines as generally noticeable, but not dominant features which occupy a relatively small portion of the overall available view.				
Overall Sensitivity Rating	Moderate Low				

8.5 Landscape sensitivity summary

As a landscape with a Moderate Low sensitivity the landscape character area characteristics are generally robust and will be less affected by the proposed Project. The degree to which the landscape may accommodate the Project will not significantly alter existing landscape character.

However, where distinguishable characteristics of the landscape character area may be altered by the proposed Project, although the landscape character area may have the capability to absorb some change. The degree to which the landscape character area may accommodate the proposed Project will potentially result in the introduction of prominent elements to the landscape character area, which may be accommodated to some degree.

Section 9. Zone of Theoretical Visibility

9.1 Zone of Theoretical Visibility (ZTV)

The ZTV diagrams are used to identify theoretical areas of the landscape from which wind turbines, or portions of turbines, may be visible from areas within and surrounding the Project site. They are useful for providing an overview as to the extent to which the Project wind turbines may be visible from surrounding areas.

9.2 ZTV Methodology

The ZTV methodology is a purely geometric assessment where the visibility of the wind turbines is determined from carrying out calculations based on a digital terrain model of the Project site and the surrounding terrain.

Calculations have been made to determine the visibility of the wind turbines from:

- blade tips (essentially a view toward any part of the wind turbine rotor, including views toward the tips) and
- hub height (view between the nacelle and tip of blade).

The ZTV assessment methodology is very conservative as:

- the screening effects of any structures and vegetation above ground level are not considered in any way. Therefore, the Project may not be visible at many locations indicated on the ZTV diagrams due to the local presence of trees, buildings or other screening materials.
- additionally, the number of turbines visible from any location is also influenced by prevailing weather conditions. Inclement or cloudy weather would tend to mask the visibility of the wind turbines.

Accordingly, while a ZTV diagram is a useful visualisation tool, it is very conservative in nature and the level of visibility as illustrated in the ZTV diagram is unlikely to occur from all view locations within the viewshed.

A diagram illustrating the tip of blade and hub height visibility is illustrated in **Figure 8** and the ZTV diagrams are shown in **Figures 9** and **10**.

The tip of blade and hub height ZTV illustrate the extent of similar areas of potential visibility and highlight the extent and influence of landform surrounding the Project site; however, the ZTV do not illustrate screening provided by tree cover.

9.3 Visibility

The level of wind turbine visibility of the Project would result from several factors including, but not limited to:

- Distance between view location and wind turbine
- Directional movement (travelling toward or away from wind turbines)
- Relative position and backdrops and
- Climatic and atmospheric conditions.

9.3.1 Distance

With an increase in distance, the proportion of a person's horizontal and vertical view cone occupied by a visible turbine structure, or group of turbine structures, would decline. **Figure 11** illustrates the effect increasing view distance on the scale and visibility of wind turbines.

As the view distance increases so do the atmospheric effects resulting from dust particles and moisture in the atmosphere, which makes the turbines appear to be grey thus potentially reducing the contrast between the wind turbines and the background against which they are viewed.

9.3.2 Movement

The visibility of the wind turbines would vary between the categories of static and dynamic view locations. In the case of static views, the relationship between a wind turbine and the landscape would not tend to vary greatly. The extent of vision may be relatively wide as a person would tend to scan back and forth across the landscape where panoramic views are available.

In contrast, views from a moving vehicle are dynamic as the visual relationship between wind turbines is constantly changing as well as the visual relationship between the wind turbines and the landscape in which they are seen. The extent of vision available from a vehicle can be partially constrained by the vehicle interior at proximate distances.

9.3.3 Relative position

In situations where the view location is at a lower elevation than the wind turbine structure most of it would be viewed against the sky. The degree of visual contrast between a white coloured turbine and the sky would depend on the presence of background clouds and their colour. Dark grey clouds would contrast more strongly with white turbines than a background of white clouds.

The level of contrast is also influenced by the position of the sun relative to the individual wind turbines and the view location. Where the sun is in front of the viewer, the visible portion of the wind turbine would be seen in shadow. Where the background to the wind turbine is dark toned the visual contrast would be reduced.

Where the sun is located behind the view location then the visible portion of the wind turbine would be in full sun. If the background is also light toned, such as white clouds, then the contrast is less when compared to a dark background.

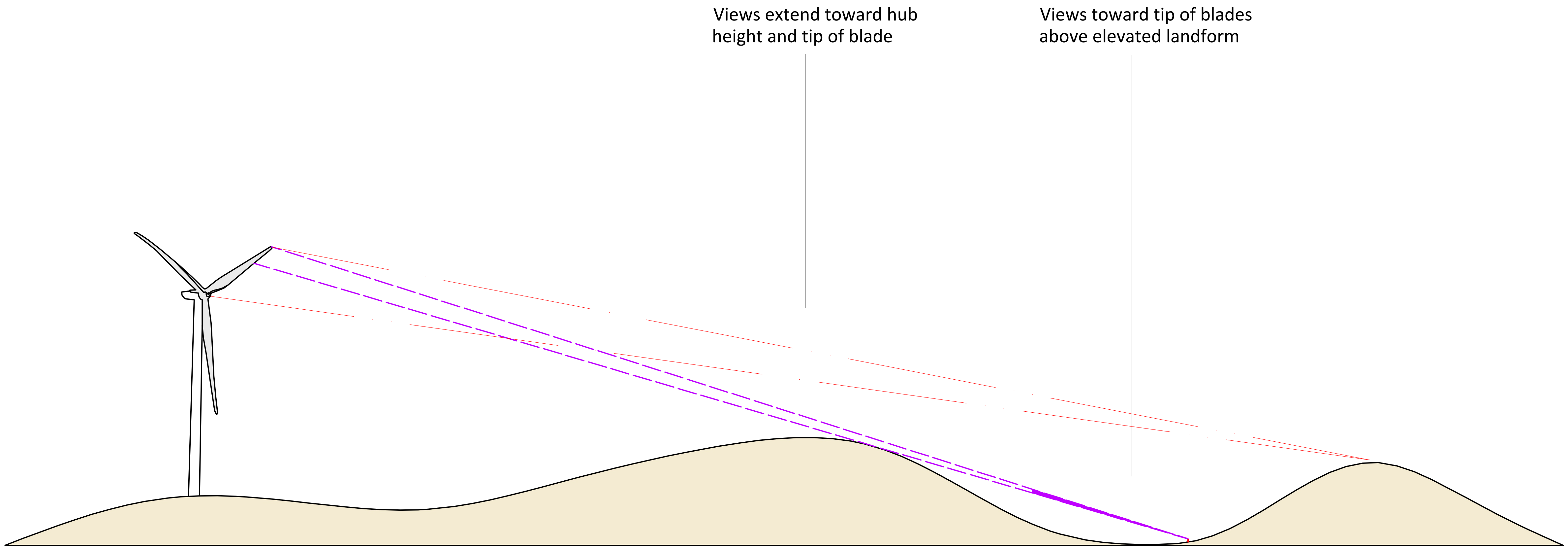
9.3.4 Climatic and Atmospheric Conditions

Local climatic and atmospheric conditions have the potential to influence the visibility of the Project from surrounding view locations, and more significantly, from middle ground and distant view locations.

Rainfall would tend to reduce the level of visibility toward the Project from several surrounding view locations, with the degree of visibility tending to decrease over distance. Rain periods may also reduce the number of visitors travelling through the areas from which the Project may be visible, and potentially decrease the duration of time spent at a particular public view location with a view toward the Project.

Cloud cover would also tend to reduce the level of visibility of the Project and lessen the degree of contrast between the wind turbine structures and the background against which the wind turbines may be visible.

On clear or partly cloudy days, the position of the sun would also influence the degree of visibility of the Project. The degree of effect would be largely dependent on the relationship between the position and angle of the sun relative to the view location. Late afternoon and early evening views toward the west would result in the wind turbines silhouetted above the horizon line, and with increasing distance would tend to reduce the contrast between the wind turbine structures and the surrounding landform.



'Tip of blade'

View toward 'tip of blade' - where views extend toward any part of the turbine including views toward the tip of blades above elevated landform and ridgelines.

'Hub height'

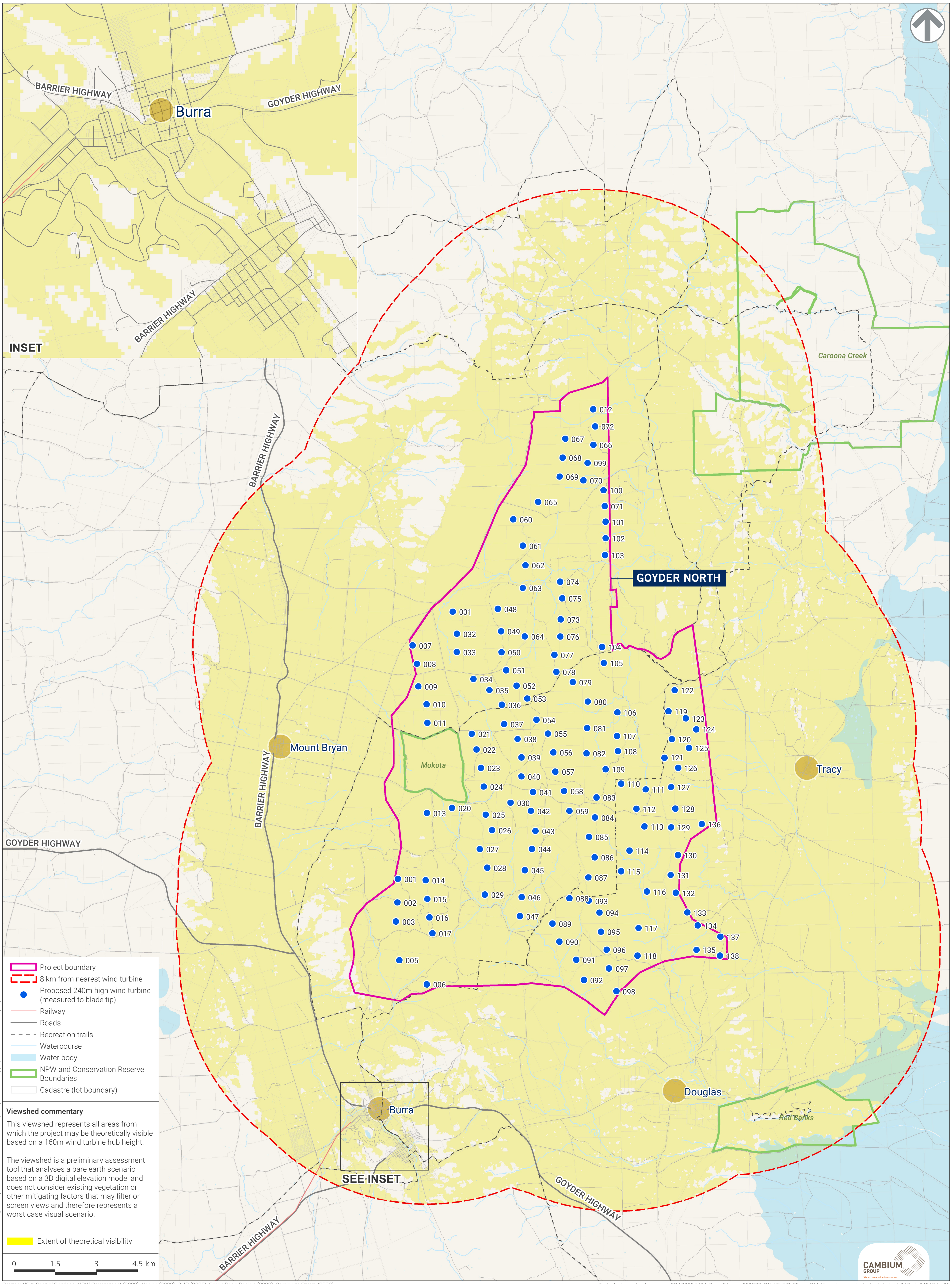
View toward 'hub height' - where views extend toward the wind turbine hub blades swept path above hub.

Figure 8
Zone of theoretical visibility

Figure 9

Zone of Theoretical Visibility (hub height 160m)

GBD Landscape architecture



Source: NSW Spatial Services, NSW Government (2023), Neoen (2023), GHD (2023), Green Bean Design (2023), Cambium Group (2023).

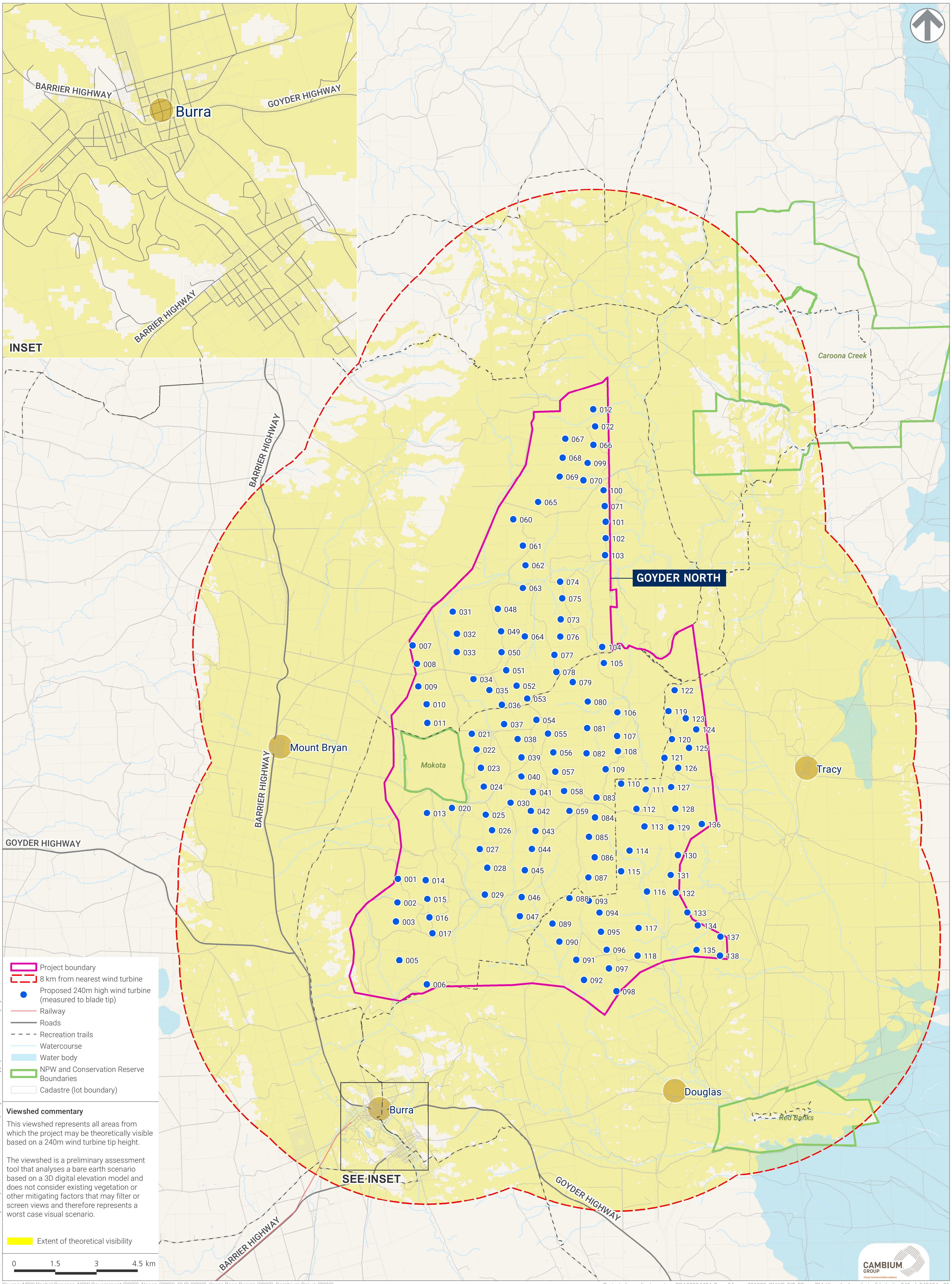
Projected coordinate system GDA2020 MGA Zone 54

031280_GNWF_EIS_F3_no_PM_Viewshed_analysis_(hub_height_160m)_240404_v01

Figure 10

Zone of Theoretical Visibility (blade tip 240m)

GBD
Landscape architecture



Source: NSW Spatial Services, NSW Government (2023), Neoen (2023), GHD (2023), Green Bean Design (2023), Cambium Group (2023).

Projected coordinate system GDA2020 MGA Zone 54

031280_GNWF_EIS_F2_no_PM_Viewshed_analysis_(blade_tip_240m)_240404_v01

Image 1 Modelled wind turbine 240 metre tip height - view distance 2 km

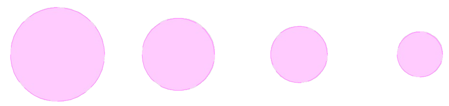
Image 2 Modelled wind turbine 240 metre tip height - view distance 3 km

Image 3 Modelled wind turbine 240 metre tip height- view distance 4 km

Image 4 Modelled wind turbine 240 metre tip height - view distance 5 km

Camera: Nikon D700, 50mm prime lens

Approximate wind turbine swept area



2km 3km 4km 5km

Figure 11
Wind turbine visibility

GBD
Landscape architecture

Section 10. Response to Planning and Design Code – Zones and General Development Policies

10.1 Introduction

General development policies broadly relate to how a development should occur. These polices address the functional requirements for a development type or class, such as minimisation of overshadowing for a multi-storey building.

General development policies contain Assessment Provisions and are linked to specific development types as listed in a zone's Classification Table.

10.2 Assessment Provisions

Each of the Code modules – zones, subzones, overlays, and general development policies – contain four different types of Assessment Provisions:

Desired outcomes set the overarching vision/objectives for a particular zone, subzone, overlay or general development policies and aid in the interpretation of performance outcomes.

Where a relevant authority is uncertain as to whether or how a performance outcome applies to a development, desired outcomes may inform its consideration or may assist in assessing the merits of the development against the applicable performance outcomes collectively.

Performance outcomes (POs) are policies designed to facilitate assessment of certain matters, such as land use and intensity, site dimensions and land division, built form and character, and hazard risk minimisation.

The Assessment Provisions for Zones and General Development Policies (as relevant to the Project) include consideration of the policies contained in the following modules of the Code:

- *Rural Zone*
- *Rural Intensive Enterprise Zone*
- *Design*
- *Infrastructure and Renewable Energy Facilities and*
- *Interface between Land Uses*

The following identifies those policies considered most relevant to the Project.

Table 5 Rural Zone

Assessment Provisions
Desired Outcome
DO.1 *A zone supporting the economic prosperity of South Australia primarily through the production, processing, storage and distribution of primary produce, forestry and the generation of energy from renewable sources.*
DO.2

Table 5 Rural Zone

A zone supporting diversification of existing businesses that promote value-adding such as industry, storage and warehousing activities, the sale and consumption of primary produce, tourist development and accommodation.		
Performance Outcome	**Designated Performance Feature**	**Visual Assessment response:**
PO 2.2 *Buildings are generally located on flat land to minimise cut and fill and the associated visual impacts.*	*DPF 2.2 Buildings:* *(a) are located on sites with a slope not greater than 10% (1-in-10)* *(b) do not result in excavation and/or filling of land greater than 1.5m from natural ground level.*	The principal Project buildings including control rooms, maintenance sheds, substations and batteries sites have been located on relatively flat land to accommodate the nature of the development and to avoid excessive amounts of cut and fill. Whilst the final location and design of the principal buildings is subject to detailed design, it is unlikely that buildings would be elevated more than 1.5m above the natural ground level.
PO 4.3 *Industry, storage, warehousing, transport distribution or similar activities are sited, designed and of a scale that maintains rural character and function and respects landscape amenity.*	*DPF 4.2* *Buildings and associated activities:* *(a) are set back at least 100m from all road and allotment boundaries* *(b) are not sited within 200m of a sensitive receiver in other ownership* *(c) have a building height not greater than 10m above natural ground level* *(d) incorporate the loading and unloading of vehicles within the confines of the* *allotment*	The principal Project buildings, including the Operations and Maintenance facilities, would be sited at distances exceeding Code requirements and set back at a distance from which the scale and design would not dominate or appear incongruous with the surrounding rural character of the Project site.
PO 10.1		Large buildings would be sited to reduce impacts on scenic and rural vistas and are not proposed to be

Table 5 Rural Zone

Large buildings are designed and sited to reduce impacts on scenic and rural vistas by: *(a) having substantial setbacks from boundaries and adjacent public roads* *(b) using low-reflective materials and finishes that blend with the surrounding landscape* *(c) being located below ridgelines.*		located on ridgelines. Whilst subject to final design, buildings would adopt low reflective materials to blend with the landscape

Table 6 Rural Intensive Enterprise Zone

Assessment Provisions		
Desired Outcome		
DO.1 Multi-purpose intensive agricultural production, processing facilities and supporting ancillary industries that are important economic and employment assets to the state.		
Performance Outcome	**Designated Performance Feature**	**Visual Assessment response:**
PO 7.1 *Freestanding advertisements that identify the associated business without creating a visually dominant element within the locality.*	*DPF 7.1* *Freestanding advertisements* *(a) do not exceed 2m in height* *(b) do not have a sign face that exceeds 2m2 per side.*	A range of signage may be incorporated into the Project during construction and operation; however Project signage will be mostly directional or safety related as opposed to advertising. Any signage related to advertising will be installed in accordance with the Code criteria. All other signage will be installed to avoid creating visually dominant elements within the locality.
PO 9.1 *Industry, storage, warehousing, transport distribution or similar activities are sited, designed and of a scale that minimises the potential*		Above ground Project infrastructure, including substation extension, BESS and ancillary items, will be sited and suitably designed to avoid adverse impacts on adjoining activities.

Table 6 Rural Intensive Enterprise Zone

for adverse impact on adjoining activities.		

Table 7 Design

Assessment Provisions		
Desired Outcome		
DO.1 Development is: *(a) contextual - by considering, recognising and carefully responding to its natural surroundings or built environment and positively contributes to the character of the immediate area* *(b) durable - fit for purpose, adaptable and long lasting* *(c) inclusive - by integrating landscape design to optimise pedestrian and cyclist usability, privacy and equitable access, and promoting the provision of quality spaces integrated with the public realm that can be used for access and recreation and help optimise security and safety both internally and within the public realm, for occupants and visitors* *(d) sustainable - by integrating sustainable techniques into the design and siting of development and landscaping to improve community health, urban heat, water management, environmental performance, biodiversity and local amenity and to minimise energy consumption.*		
Performance Outcome	**Designated Performance Feature**	**Visual Assessment response:**
PO 1.4 Plant, exhaust and intake vents and other technical equipment is integrated into the building design to minimise visibility from the public realm and negative impacts on residential amenity by: *(a) positioning plant and equipment in unobtrusive locations viewed from public roads and spaces* *(b) screening rooftop plant and equipment from view* *(c) when located on the roof of non-residential development, locating the plant and equipment as far as practicable from adjacent sensitive land uses.*		Technical equipment would be incorporated into building design where possible; however, the distance between technical equipment within the Project site and the public realm/dwellings would result in largely negligible visual effects.

Table 7 Design

PO1.5 *The negative visual impact of outdoor storage, waste management, loading and service areas is minimised by integrating them into the building design and screening them from public view (such as fencing, landscaping and built form) taking into account the form of development contemplated in the relevant zone.*		Undulating landscape characteristics and distances between storage areas within the Project site and the public realm/dwellings would result in largely negligible visual effects.
PO3.1 Soft landscaping and tree planting is incorporated to: *(a) minimise heat absorption and reflection* *(b) maximise shade and shelter* *(c) maximise stormwater infiltration* *(d) enhance the appearance of land and streetscapes* *(e) contribute to biodiversity.*		Soft landscape and tree planting may be incorporated into the Project site to mitigate potential significant visual effects from surrounding sensitive receiver locations; however, the requirement for soft landscape and tree planting is not considered likely to be required given the degree of inherent screening characteristics of the existing landscape.
PO 3.2 *Soft landscaping and tree planting maximises the use of locally indigenous plant species, incorporates plant species best suited to current and future climate conditions and avoids pest plant and weed species.*		Soft landscape and tree planting may be incorporated into the Project site to mitigate potential significant visual effects from surrounding sensitive receiver locations; however, the requirement for soft landscape and tree planting is not considered likely to be required given the degree of inherent screening characteristics of the existing landscape.

Table 8 Infrastructure and Renewable Energy Facilities

Assessment Provisions		
Desired Outcome		
DO.1 *Efficient provision of infrastructure networks and services, renewable energy facilities and ancillary development in a manner that minimises hazard, is environmentally and culturally sensitive and manages adverse visual impacts on natural and rural landscapes and residential amenity.*		
Performance Outcome	**Designated Performance Feature**	**Visual Assessment response:**
PO2.1 *The visual impact of above-ground infrastructure networks and services (excluding high voltage transmission lines), renewable energy facilities (excluding wind farms), energy storage facilities and ancillary development is minimised from townships, scenic routes and public roads by:* *(a) utilising features of the natural landscape to obscure views where practicable* *(b) siting development below ridgelines where practicable* *(c) avoiding visually sensitive and significant landscapes* *(d) using materials and finishes with low-reflectivity and colours that complement the surroundings* *(e) using existing vegetation to screen buildings* *(f) incorporating landscaping or landscaped mounding around the perimeter of a site and between adjacent allotments accommodating or zoned to*		Above ground infrastructure within the Project site (excluding high voltage transmission lines and wind farms) would utilise existing undulating landforms, and tree cover within the south battery and substation, to minimise the potential for significant visual effects from sensitive receiver locations. Infrastructure (excluding high voltage transmission lines and wind turbines) would avoid ridgeline locations and would not be located within visually sensitive or significant landscapes as designated within relevant Overlays. Subject to final detailed design, above ground infrastructure cladding would adopt low reflectivity materials with colour finishes to complement the surrounding landscape. Existing vegetation would be retained where possible to assist in screening above ground infrastructure. Soft landscape works, or mounding incorporating landscape screening treatment, are not considered viable options to the perimeter of the

Table 8 Infrastructure and Renewable Energy Facilities

primarily accommodate sensitive receivers.		Project site, given the extent of the site boundary and the distance between above ground infrastructure and surrounding sensitive receivers.
PO2.2 *Pumping stations, battery storage facilities, maintenance sheds and other ancillary structures incorporate vegetation buffers to reduce adverse visual impacts on adjacent land.*		Soft landscape works are not considered viable options to screen battery storage facilities or other ancillary structures, given the proposed distance between ancillary infrastructure and surrounding sensitive receivers.
PO2.3 *Surfaces exposed by earthworks associated with the installation of storage facilities, pipework, penstock, substations and other ancillary plant are reinstated and revegetated to reduce adverse visual impacts on adjacent land.*		Any existing surfaces exposed by earthworks for storage facilities, substations and ancillary plant will be reinstated and revegetated to reduce visual impacts on adjacent land.
PO3.1 *Progressive rehabilitation (incorporating revegetation) of disturbed areas, ahead of or upon decommissioning of areas used for renewable energy facilities and transmission corridors.*		Progressive rehabilitation (incorporating revegetation) of disturbed areas, would be undertaken ahead of or upon decommissioning of areas used for renewable energy facilities and transmission corridors.
PO5.1 *Electricity infrastructure is located to minimise visual impacts through techniques including:* *(a) siting utilities and services:* *(i) on areas already cleared of native vegetation* *(ii) where there is minimal interference or disturbance to*		The siting of electricity infrastructure has sought to minimise visual impacts where possible by avoiding areas of native vegetation or limiting development to areas where minimal interference or disturbance to existing native vegetation may be required. Grouping built structures, such as substations and BESS has been

Table 8 Infrastructure and Renewable Energy Facilities

existing native vegetation or biodiversity *(b) grouping utility buildings and structures with non-residential development, where practicable.*		proposed to minimise the extent of buildings through the Project site.
PO5.3 *Battery storage facilities are co-located with substation infrastructure where practicable to minimise the development footprint and reduce environmental impacts.*		The three battery storage facilities have been co-located with proposed and existing substation infrastructure to minimise landscape and visual effects.
PO7.1 *Renewable energy facilities are located as close as practicable to existing transmission infrastructure to facilitate connections and minimise environmental impacts as a result of extending transmission infrastructure.*	*DPF 7.1* *Wind turbine generators are:* *(a) set back at least 2000m from the base of a turbine to any of the following zones:* *(i) Rural Settlement Zone* *(ii) Township Zone* *(iii) Rural Living Zone* *(iv) Rural Neighbourhood Zone* *with an additional 10m setback per additional metre over 150m overall turbine height (measured from the base of the turbine).* *set back at least 1500m from the base of the turbine to non-associated (non-stakeholder) dwellings and tourist accommodation.*	The wind turbines have been set back from inhabited zones and dwellings within rural areas in accordance with the Planning and Design Code requirements.
PO8.2		All wind turbines will be based on a similar model being uniform in colour, size and shape.

Table 8 Infrastructure and Renewable Energy Facilities

The visual impact of wind turbine generators on natural landscapes is managed by: *(a) designing wind turbine generators to be uniform in colour, size and shape* *(b) coordinating blade rotation and direction* *(c) mounting wind turbine generators on tubular towers as opposed to lattice towers.*		All wind turbine blades will rotate in a clockwise direction and will face the prevailing wind direction under normal operating conditions. The wind turbines will not be mounted on lattice towers.
PO8.4 *Wind turbine generators incorporate recognition systems or physical markers to minimise the risk to aircraft operations.*		Given their scale, wind turbines are inherently physical markers in the landscape and are coloured white to increase their contrast with the ground when viewed from aircraft. An Aviation Impact Assessment concluded that there would be no impact on aviation operations.
PO13.2 *Temporary facilities to support the establishment of renewable energy facilities (including borrow pits, concrete batching plants, laydown, storage, access roads and worker amenity areas) are sited and operated to minimise environmental impact.*		Temporary facilities within the Project site would be located at distance from sensitive receiver locations and largely screened through undulating landforms within and surrounding the Project site.

Table 9 Interface between Land Uses

Assessment Provisions		
Desired Outcome		
DO.1 *Development is located and designed to mitigate adverse effects on or from neighbouring and proximate land uses.*		
Performance Outcome	**Designated Performance Feature**	**Visual Assessment response:**
PO3.4 *Development that incorporates moving parts, including windmills and wind farms, are located and operated to not cause unreasonable nuisance to nearby dwellings and tourist accommodation caused by shadow flicker.*		A shadow flicker assessment has been prepared separately to this Visual Assessment and demonstrates that shadow flicker would not cause an unreasonable nuisance to nearby dwellings and tourist accommodation.
PO6.1 *External lighting is positioned and designed to not cause unreasonable light spill impact on adjacent sensitive receivers (or lawfully approved sensitive receivers).*		The location of external lighting at principal buildings within the Project site would not cause any light spill impact on surrounding sensitive receivers and would be located at a distance where light spill would not occur.
PO6.2 *External lighting is not hazardous to motorists and cyclists.*		The location of external lighting would not present a hazard to motorists or cyclists and would be located at a distance where light spill would not occur.

Section 11. Key views and visual effects

11.1 Introduction

The overall determination of visual effects resulting from the Project would result primarily from a combination of receptor sensitivity and the magnitude of visual effects.

A determination of visual effects from the combination of receptor sensitivity and the magnitude of visual effect is a well-established methodology and has been applied extensively on proposed wind farms in South Australia and across Australia. The standard methodology is set out in industry and best practice guidelines including the Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute, and Institute of Environmental Management & Assessment, 2013 – Chapter 6 Assessment of visual effects.

11.2 Sensitivity of visual receivers

Judging the sensitivity of visual receivers needs to consider the occupation or activity of people experiencing the view at particular locations and the extent to which their attention or interest is focussed on views toward the wind turbines or electrical infrastructure within and surrounding the Project site.

11.3 Magnitude of visual effects

Judging the magnitude of visual effects has considered the:

- Distance and resultant scale of the change in the view with respect to the loss or addition of features in the view
- Changes in landscape composition, including the proportion of the view occupied by the Project
- Degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line height, colour, and texture
- Nature of the view of the proposed development, in terms of the relative amount of time over which it would be experienced and
- Whether views from receiver locations would be screened to any degree by existing vegetation or other above ground structures.

View distance and the resultant change in wind turbine scale are illustrated in **Figure 11.** Wind turbines at around a 6km view distance are clearly visible; however, the overall wind turbine scale presents a less dominant visual element within the available field of view. As the overall scale of wind turbine structures diminish with distance the greater the potential for screening where trees are located between the receiver and the wind turbine. The overall height of planting required to screen wind turbines decreases as it moves nearer to the receiver. The consideration of distance magnitude criteria has determined that wind turbines occupying around 2% or less of a person's vertical field of view are unlikely to result in a significant visual effect.

The combination of sensitivity and magnitude would provide the rating of visual effect for viewpoints. **Table 10** sets out the relative visual impact grading values which combines issues of sensitivity and magnitude for the Project.

An overall determination of potential visual effect at each key view location has been assessed and determined against the visual impact grading matrix in **Table 10** below. The levels of sensitivity and magnitude of visual effects outlined in **Table 10** are **used as a guide** to determine levels of visual effect and are not absolute. For example, views may extend toward the Project from 'high' sensitive view locations; however, a 'medium' magnitude may be adjusted to 'low' as a result of restricted views or existing screening, resulting in 'moderate' visual effects rather than 'high moderate' visual effects.

Key view locations up to 6km from the wind turbines are illustrated in **Figure 12**. Non-dwelling structures, such as agricultural sheds, within 6km of the proposed wind turbines have not been assessed.

Figure 12
Key View Locations

GBD
Landscape architecture

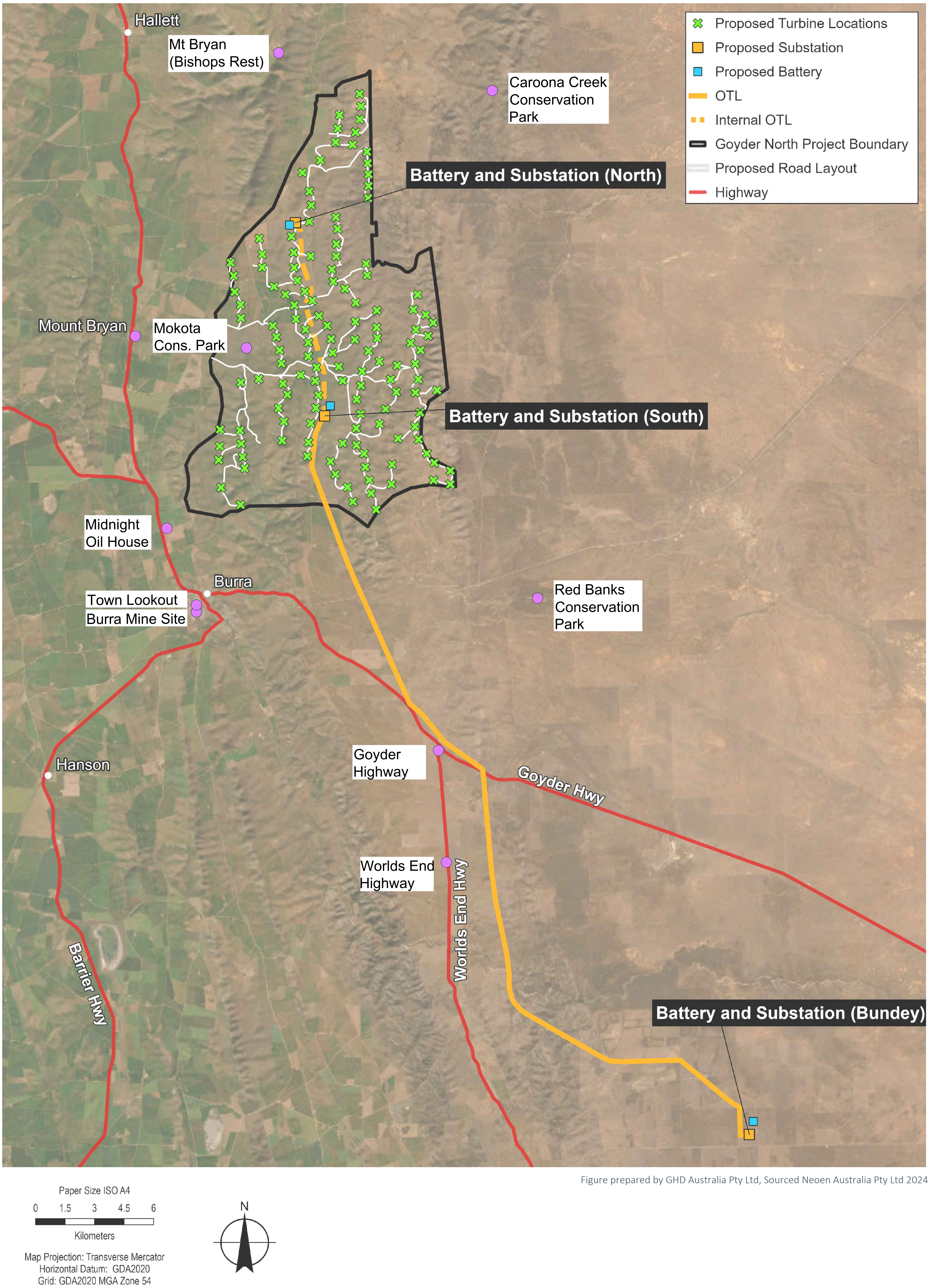


Figure prepared by GHD Australia Pty Ltd, Sourced Neoen Australia Pty Ltd 2024

Table 10 Visual effect grading matrix

			Scale or magnitude of visual effects			
			High	Moderate	Low	Negligible
			Very short distance view over a long duration of time. A high extent of wind turbine visibility would tend to dominate the available skyline view and significantly disrupt existing views or vistas. Total loss or major change to pre-development view or introduction of elements which are uncharacteristic to the existing landscape features.	Short to moderate distance views over a moderate duration of time. A moderate extent of wind turbine visibility would have the potential to dominate available views with visibility recessing over increasing distance. Partial alteration to pre-development view or introduction of elements that may be prominent but not uncharacteristic with the existing landscape.	Moderate to long distance views over a low to moderate duration of time. Wind turbines in views, at long distances or visible for a short duration not expected to be significantly distinct in the existing view. Minor alteration to pre-development view or introduction of elements that may not be uncharacteristic with the existing landscape.	Visible change perceptible at a very long distance, or visible for a very short duration, and/or is expected to be less distinct within the existing view. Very minor loss or alteration to pre-development view or introduction of elements which are not uncharacteristic with the existing landscape features.
Sensitivity of visual receptor		**Indicator**				
	High	People with a proprietary interest and prolonged viewing opportunities such as those in dwellings or visitors to attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape e.g., from lookouts or areas/campgrounds within National Parks.	High	High-moderate	Moderate	Negligible
	Moderate	People with an interest in their environment e.g., visitors to environmental areas, bush walkers, and horse riders etc…those travelling with an interest in their surroundings	High-moderate	Moderate	Moderate-low	Negligible
	Low	People with a passing interest in their surroundings e.g., those travelling along local roads between townships, or people whose interest is not specifically focussed on the wider landscape e.g., service providers or commuters.	Moderate	Moderate-low	Low	Negligible
	Negligible	People with no specific interest in their surroundings or those with occasional and transient views travelling at speed along highways or from a place of work where attention may not be focussed on surrounding views.	Negligible	Negligible	Negligible	Negligible

11.4 Key viewpoints

This Visual Assessment acknowledges that the practicalities of preparing an assessment does not extend to assessing every public viewpoint in the landscape from which the Project may be visible. However, every effort has been made to include significant and key viewpoints where wind turbines, or other Project infrastructure visibility, may result in a change to scenic amenity from sensitive or established viewpoints where people are likely to visit. This assessment, based on the current project layout, has determined the potential visual effect on views from:

- Burra township/public spaces
- Burra dwellings
- Mount Bryan township and dwellings
- Rural dwellings
- Burra Mine site (heritage locations)
- Heritage/tourist locations (beyond the Burra Mine site)
- Conservation areas
- Midnight Oil House
- Lookouts
- Highways (Barrier and Goyder)
- Local road corridors and
- Agricultural land.

11.5 Key Viewpoint Assessment

An assessment of potential visual effects has been prepared against the methodology and criteria outlined above and as described in the following sections.

11.6 Burra township public spaces

Views toward the proposed wind turbines from most public spaces within the Burra township would be largely screened by buildings and/or vegetation and tree cover within surrounding streetscapes, located within parks and gardens or following the Burra Creek corridor. Views from public spaces within the north section of the Burra township would also be subject to screening through undulating landform north of the township that rises toward the Project site.

Ancillary electrical infrastructure, including substations, the OTL and BESS facilities, would not be visible from public spaces within the Burra township.

This Visual Assessment notes that the offset between the wind turbines and the Burra township is in accordance with the relevant Design and Planning Code requirements, and that the overall extent of wind turbine visibility would be restricted to a small number of wind turbines within the south west portion of the Project site.

Table 11

Visual effect grading – Burra township public spaces

Sensitivity of visual receiver	High
Magnitude of visual effects	Low
Visual Effect	Moderate Low where wind turbines are visible

11.7 Burra dwellings

Most private dwellings within the Burra township are generally located within discrete clusters to the north and south of the Burra Mine site. Dwellings within the township are largely visually contained by the broader surrounding landscape of low hills and ridgelines extending north to south within the State Mid North region. The township is comfortably nestled within local landforms extending along and beyond the Burra Creek corridor. The township's urban scale is intimate with minimal contemporary development within the historical timeframe. Views toward the Project site from most dwellings within the township would be screened by combinations of built form, vegetation, tree cover and landform rising toward the Project site.

This Visual Assessment identified several areas including dwellings and their immediate curtilage within the township from which around 10 wind turbines would be visible within the south west portion of the Project site. These areas would tend to include elevated locations within the south west portion of the township (around Kangaroo Street), a small number of dwellings to the west of Mount Pleasant Road, and dwellings within the north west portion of the township, around Butterworth Street, Packard Street. Views from dwellings would not tend to be extensive, with shrub and tree planting occurring within gardens and streetscapes.

Ancillary electrical infrastructure, including substations, the OTL and BESS facilities, would not be visible from dwellings within the Burra township.

This Visual Assessment notes that the offset between the wind turbines and the Burra township is in accordance with the relevant Design and Planning Code requirements, and that the overall extent of wind turbine visibility would be restricted to a small number of wind turbines within the south west portion of the Project site.

Table 12

Visual effect grading – Burra dwellings

Sensitivity of visual receiver	High
Magnitude of visual effects	Moderate Low
Visual Effect	Moderate Low where wind turbines are visible

11.8 Mount Bryan township

Whilst wind turbines will be visible over distances beyond 5km, most views toward wind turbines within the Project site would be partially restricted by development, built structures and tree planting within the Mount Bryan township area. Potential views toward the wind turbines would also tend to be disrupted by discrete areas of vegetation both within and beyond the township. It is unlikely that the proposed wind turbines would have a significant visual impact on most people within the Mount Bryan township and other township localities beyond the Project site.

Ancillary electrical infrastructure, including substations, the OTL and BESS facilities, would not be visible from public spaces within the Mount Bryan township.

This Visual Assessment notes that the offset between the wind turbines and the Mount Bryan township is in accordance with the relevant Design and Planning Code requirements, and that the overall extent of wind turbine visibility would be restricted to a small number of wind turbines within the western portion of the Project site.

Table 13

Visual effect grading – Mount Bryan township

Sensitivity of visual receiver	High
Magnitude of visual effects	Low
Visual Effect	Moderate Low

11.9 Rural dwellings (non-involved)

Most rural dwellings located within 5km of the wind turbines are unlikely to be significantly impacted by the Project. Rural dwellings include varying extents of tree screen/shelter planting within proximity to dwellings which has the potential to offer a greater degree of screening significance as the viewing distance from the wind turbines increases and visual scale of the wind turbines decreases.

The substations associated buildings and electrical infrastructure would not be out of character with other moderate to large scale agricultural and existing electrical infrastructure located within the broader landscape beyond the Project site. Most ancillary electrical infrastructure would be located away from non-involved dwellings and would not result in significant visual effects.

Table 14

Visual effect grading – Rural dwellings (non-involved)

Sensitivity of visual receiver	High
Magnitude of visual effects	Moderate Low
Visual Effect	Moderate

11.10 Burra Mine Site

Views toward wind turbines would occur from several locations within the Burra Mine site including areas around heritage structures such as Morphet's Enginehouse, the Windinghouse, Powder Magazine and standing chimney locations. Views toward wind turbines would also extend from walking/access tracks surrounding the mine. Views from most areas within the Burra Mine site would be limited to around 10 wind turbines within the south west portion of the Project site.

Ancillary electrical infrastructure, including substations, the OTL and BESS facilities, would not be visible from the Burra Mine site.

Table 15

Visual effect grading – Burra Mine site

Sensitivity of visual receiver	High
Magnitude of visual effects	Low
Visual Effect	Moderate Low

11.11 Heritage/tourist sites (beyond the Burra Mine site)

There are numerous heritage locations within the Burra township comprising administrative, religious, commercial and dwelling structures. Most heritage sites are located within the broader urban setting and afforded screening toward the Project site by other buildings and structures, or tree cover within the township.

Ancillary electrical infrastructure, including substations, transmission lines and BESS facilities, would not be visible from heritage and tourist visitation locations within the Burra township.

Table 16

Visual effect grading – Heritage/tourist sites (beyond the Burra Mine site)

Sensitivity of visual receiver	High
Magnitude of visual effects	Low where visible
Visual Effect	Moderate where visible

11.12 Conservation areas

The Mokota Conservation Park covers an area around 445 hectares in size and is located to the west of the Project site boundary with wind turbines to the north, south and east of the Conservation Park. The Park is bounded by White Hill Road to the north. The Park is noted for its role in protecting native grassland, associated plant and animal species. Wind turbines would be prominent within surrounding views from the Park; however, the presence of wind turbines beyond the Park is not considered to detract from the noted qualities and purpose of the Park. Ancillary electrical infrastructure would be largely screened by low undulating hills and ridgelines within and beyond the Park.

The Caroona Creek Conservation Park is described by National Parks and Wildlife Service South Australia as being *'situated on the western edge of the Olary Plain, this park contains a range of landforms from steep rocky ridges and calcrete hills extending to alluvial plains. The park conserves a representative sample of the transitional zone between the rounded hills of the Mid North to the beginning of the rocky gorge country of the Flinders Ranges. The northern area contains the beautiful Tourilie Gorge and its surrounding rugged hilly terrain'.* The Park includes a section of the Heysen Trail as well as other bushwalking areas and camping facilities.

The Park, located to the east and north east of the Project site, covers around 5,422 hectares of land. Wind turbine visibility would be largely disrupted by landform as well as vegetation and tree cover occurring within the Park. Ancillary electrical infrastructure would be largely screened by low undulating hills and ridgelines within and beyond the Park.

The Red Banks Conservation Park is located to the south of the Project site, covering an area of around 1,030 hectares. It is noted for containing remains of extinct megafauna as well as numerous plant communities and associated fauna. The Park contains walking tracks and camping facilities. Located in excess of 5km from the Project wind turbines, the Park would not be subject to significant visual effects, including some bushwalking areas and the campground which would be partially screened by tree cover. Ancillary electrical infrastructure would be largely screened by low undulating hills and ridgelines within and beyond the Park.

Table 17

Visual effect grading – Conservation areas

Sensitivity of visual receiver	High
Magnitude of visual effects	Low
Visual Effect	Moderate

11.13 Midnight Oil House

The Midnight Oil House is an abandoned farmhouse located around 3km north of Burra beside the Barrier Highway. Originally photographed by Australian landscape photographer Ken Duncan, the abandoned farmhouse became an iconic image after appearing on the Midnight Oil 'Diesel and Dust' album cover released in 1987. A preliminary review of previously proposed wind turbine layouts recommended the removal of wind turbines sited on hills directly behind the Midnight Oil House to minimise potential visual effects. This recommendation was implemented by the Proponent and results in around 7 wind turbines occurring within background views and are not considered to dominate existing views toward the Midnight Oil House from the constructed lookout to the west of the abandoned farmhouse.

Ancillary electrical infrastructure, including substations, transmission lines and BESS facilities, would not be visible from the lookout at the Midnight Oil House.

Table 18

Visual effect grading – Midnight Oil House

Sensitivity of visual receiver	High
Magnitude of visual effects	Low
Visual Effect	Moderate

11.14 Highways

View toward wind turbines would occur from sections of the Barrier Highway. Views would be partially restricted to upper portions of the wind turbine structures where screened by undulating landform, with greater extent of wind turbine visibility blocked by low hills to the east of the Barrier Highway corridor. The dynamic and constantly changing nature of views (through direction and distance) from vehicles travelling along local roads will tend to be transitory in nature and generally short term.

Ancillary electrical infrastructure, including substations, transmission lines and BESS facilities, would not be visible from the Barrier Highway. The proposed transmission line route would extend south, from the main Project site toward and then extend/follow to the north of the Goyder Highway for around 5km before spanning the highway around 900m west of the Satchell Road intersection. The transmission line would then extend south parallel to the Worlds End Highway offset by around 2km. The transmission line would not form a dominant visual element at a 2km view distance and would not result in any significant visual effects, or cumulative visual effects, on people driving along the Worlds End Highway.

Views toward the proposed transmission line from around 5km of the Goyder Highway would provide some opportunities for short distance views with some partial screening provided by landform rising to the north of the highway corridor. as well as passing beneath the transmission line as it spans the highway south toward the ENet Bundey substation connection north of Powerline Road.

Table 19

Visual effect grading – Highways

Sensitivity of visual receiver	Low
Magnitude of visual effects	Moderate
Visual Effect	Moderate Low

11.15 Local Road corridors

Views toward wind turbines and ancillary infrastructure would occur from sections of several local road corridors, either proximate to, or passing within the Project site. Views would be partially restricted to upper portions of the wind turbine structures where screened by undulating landform, with greater extent of wind turbine visibility blocked by low hills beyond local road corridors. The dynamic and constantly changing nature of views (through direction and distance) from vehicles travelling along local roads will tend to be transitory in nature and generally short term.

Table 20

Visual effect grading – local road corridors

Sensitivity of visual receiver	Low
Magnitude of visual effects	Moderate
Visual Effect	Moderate Low

11.16 Agricultural land

The Project site, wind turbines and ancillary infrastructure would be visible to people engaged in predominantly farming activities surrounding the Project site. Ultimately the level of visual effect would depend on the type of activities engaged in as well as the location of the activities together with the degree of screening provided by local vegetation within the landscape.

Table 21

Visual effect grading – agricultural land

Sensitivity of visual receiver	Low
Magnitude of visual effects	Moderate
Visual Effect	Moderate Low

Section 12 Night lighting – ancillary structures

12.1 Existing light sources

Some existing night time light sources occur within the Project viewshed and include residential, general amenity and road lighting associated within township areas; however, most of the wind farm Project site has no illumination and presents a dark sky environment.

Local and domestic lighting is associated with rural dwellings within 6km of the wind turbines, but lighting is unlikely to be visually prominent and does not emit any significant illumination beyond immediate areas surrounding residential and agricultural buildings.

Vehicle headlights and tail lights visible along local roads and highways provide dynamic and temporary sources of light.

12.2 Potential light sources – ancillary structures

Potential light sources associated with the wind farm ancillary structures would include low intensity night lights for the BESS facilities, substations, control room and auxiliary buildings. Most lighting would be temporary and in use for emergency maintenance, safety, and security purposes. Lighting associated with the Project would not include flood or broad area lighting installations.

12.3 Potential receiver locations and impact

Potential receiver locations that may be impacted by night time lighting include residents and motorists. Night time lighting would not be visible from sensitive visual locations surrounding the Project.

Night time lighting associated with the wind farm is unlikely to have a significant visual impact on public receiver locations.

Irrespective of the total number of visible lights, lighting is more likely to be noticeable from exterior areas surrounding dwellings rather than from rooms within dwellings, where internal lighting tends to reflect and mirror views in windows, or where exterior views would be obscured when curtains and blinds are closed.

12.4 Night lighting mitigation

Impacts of ancillary lighting may be mitigated by ensuring that installed lighting meets the requirements of Australian Standard AS 4282:2019: Control of the obtrusive effects of outdoor lighting. To assist in the mitigation of night lighting associated with ancillary structures the following should be considered:

- Security lighting throughout the wind farm, switching station and the substation should be minimised to decrease the contrast between the wind farm and the surrounding night time environment
- Motion detectors should be used to activate night time security lighting when required
- Ancillary lighting is to be designed to ensure it does not spill onto nearby roads or dwellings

An AIA lighting review determined that the Project is a low risk to aviation activity and therefore does not require wind turbine obstacle lighting with no further mitigation required.

Section 13 Cumulative assessment

13.1 What is Cumulative Assessment?

A cumulative effect may result from a wind farm being constructed in conjunction with other existing or proposed wind farm developments or other large-scale infrastructure projects and may be either associated or separate to it.

Separate wind farm or other developments may occur within the viewshed of the proposed wind farm or may be located within a regional context where visibility is dependent on a journey between different wind farms.

'Direct' cumulative visual effects may occur where two or more winds farms, or other infrastructure developments have been constructed within the same locality and may be viewed from the same view location simultaneously.

'Indirect' cumulative visual effects may occur where two or more wind farms or other infrastructure developments have been constructed within the same locality and may be viewed from the same view location but not within the same field of view (i.e., the viewer must turn their head in order to view both wind farms).

'Sequential' cumulative visual effects may arise because of multiple wind farms or other infrastructure developments being observed at different locations during a journey (e.g., from a vehicle travelling along a highway or from a network of local roads), which may form an impression of greater magnitude within the construct of short term memory.

13.2 Other wind farm developments (regional locality)

An assessment of cumulative visual effect identified several wind farm developments within the Project broader viewshed, or regional locality. These include the Goyder South Hybrid Renewable Energy Facility (under construction), the operational Waterloo Wind Farm, Willogoleche Wind Farm, the Hornsdale Wind Farm and Hallet group of Wind Farms to the north north west the Project site.

Table 22 – Other Wind Farm Developments

Other Wind Farms	Turbine tip height	Status	Number of turbines	Approximate distance from Project site
Goyder South Hybrid Renewable Energy Facility	150-270m	Construction	75	10km
Hallett 1 Brown Hill	124m	Operating	45	22km to 28km
Hallett 2 Hallett Hill	124m	Operating	34	22km to 28km
Hallett 4 Brown Hill North	124m	Operating	63	22km to 28km

Table 22 – Other Wind Farm Developments

Other Wind Farms	Turbine tip height	Status	Number of turbines	Approximate distance from Project site
Hallett 5 The Bluff	124m	Operating	25	22km to 28km
Hornsdale (1,2 and 3)	150m	Operating	99	55km
Willogoleche	150m	Operating	32	14.5km
Waterloo	124m	Operating	43	35km

Overall, the Project would not significantly increase the magnitude of cumulative visual effect for most dwelling locations surrounding the Project site. The potential for the occurrence of 'direct' and 'indirect' cumulative visual effect is partially mitigated by the screening or filtering of views toward approved and existing wind farms.

Sequential views from local roads would be mitigated to some extent by undulating landform and tree cover alongside road corridors and the transitory nature of short-term dynamic views, and the fact that most wind farm developments are not located along a single highway or thoroughfare.

Section 14 Pre-construction and construction

14.1 Potential visual effect

There are potential visual effects that could occur during both pre-construction and construction phases of the Project. The Project construction phase is likely to occur over several years and will be rolled out in Stages, although the extent and nature of pre-construction and construction activities would vary at different locations within the Project area.

The key pre-construction and construction activities that would be visible from areas surrounding the proposed wind farm include:

- Ongoing detailed site assessment including sub surface geotechnical investigations
- Various civil works to upgrade local roads and access point
- Temporary construction compound buildings and facilities
- Temporary construction facilities, including portable structures and laydown areas
- Various temporary construction and directional signage
- Mobilisation of rock crushing equipment and concrete batching plant (if required)
- Excavation and earthworks and
- Various construction activities including erection of wind turbines, monitoring mast and electrical infrastructure works.

Most pre-construction and construction activities, some of which would result in physical changes to the landscape (which have been assessed in this Visual Assessment report), are generally temporary in nature and for the most part restricted to various discrete areas within or beyond the immediate wind farm Project area. Most of the pre-construction and construction activities would be unlikely to result in an unacceptable level of visual effect for their duration and temporary nature.

Plates 7 to **11** illustrate typical construction activities during preparation and installation of wind turbines:

Plate 7 Cable laying equipment (Image: ©GBD 2023)

Plate 8 Typical crane plant utilised in wind turbine construction (Image: ©GBD 2023)

Plate 9 Typical storage and laydown area (Image: ©GBD 2023)

Plate 10 Typical contractors site office and amenities compound (Image: ©GBD 2023)

Plate 11 Typical view toward wind turbines under construction (Image: ©GBD 2023)

Section 15 Mitigation

15.1 Introduction

The application of mitigation measures are a standard approach to minimise visual effects for proposed wind farm developments. The British Landscape Institute states 'the purpose of mitigation is to avoid, reduce, or where possible remedy or offset any significant negative (adverse) effects on the environment arising from the proposed development' (2012).

15.2 Mitigation limitations

There are several limitations to mitigation strategies applicable to wind energy facilities and this Visual Assessment recognises that large scale wind energy facilities are likely to result in unavoidable visual impacts in the current landscape and Project context. Wind turbines are large scale constructed elements with a form and line that will contrast with the relatively simple landscape forms and lines that adjoin and extend beyond the Project site.

The efficiency of the Project is dependent on a range of technical factors, and the potential for visual impacts must be balanced against other requirements. A level of acceptance for unavoidable low to moderate visual impacts should be considered appropriate without the need for mitigation as has been applied to several preceding wind farm developments including the Goyder South Project.

15.3 Mitigation strategies

Mitigation strategies considered applicable to wind farm projects include:

- *using turbine colour to reduce visual impacts from key public viewpoints*

  Wind turbines are commonly installed in a white to off white colour across Australia as well as most other countries around the world. This industry standardised colour has likely been adopted for several reasons. White is a neutral colour and whilst visible against blue sky backdrops it will tend to blend readily on cloudy or partly cloudy days. The white colour also assists with protecting wind turbine infrastructure by reflecting ultraviolet rays rather than absorbing them which helps to protect the generator from overheating. Wind turbines are also painted white to provide contrast between the wind turbine structures and the ground when viewed from aircraft flying above the wind farm.

Plate 12 illustrates 'white' wind turbines with apparent colour differences (grey and white). This demonstrates the effect of partial cloud cover and shading on visible wind turbine colour. **Plate 13** illustrates wind turbines at the Windy Hill Wind Farm in Far North Queensland. The wind turbines have been painted with concentric bands of green paint, from dark green at the base to light green for approximately one third of the tower height. The success of painting the wind turbine tower is dependent on the viewpoint location, elevation and backdrop against which the wind turbine is visible.

Plate 12 – Wind turbines at Crookwell 2 Wind Farm NSW (Image: ©GBD 2018)

Plate 13 – Wind turbines with coloured base Windy Hill Wind Farm QLD (Image: ©GBD 2017)

- *selecting turbines that are consistent in height, appearance and rotate the same way*

  Selected wind turbines would be consistent in visual form and design, comprising similar basic components of towers, hubs and blades. Most current wind turbines rotate in a clockwise direction. Adopting wind turbines that rotate in different directions would result in engineering challenges with the creation of turbulent airflow.

- *spacing turbines to respond to landscape characteristics*

  The wind farm design and wind turbine layout responds to a range of technical and environmental requirements, as well as landuse/farming operations and regulatory requirements. Where possible, wind turbine spacing, and the overall layout, has considered strategies to minimise impacts on the characteristics of the landscape surrounding the Project site including establishing offsets from sensitive locations as nominated in the Planning and Design Code.

- *minimising removal of vegetation*

  The Project will minimise the removal of vegetation from the Project site where possible; however, vegetation within the Project site does not offer significant screening potential toward the wind turbines.

- *avoiding additional clutter on turbines, such as unrelated advertising and telecommunications apparatus*

  The wind turbines would not include unrelated advertising and/or telecommunications apparatus.

The landscape plan mitigation measures generally involve reducing the extent of visual contrast between the visible portions of the proposed structures and the surrounding landscape and are discussed below.

15.4 Detail design

Mitigation measures during the detail design process should consider:

- further refinement in the design and layout where possible, which may assist in the mitigation of bulk and height of proposed structures and
- a review of materials and colour finishes for selected components including the use of non-reflective finishes to structures where possible.

15.5 Construction

Mitigation measures during the construction period should consider actions to:

- minimise tree removal where possible
- avoidance of temporary light spill beyond the construction site where temporary lighting is required
- progressively rehabilitate disturbed areas and
- protect mature trees within the Project site where possible.

15.6 Operation

Mitigation measures during the operational period should consider:

- ongoing maintenance and repair of constructed elements
- replacement of damaged or missing constructed elements and

- long term maintenance (and replacement as necessary) of vegetation within the Project site to maintain visual filtering and screening of external views where appropriate.

Section 16. Summary

The following key findings have been determined from the Visual Assessment addressing the Planning and Design Code requirements and more general guidelines applicable to wind farm visual assessment.

16.1 Planning and Design Code

This Visual Assessment has considered and responded to relevant sections of the Planning and Design Code. This Visual Assessment has determined that the Project is compliant with the Planning and Design Code where relevant to potential landscape and visual effects that may occur at various view locations surrounding the Project site.

16.2 Key view locations

The Project and proposed wind turbines would not have a significant visual effect on the character of surrounding townships and localities, where views toward the wind turbines from most view locations would be screened by adjoining structures, and a combination of tree cover and low undulations and ridgelines in local landforms. Where wind turbines would be visible from areas within townships, the overall number of visible wind turbines, and distance between wind turbines and the view location would generally result in Moderate Low visual effects.

Views from most non-involved dwellings located within 6km of a wind turbine would not result in significant levels of visual effect with most dwellings likely experience no more than a Moderate level of visual effect.

Views toward the Project from the Barrier Highway and local roads would offer a range of transitory views which would be subject to direction of travel and potential screening influence of vegetation alongside road corridors. Views from transport corridors would not result in a significant level of visual effect.

16.3 Electrical infrastructure

Proposed electrical infrastructure including substations and BESS, as well as some sections of overhead transmission lines, would be screened from most view locations surrounding the Project site by hills and ridgelines.

The proposed transmission line extending south from the main Project site toward and beyond the Goyder Highway, would be visible from vehicles for a short duration of time which would limit the overall potential for significant visual effects. The potential for significant cumulative visual effects to occur between the existing Goyder South transmission line and proposed transmission line would be largely mitigated by the distance separating both transmission line corridors. Where running parallel, transmission line cumulative visual effects would be mitigated by the 2km offset from the Worlds End Highway and/or distance from non-involved dwellings within the surrounding landscape.

16.4 Lighting

Temporary and safety night lighting associated with Project electrical infrastructure and office/maintenance buildings would be largely filtered or screened from most surrounding view locations and not considered significant enough to directly impact upon the dark sky night time experience within or beyond the Project site.

An obstacle lighting review determined that wind monitoring towers be appropriately marked in accordance with applicable guidelines (excluding strobe lighting) noted in the lighting review. The lighting review further determined that the Project is a low risk to aviation activity and therefore does not require obstacle lighting with no further mitigation required.

The overall visual effect on views from temporary and safety night lighting would be **Low**.

16.5 Cumulative

The Project would not result in a significant increase in cumulative visual effect for many non-involved dwelling locations surrounding the Project site. The potential for the occurrence of 'direct' and 'indirect' cumulative visual effect is partially mitigated by screening between approved and existing wind farms.

Sequential views from local roads and highways would be mitigated to some extent by undulating landform and tree cover alongside road corridors and the transitory nature of short-term dynamic views, and the fact that most wind farm developments are not located along a single highway or thoroughfare.

16.6 Mitigation

This Visual Assessment has considered a range of mitigation measures which may be adopted to minimise potential visual effects associated with the Project. Overall, the extent and level of potential visual effect is moderate to low at most view locations resulting in minimal application of mitigation measures to screen views. Screening views may also be detrimental to various locations where foreshortening or restricting existing views may not be desirable. The mitigation strategies outlined in **Section 15** are considered to provide some level of mitigation to potential visual effects.

16.7 Conclusion

In conclusion, the proposed development of a wind farm project requires a responsible authority to determine whether the visual effects of a wind energy facility in the landscape is acceptable. This Visual Assessment has assessed the potential visual effect of the Project against relevant policies and guidelines, and has determined that, in our professional opinion, the level of landscape and visual effects are acceptable.

Appendix A – Photomontages/wireframes

Photomontages/wireframes have been prepared to illustrate the general location of the Project wind turbines following construction. The photomontages/wireframes have been located to illustrate views from areas close to non-host dwellings/heritage locations or to illustrate cumulative impacts where possible.

The photomontage/wireframe locations were selected following a review of ZTV maps, together with the site inspection to identify potential representative viewpoints. The photomontages/wireframe locations were selected at a range of distances between viewpoints and wind turbines to illustrate the potential influence of distance on visibility. The photomontage locations are illustrated in **Figure 13** and photomontages/wireframes presented in **Figures 14** to **47**.

Each photomontage/wireframe was generated through the following steps:

- A digital terrain model (DTM) of the Project site was created from a terrain model of the surrounding area using digital contours
- The site DTM was loaded in the modelling software package
- The layout of the wind farm and 3-dimensional representation of the wind turbine was configured in the modelling software
- The wind turbine dimensions assumed are a tip height of 240m with a hub height of 160m and blade length of 80m
- The location of each viewpoint (photo location) was configured in the modelling software for sun position for each viewpoint by using the time and date of the photographs from that viewpoint
- The view from each photomontage location was then assessed in the modelling software package. This process requires accurate mapping of the terrain as modelled, with that as seen in the photographs. The photographs, taken from each photomontage location were loaded into the modelling software and the visible turbines superimposed on the photographs
- The photomontages were adjusted using Photoshop CS3 to compensate for fogging due to haze or distance, as well as screening by vegetation or obstacles and
- The final image was converted to JPG format and imported and annotated as the final figure.

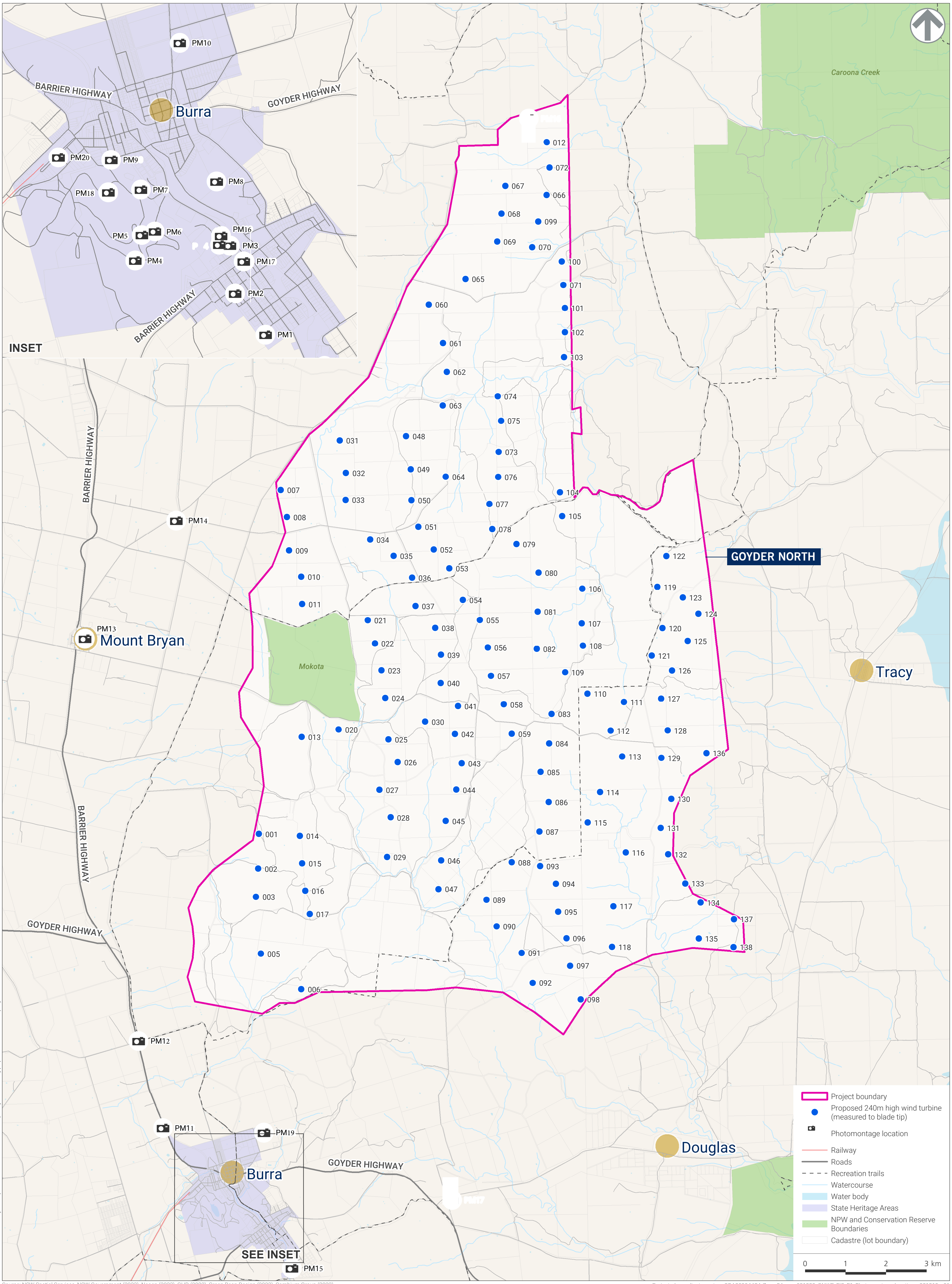
Whilst a photomontage can provide an image that illustrates a very accurate representation of a wind turbine in relation to its proposed location and scale relative to the surrounding landscape, this Visual Assessment acknowledges that large scale objects in the landscape can appear smaller in photomontage than in real life and is partly due to the fact that a flat image does not allow the viewer to perceive any information relating to depth or distance.

The horizontal and vertical field of view within most of the photomontages exceeds the parameters of normal human vision. However, the eyes, head and body can all move and under normal conditions a person would sample a broad area of landscape within a panorama view. The photomontages have been prepared as extended panorama for broader visual context (**Figures 14** to **27**) and detailed single photo frame photomontages (**Figures 28** to **41**) providing greater detail. The wireframe images (**Figures 42** to **47**) illustrate wind turbines (as yellow) where screened from the photo location by vegetation or landform.

Figure 13

Photomontage locations

GOYDER NORTH | **VISUAL IMPACT ASSESSMENT**



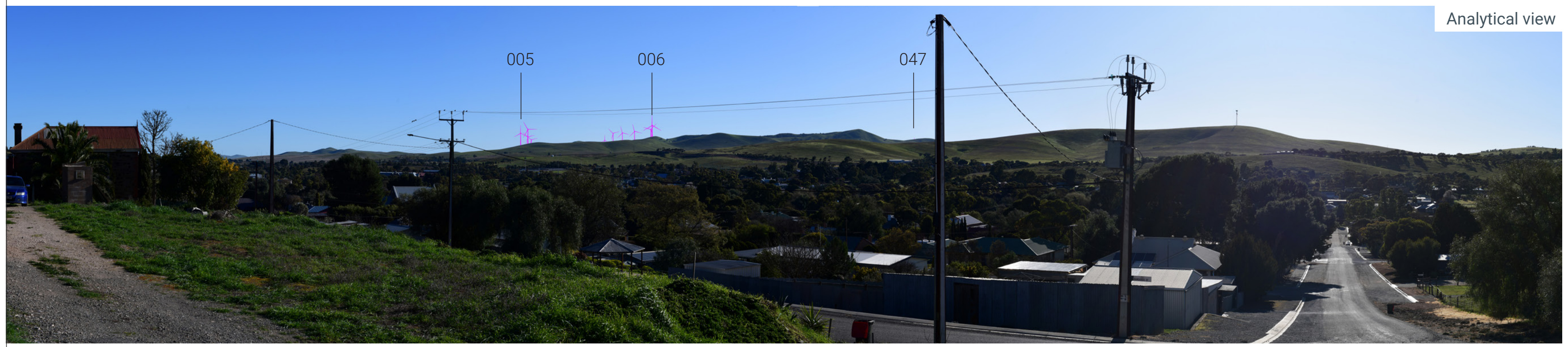
Source: NSW Spatial Services, NSW Government (2023), Neoen (2023), GHD (2023), Green Bean Design (2023), Cambium Group (2023).

Projected coordinate system GDA2020 MGA Zone 54

031280_GNWF_EIS_F1_Photomontage_locations_231219_v01

Figure 14
PM1 | Kangaroo Street, Burra

GBD
Landscape architecture



Date	15/08/2023
Time	10:37
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	309115m E, 6270537m S
Camera level	487.8 mAHD
Camera bearing	27°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	6.57 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 15

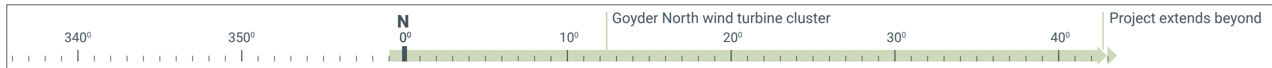
PM2 | Kangaroo and Church Street

Date	15/08/2023
Time	10:21
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308850m E, 6270908m S
Camera level	478.1 mAHD
Camera bearing	29º
Vertical field of view	27º
Project horizontal field of view	59º
Distance to nearest turbine	6.22 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 16

PM3 | Town Hall steps, Burra



Existing view

Analytical view

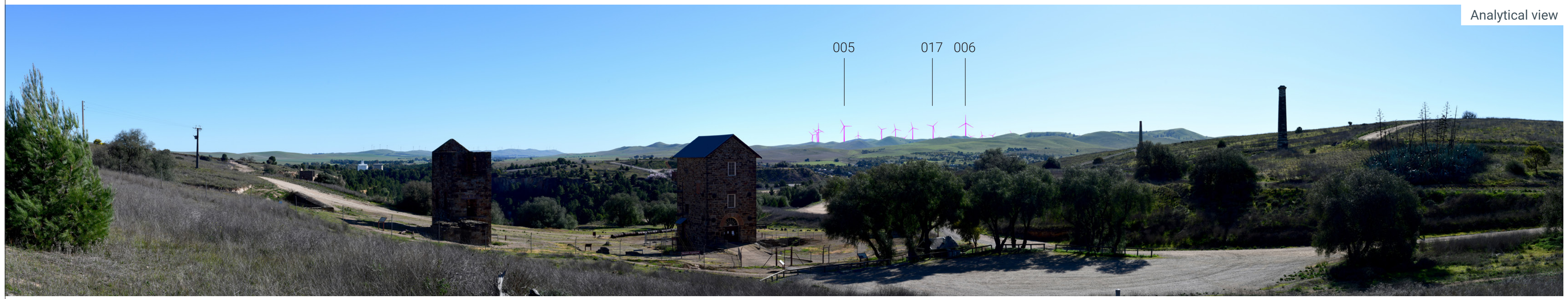
Photomontage

Date	15/08/2023
Time	10:33
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308804m E, 6271337m S
Camera level	472.17 mAHD
Camera bearing	30º
Vertical field of view	27º
Project horizontal field of view	60º
Distance to nearest turbine	5.83 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

GBD Landscape architecture

Figure 17
PM4 | Burra Mine (toward Morphett's Enginehouse and Windinghouse)



Date	15/08/2023
Time	11:19
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307945m E, 6271203m S
Camera level	518.41 mAHD
Camera bearing	34°
Vertical field of view	27°
Project horizontal field of view	56°
Distance to nearest turbine	6.17 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

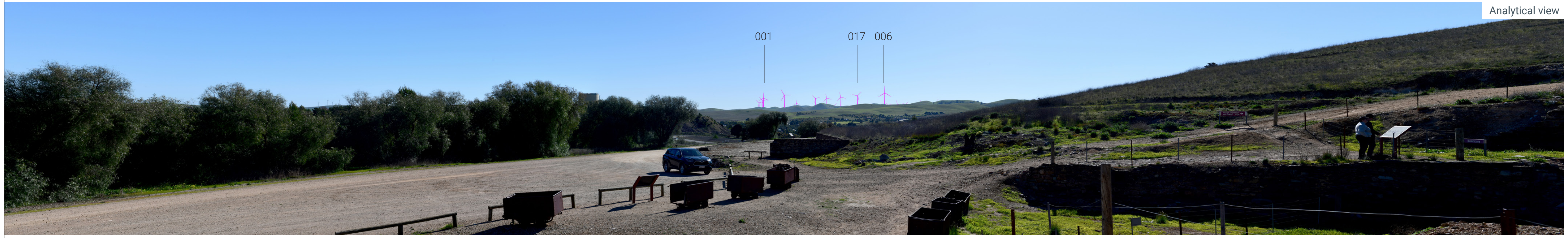
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 18

PM5 | Dressing Tower

GBD
Landscape architecture



Date	15/08/2023
Time	11:39
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308003m E, 6271432m S
Camera level	507.33 mAHD
Camera bearing	33°
Vertical field of view	27°
Project horizontal field of view	58°
Distance to nearest turbine	5.94 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

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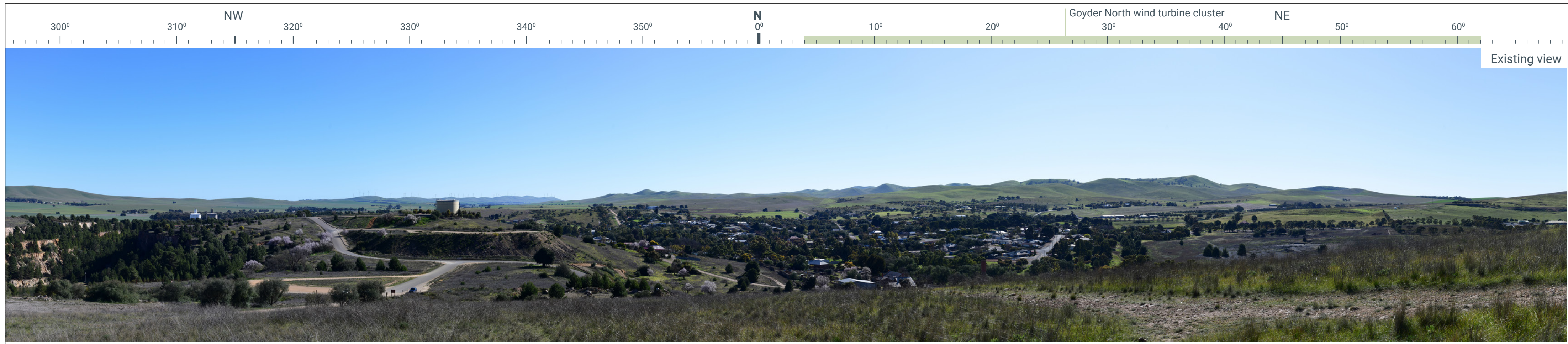
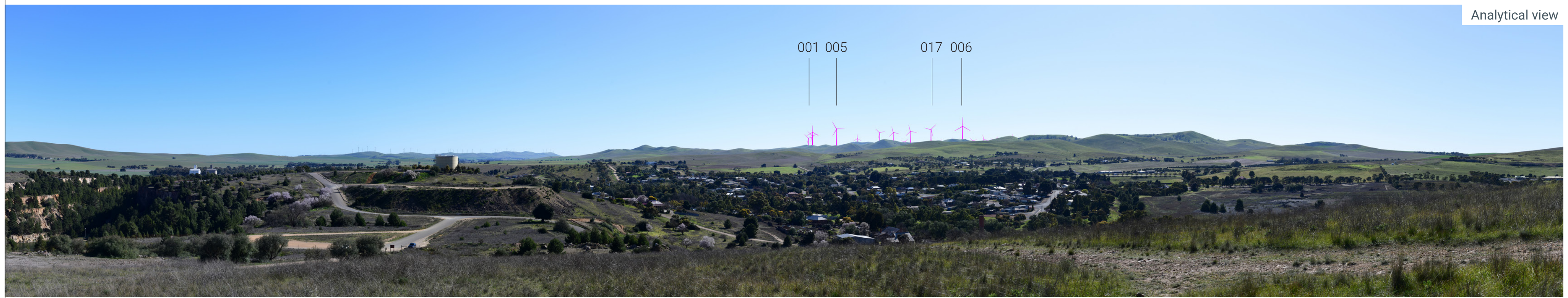
Figure 19

PM6 | Haulage Enginehouse Chimney

GBD
Landscape architecture



Existing view



Analytical view

Photomontage

Date	15/08/2023
Time	11:31
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308121m E, 6271464m S
Camera level	522.57 mAHD
Camera bearing	33°
Vertical field of view	27°
Project horizontal field of view	58°
Distance to nearest turbine	5.87 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 20
PM7 | Town Lookout

GBD
Landscape architecture

Date	15/08/2023
Time	11:48
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307996m E, 6271840m S
Camera level	503.9 mAHD
Camera bearing	34°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	5.56 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 21
PM8 | Smelting Works Site

GBD
Landscape architecture

Date	15/08/2023
Time	12:20
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308675m E, 6271914m S
Camera level	487.23 mAHD
Camera bearing	32°
Vertical field of view	27°
Project horizontal field of view	62°
Distance to nearest turbine	5.29 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

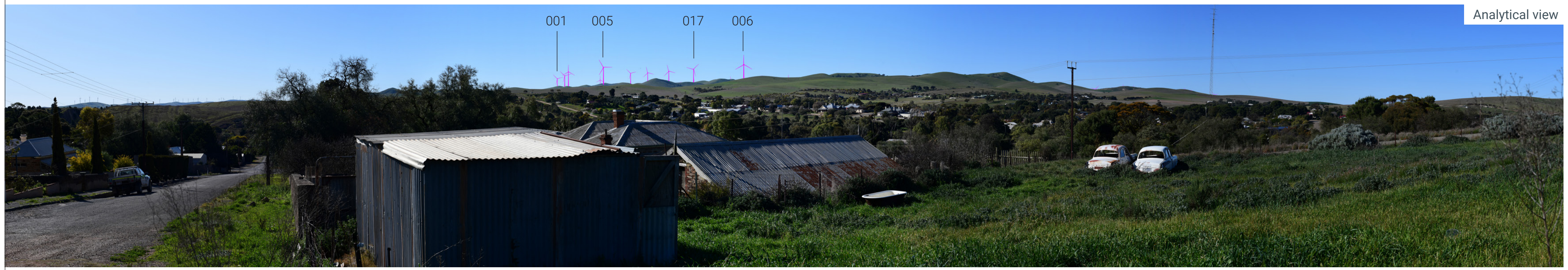
CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 22

PM9 | Butterworth Street, Burra

GBD
Landscape architecture



Date	15/08/2023
Time	16:16
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307728m E, 6272109m S
Camera level	496.48 mAHD
Camera bearing	35°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.41 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 23
PM10 | Redruth Gaol

GBD
Landscape architecture

Date	15/08/2023
Time	12:34
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308346m E, 6273158m S
Camera level	495.5 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	64°
Distance to nearest turbine	4.21 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

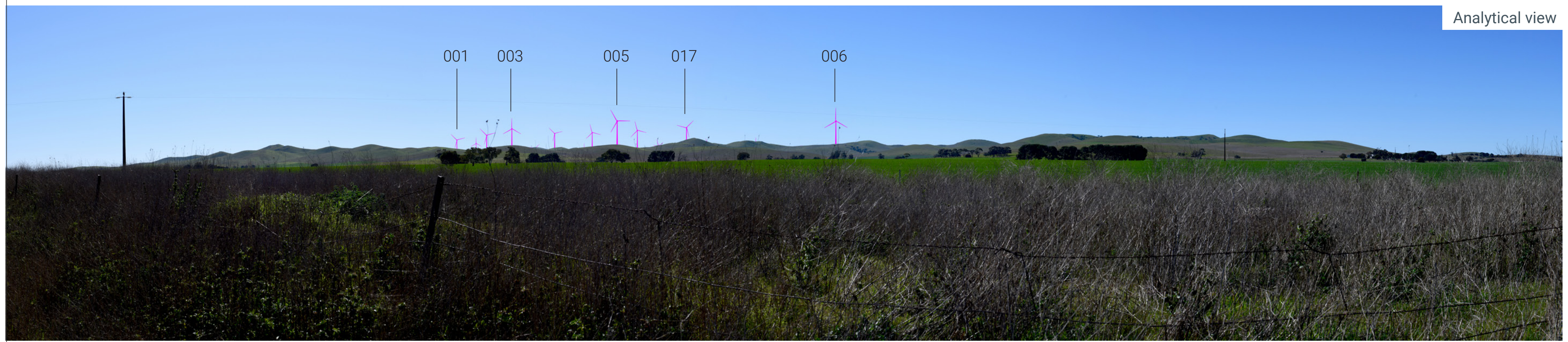
Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 24

PM11 | Barrier Highway

GBD
Landscape architecture

Existing view



Analytical view

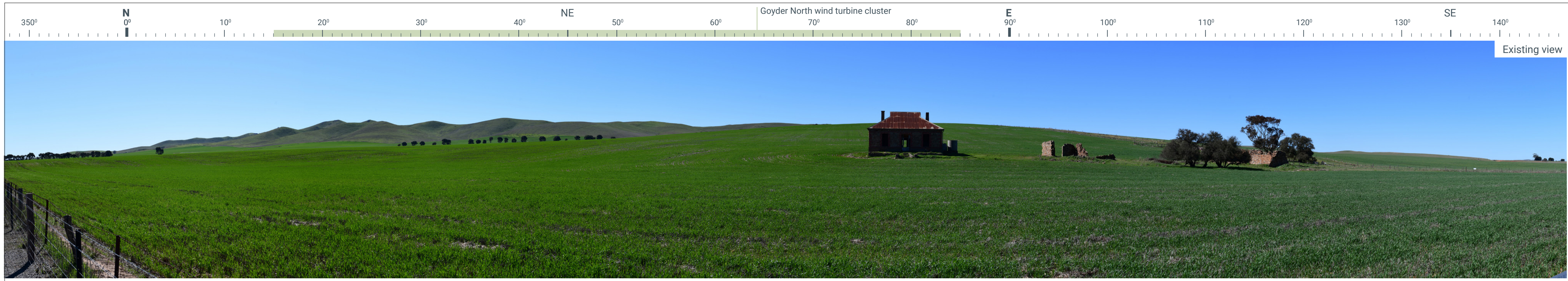

Photomontage

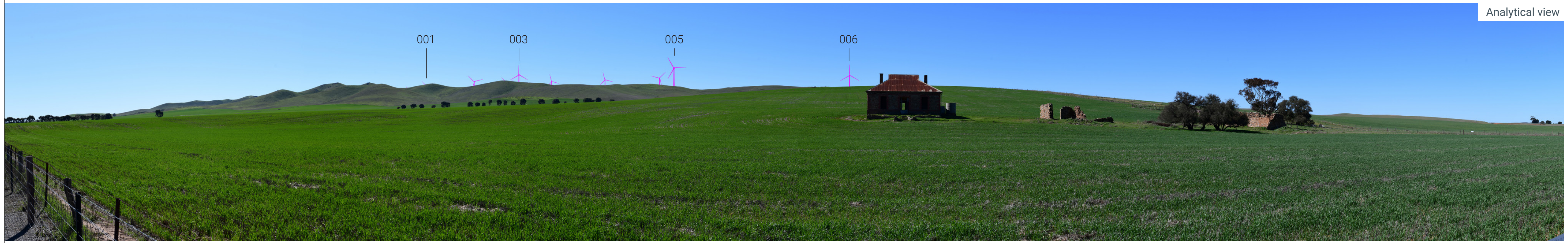
Date	15/08/2023
Time	13:08
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	306461m E, 6273728m S
Camera level	485.4 mAHD
Camera bearing	42°
Vertical field of view	27°
Project horizontal field of view	63°
Distance to nearest turbine	4.83 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 25
PM12 | Midnight Oil House





Date	15/08/2023
Time	13:16
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	305862m E, 6275877m S
Camera level	484.59 mAHD
Camera bearing	50°
Vertical field of view	27°
Project horizontal field of view	71°
Distance to nearest turbine	3.67 km (005)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 26

PM13 | East Terrace, Mount Bryan

GBD Landscape architecture

Date	15/08/2023
Time	13:33
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	304534m E, 6285818m S
Camera level	523.92 mAHD
Camera bearing	97°
Vertical field of view	27°
Project horizontal field of view	108°
Distance to nearest turbine	5.44 km (011)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

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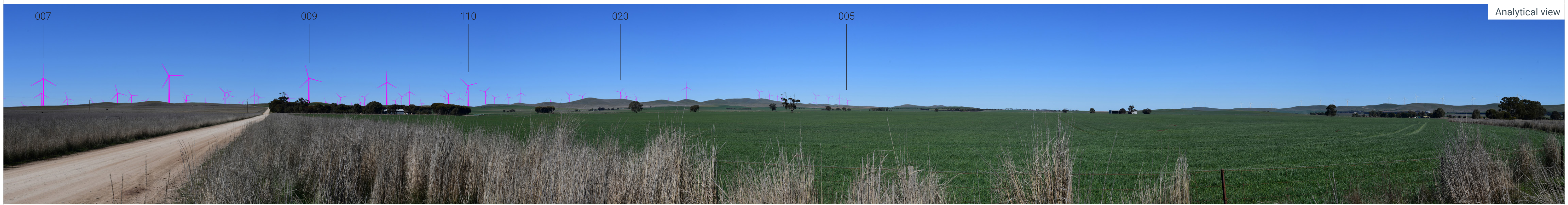
Figure 27

PM14 | Old Belcunda Road

GBD
Landscape architecture



Date	15/08/2023
Time	13:44
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	306794m E, 6288738m S
Camera level	540.7 mAHD
Camera bearing	107°
Vertical field of view	27°
Project horizontal field of view	124°
Distance to nearest turbine	2.66 km (007)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Photo location PM1 - Proposed view north north west to north north east from Kangaroo Street, Burra.

General Notes:

Coordinates:
Easting 309115, Northing 6270537

Photo date:
15th August 2023, 10.37am

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM1 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 28
Photomontage PM1 Kangaroo Street, Burra - 40 degree field of view

Photo location PM2 - Proposed view north to north north east from Kangaroo and Church Street intersection, Burra

General Notes:

Coordinates:
Easting 308850, Northing 6270908

Photo date:
15th August 2023, 10.21am

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM2 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 29
Photomontage PM2 Kangaroo and Church Street, Burra - 40 degree field of view

GBD
Landscape architecture

Photo location PM3 - Proposed view north north west to north north east from Town Hall Steps, Burra.

General Notes:

Coordinates:
Easting 308804, Northing 62711337

Photo date:
15th August 2023, 10.33am

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM3 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 30
Photomontage PM3 Town Hall Steps, Burra - 40 degree field of view

GBD
Landscape architecture

Photo location PM4 - Proposed view north to north north east from Burra Mine toward Morphett's Enginehouse.

General Notes:

Coordinates:
Easting 307945, Northing 6271203

Photo date:
15th August 2023, 11.19am

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM4 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 31
Photomontage PM4 Burra Mine toward Morphett's Enginehouse - 40 degree field of view

GBD
Landscape architecture

Photo location PM14 - Proposed view north to north north east from Old Belcunda Road

General Notes:

Coordinates:
Easting 306795, Northing 6288737

Photo date:
15th August 2023, 1.54pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM14 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 31
Photomontage PM14 Old Belcunda Road - 40 degree field of view

GBD
Landscape architecture

Photo location PM5 - Proposed view north north west to north north east from Burra Mine Dressing Tower

General Notes:

Coordinates:
Easting 308003, Northing 6271432

Photo date:
15th August 2023, 11.39pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM5 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 32
Photomontage PM5 Burra Mine Dressing Tower - 40 degree field of view

GBD
Landscape architecture

Photo location PM7 - Proposed view north to north east from Burra Mine Town Lookout

General Notes:

Coordinates:
Easting 307996, Northing 6271840

Photo date:
15th August 2023, 11.48am

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM7 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 34
Photomontage PM7 Burra Mine Town Lookout - 40 degree field of view

Photo location PM8 - Proposed view north to north east from Smelting Works Site

General Notes:

Coordinates:
Easting 308675, Northing 6271914

Photo date:
15th August 2023, 12.20pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM8 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 35
Photomontage PM8 Smelting Works Site - 40 degree field of view

GBD
Landscape architecture

Photo location PM9 - Proposed view north to north north east from Butterworth Street, Burra

General Notes:

Coordinates:
Easting 307728, Northing 6272109

Photo date:
15th August 2023, 4.16pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM9 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 36
Photomontage PM9 Butterworth Street, Burra - 40 degree field of view

GBD
Landscape architecture

Photo location PM10 - Proposed view north to north east from Redruth Goal

General Notes:

Coordinates:
Easting 308346, Northing 6273158

Photo date:
15th August 2023, 12.34pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM10 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 37
Photomontage PM10 Redruth Goal - 40 degree field of view

GBD
Landscape architecture

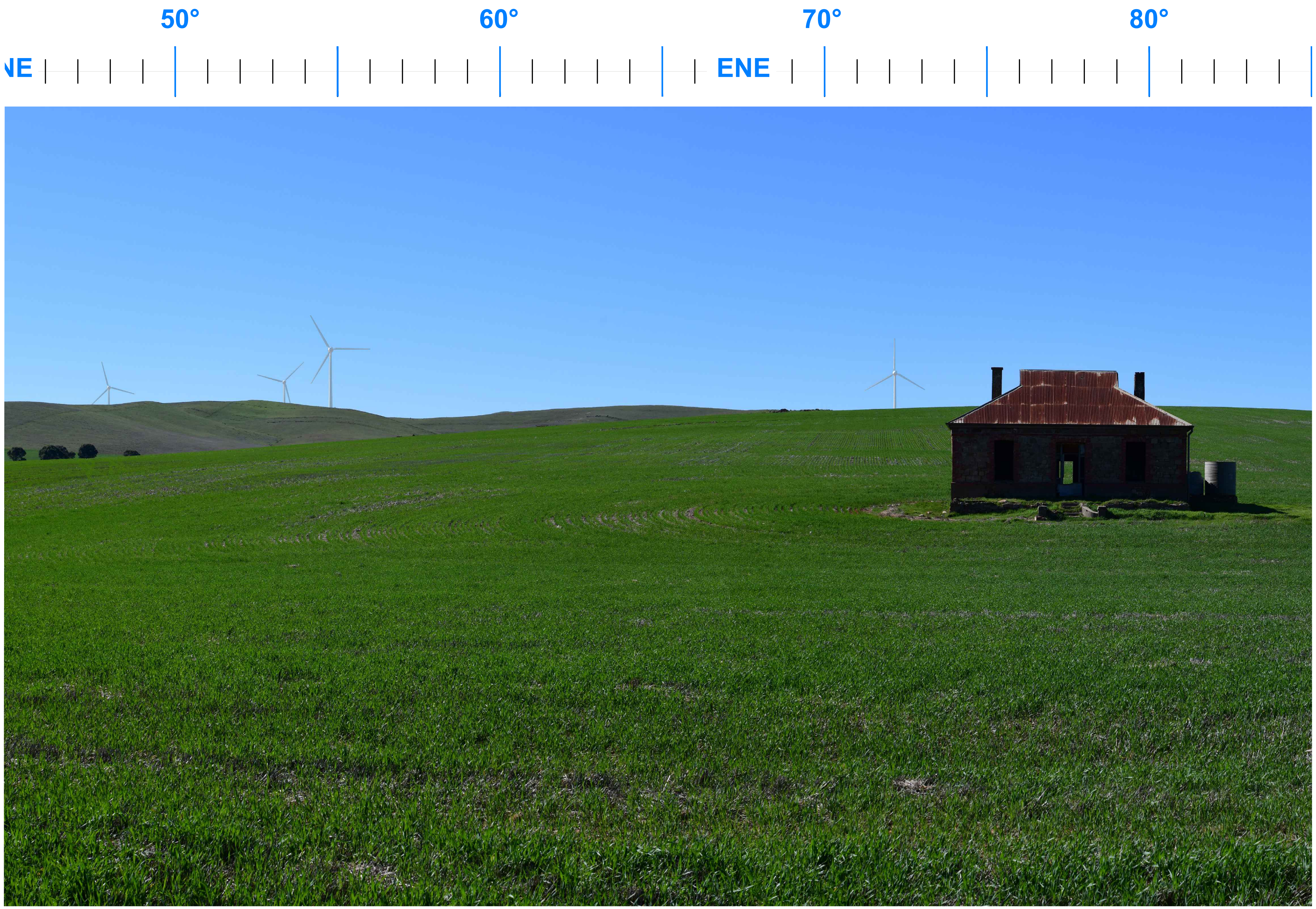


Photo location PM12 - Proposed view north east to east north east from Midnight Oil House

General Notes:

Coordinates:
Easting 305862, Northing 6275877

Photo date:
15th August 2023, 1.16pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM12 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 39
Photomontage PM12 Midnight Oil House - 40 degree field of view

GBD
Landscape architecture

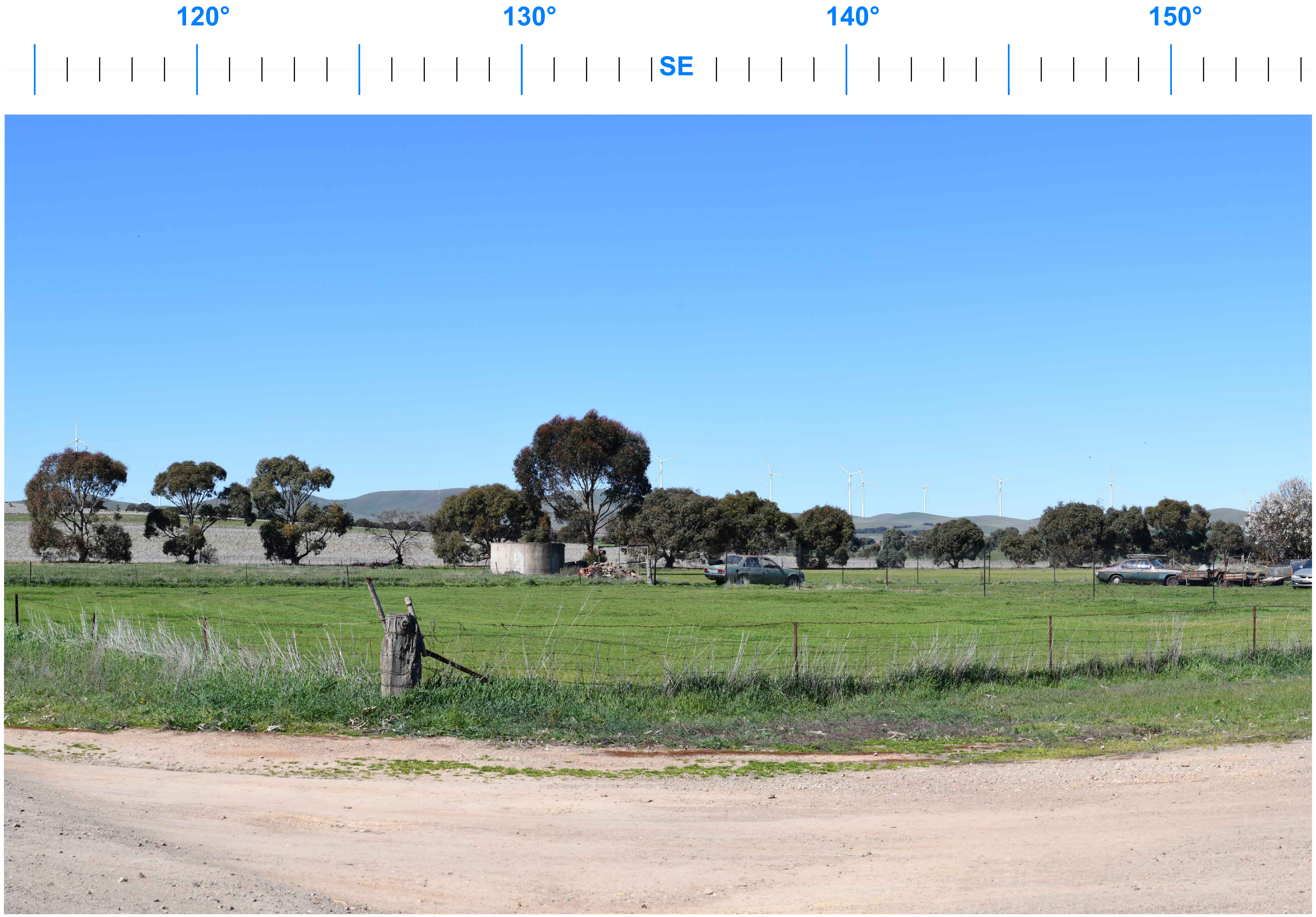


Photo location PM13 - Proposed view east south east to south east from Mount Bryan Township

General Notes:

Coordinates:
Easting 304534, Northing 6285818

Photo date:
15th August 2023, 1.33pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM13 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 40
Photomontage PM13 Mount Bryan Township - 40 degree field of view

Photo location PM14 - Proposed view east north east to east from Old Belcunda Road

General Notes:

Coordinates:
Easting 306794, Northing 6288738

Photo date:
15th August 2023, 1.44pm

Camera:
Nikon D850, 50mm 1:1.4D Lens

Original Page Format - A3 Landscape

Photomontage PM14 is illustrated at a view angle of around 40 degrees which is within the central, binocular field, of human vision.

Photomontage limitations

A photomontage 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. Also a static image cannot convey turbine movement.

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.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 41
Photomontage PM14 Old Belcunda Road - 40 degree field of view

GBD
Landscape architecture

Figure 42

PM15 | Burra Cemetery

Date	15/08/2023
Time	10:05
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	309646m E, 6270259m S
Camera level	465.8 mAHD
Camera bearing	24°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	6.79 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 43
PM16 | St Josephs Church

GBD
Landscape architecture

Date	15/08/2023
Time	10:37
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308724m E, 6271424m S
Camera level	477.8 mAHD
Camera bearing	31°
Vertical field of view	27°
Project horizontal field of view	61°
Distance to nearest turbine	5.74 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

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Figure 44

PM17 | Burra Square

GBD
Landscape architecture

Existing view

Analytical view

Date	15/08/2023
Time	10:48
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308927m E, 6271195m S
Camera level	469.6 mAHD
Camera bearing	30°
Vertical field of view	27°
Project horizontal field of view	60°
Distance to nearest turbine	5.9 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 45

PM18 | Burra Mine Lookout

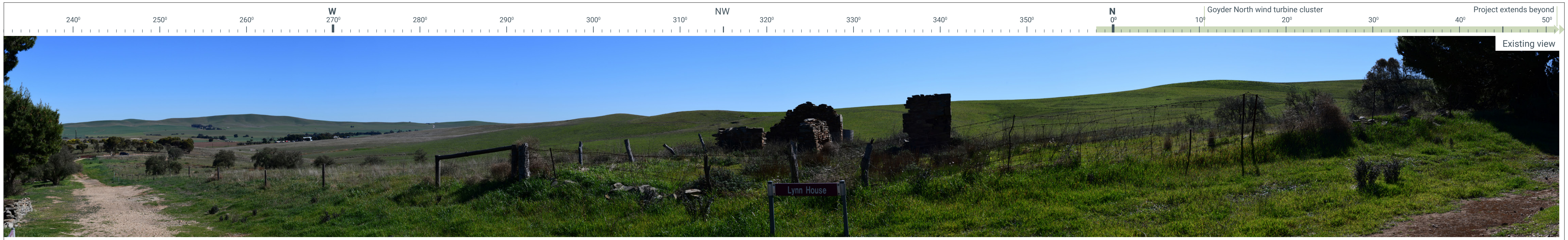
Date	15/08/2023
Time	11:59
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307957m E, 6271799m S
Camera level	498.9 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	57°
Distance to nearest turbine	5.66 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 46

PM19 | Hamptons Village

GBD
Landscape architecture



Date	15/08/2023
Time	12:49
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	308956m E, 6273615m S
Camera level	538 mAHD
Camera bearing	34°
Vertical field of view	27°
Project horizontal field of view	71°
Distance to nearest turbine	3.55 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Figure 47

PM20 | Railway Terrace, Burra

GBD
Landscape architecture

Date	16/08/2023
Time	14:53
Camera	Nikon D850 full frame DSLR
Panorama type	Landscape
Camera coordinates	307254m E, 6272130m S
Camera level	480.2 mAHD
Camera bearing	36°
Vertical field of view	27°
Project horizontal field of view	59°
Distance to nearest turbine	5.57 km (006)
Projected coordinate system	GDA2020 MGA Zone 54
Photography	Green Bean Design

CAMBIUM GROUP
Visual communication science

Source: ESRI Maxar, Elvis Elevation and Depth - Foundation Spatial Data (2023), Vestas (2023), Greenbean Design (2023), Cambium Group (2023).

Appendix B - Qualifications and experience

This Visual Assessment has been prepared by Andrew Homewood, Director and Principal Landscape Architect of Green Bean Design (GBD) Pty Ltd (ABN 866 035 75702). Andrew has held this position for the past 18 years. Andrew holds post graduate, graduate and tertiary qualifications:

- Graduate Diploma Landscape Management (Sheffield University 1995)
- Bachelor Science (Dual Honours) Landscape Design and Archaeology (Sheffield University 1991-1994)
- National Diploma Amenity Horticulture (Writtle University College 1986-1989)

Andrew is a Registered Landscape Architect (membership #001245) and a member of the Australian Institute of Landscape Architects and the Environmental Institute of Australia and New Zealand. Andrew has been directly employed or engaged in landscape related work/studies for the past 37 years in the United Kingdom and Australia.

Andrew has prepared numerous landscape and visual impact assessments across a range of state significant developments including renewable energy, mining, electricity transmission, waste management and transport. GBD has been commissioned to undertake Visual Assessment for over 60 wind farm projects across Australia. Our South Australian and Victorian wind farm project experience includes:

- Goyder South Renewable Energy Facility, SA
- Crystal Brook Wind Farm, SA
- Woolsthorpe Wind Farm Amendment, VIC
- Mumblin Wind Farm, VIC
- Brewster Wind Farm, VIC
- Kentbruck Green Energy Hub (referral), VIC
- Berrybank Wind Farm (micro siting review), VIC
- Hawkesdale Wind Farm amendments, VIC
- Ryan Corner Wind Farm amendments, VIC
- Jung and Wimmera Plains Wind Farm, VIC
- Alberton Wind Farm, VIC
- Moorabool Wind Farm (offsite landscape mitigation plan), VIC
- Kiata Wind Farm, VIC
- Murra Warra Wind Farm, VIC
- Ararat Wind Farm (terminal substation assessment), VIC
- Willatook Wind Farm, VIC

Professional History	Green Bean Design, Director/Principal Landscape Architect 2006 – to date
	URS Australia Pty Ltd, Practice Leader Landscape Architecture 2005 – 2006
	URS Australia Pty Ltd, Associate Landscape Architect 2003-2005
	URS Australia Pty Ltd, Senior Landscape Architect, 2002 – 2003
	URS Australia Pty Ltd, Landscape Planner, 2001-2002
	URS, Contract Landscape Architect, 2000-2001
	Blacktown City Council, Contract Landscape Planner, 2000-2001
	Knox & Partners Pty Ltd, Landscape Architect, 1996-2000
Relocated from United Kingdom to Australia 1996	Brown & Associates, Landscape Architect, 1995-1996
	University of Sheffield post graduate studies 1995-1996
	Philip Parker & Associates, Graduate Landscape Architect, 1994-1995
	University of Sheffield undergraduate studies 1991-1994
	Rendel & Branch, Landscape Assistant, 1989-1991
	Writtle University College, tertiary studies 1988-1989
	National Trust, Horticulturalist, 1987-1988
	Writtle University College, tertiary studies 1986-1987
	English Nature, Species Protection Warden, 1985-1986
	Essex Wildlife Trust, Botanist, 1984-1985
	Royal Society for the Protection of Birds, Voluntary Warden, 1983-1984

Limitations

This Visual Assessment has been prepared in accordance with the usual care and thoroughness of the consulting profession for the use of Neoen Australia Pty Ltd. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the GBD Proposal October 2022.

The methodology adopted and sources of information used are outlined in this report. GBD has made no independent verification of this information beyond the agreed scope of works and GBD assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to GBD was false.

This Visual Assessment was completed between October 2022 and March 2024 and is based on the conditions encountered and information reviewed at the time of preparation. GBD disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Green Bean Design Pty Ltd (GBD) is a highly experienced landscape architectural consultancy specialising in landscape and visual impact assessment. Established in 2006 as an independent consultancy, GBD provide professional advice to a range of commercial and government clients involved in large infrastructure project and policy development.

GBD Director Andrew Homewood is a Registered Landscape Architect, member of the Australian Institute of Landscape Architects and the Environmental Institute of Australia and New Zealand. Andrew has over 30 years' continuous employment in landscape consultancy and has completed numerous landscape and visual impact assessments for a range of state significant developments including wind energy, solar, mining, industrial and transport developments.

GBD has been commissioned for large scale renewable energy projects across New South Wales, Victoria, South Australia, Queensland and Tasmania.

GBD have prepared Expert Witness Statements and been engaged as a peer reviewer of renewable energy landscape and visual impact assessments in Victoria and New South Wales.

CONTACT

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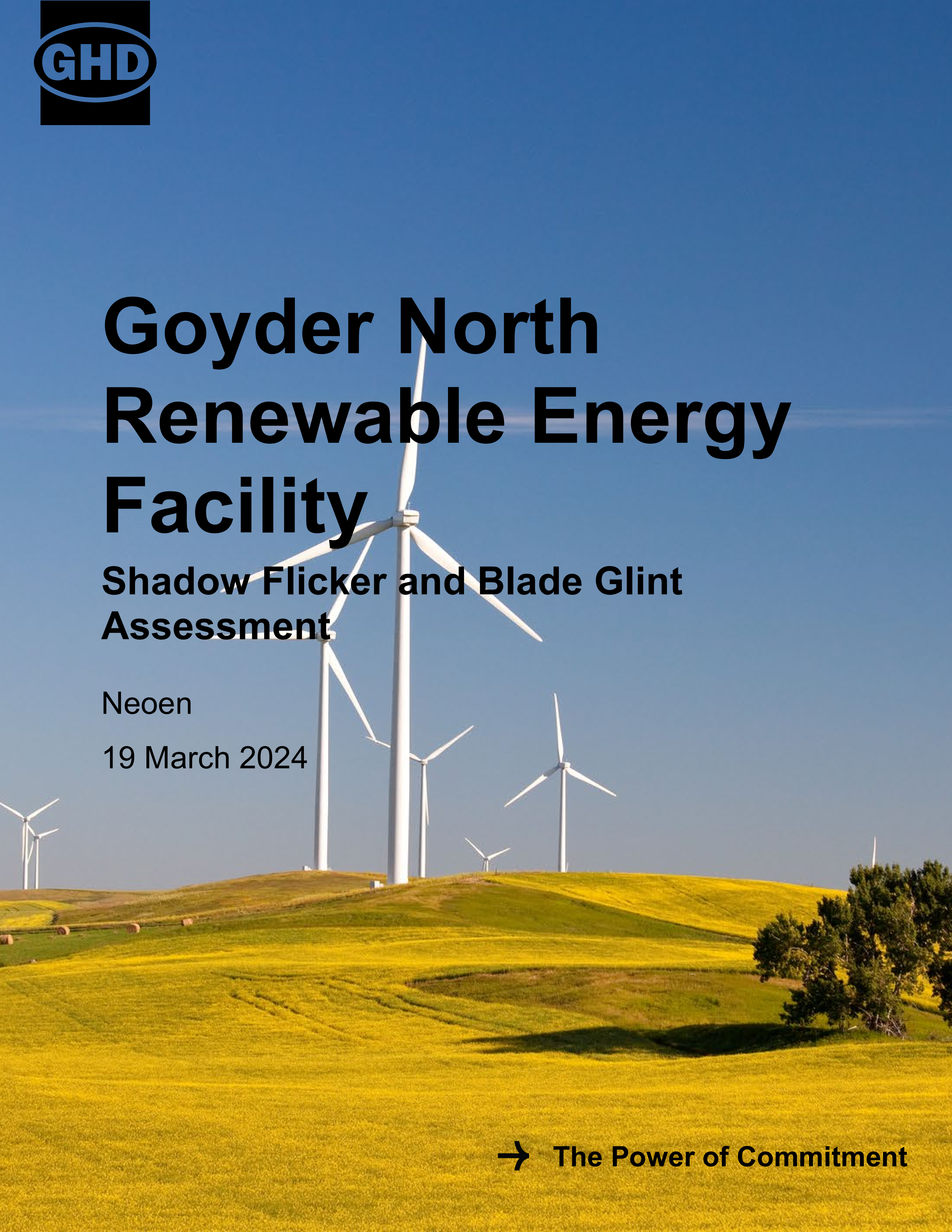

Goyder North Renewable Energy Facility

Shadow Flicker and Blade Glint Assessment

Neoen

19 March 2024

→ **The Power of Commitment**

Project name	Goyder North Wind Farm - GIS Support
Document title	Goyder North Renewable Energy Facility | Shadow Flicker and Blade Glint Assessment
Project number	12590014
File name	12590014_RPT_Goyder North Renewable Energy Facility Shadow Flicker and Blade Glint Assessment_Rev1.docx

Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S3	A	Lorena Markovic	J. King		M. Orfanos		11/01/24
S4	0	Lorena Markovic	J. King		M. Orfanos		05/03/224
S4	1	Lorena Markovic	J. King		M. Orfanos		19/03/24

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Appendices

1. Introduction

GHD Pty Ltd (GHD) was engaged by Neoen Australia Pty Ltd (Neoen) to undertake a shadow flicker and blade glint assessment for the proposed Goyder North Renewable Energy Facility development located near Burra, South Australia. The assessment comprised of undertaking a desktop and shadow flicker assessment which involved modelling the proposed WTG configuration and the surrounding buildings (sensitive receptors), whilst identifying relevant impacts and mitigation measures for potential impacts on sensitive receptors located near the proposed wind farm.

1.1 Purpose of this report

The purpose of this report is to assess the potential shadow flicker and blade glint impacts at 110 receptor locations for 135 specific wind turbine generator (WTG) locations proposed as part of the Goyder North Renewable Energy Facility (GNREF) development. This study assessed potential for significant visual effects from shadow flicker and blade glint.

1.2 Project overview

The proposed wind farm development is in Southeast South Australia, approximately 15 km Northeast of Burra and 155 km Northeast of Adelaide. The proposed wind farm will have 135 wind turbines and nameplate capacity up to 1000 MW, maximum hub height of 160 m, maximum rotor diameter of 180 m, and maximum tip height of 240, which were provided in email exchange December 2023[1].

[1] Goyder North – Project Description.pdf

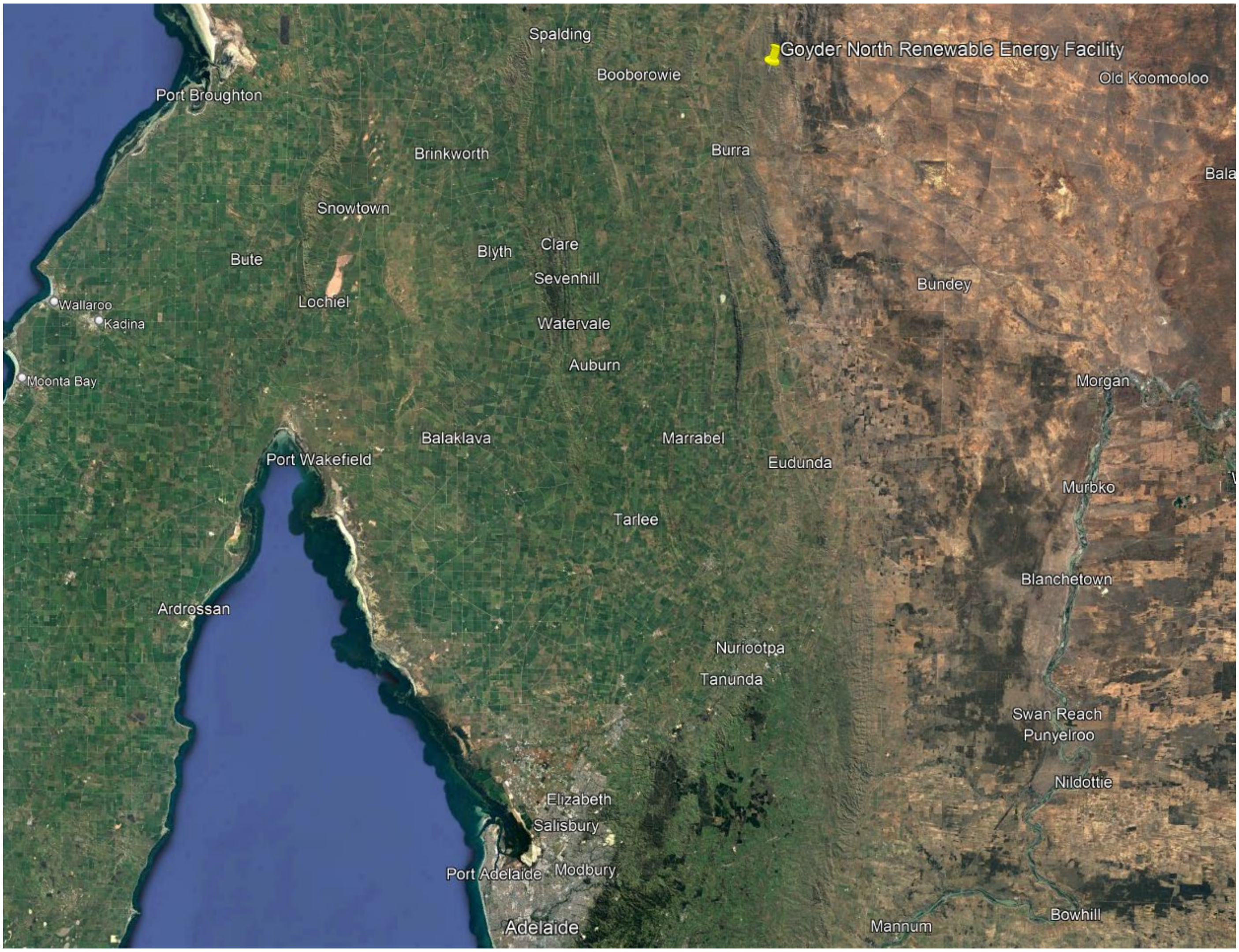

Figure 1 *Map showing Goyder North Renewable Energy Facility location*

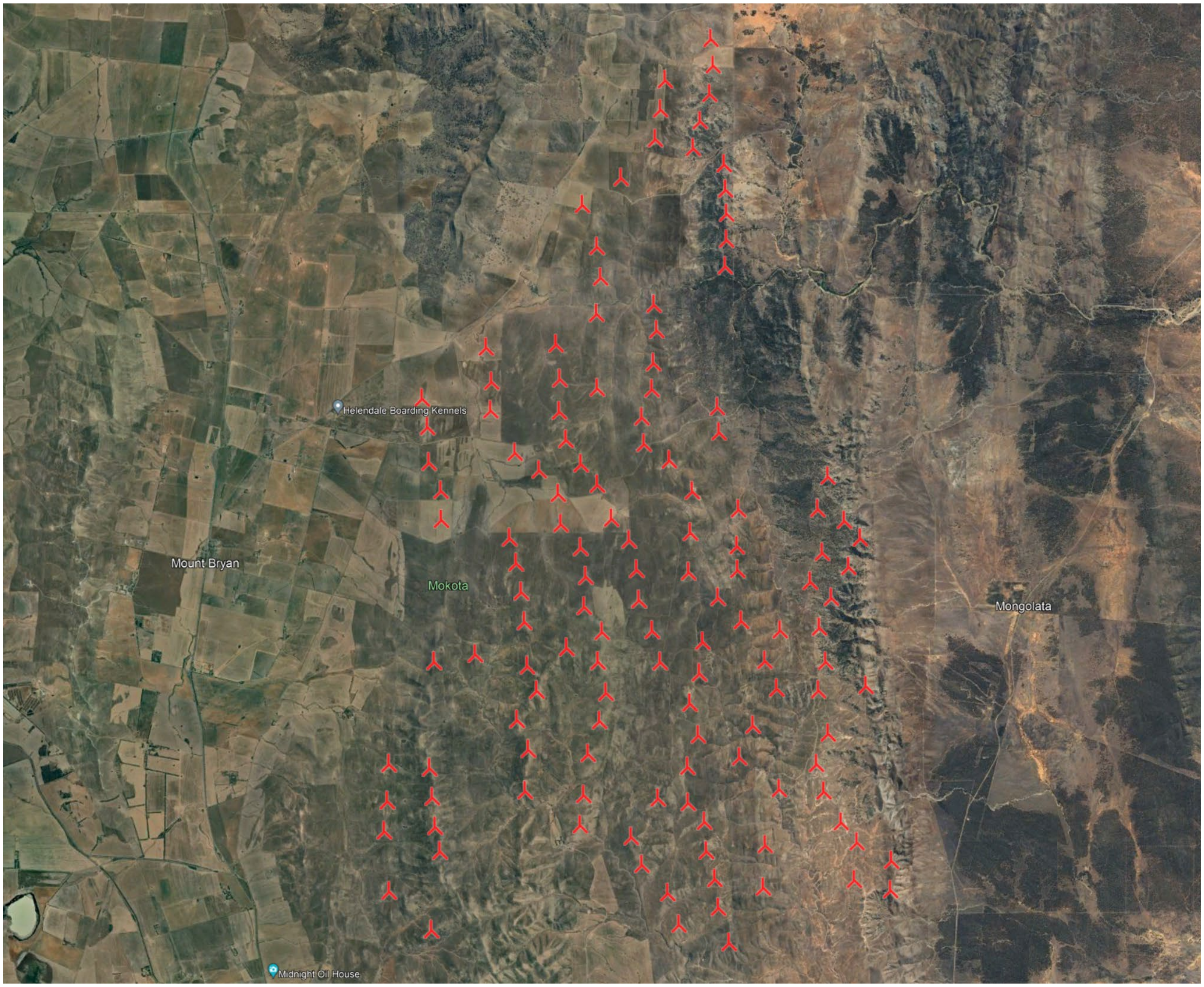

Figure 2 ***Overview of Goyder North Renewable Energy Facility arrangement***

Coordinates of proposed wind turbines assessed in this shadow flicker assessment can be found in Appendix A of this report.

1.3 Methodology

GHD has undertaken a desktop-based shadow flicker assessment using the EMD windPRO 4.0 software package against the wind turbine layout[2] and sensitive receptor locations[3] provided by Neoen.

The model simulates the path of the sun during the year and can calculate the position of the sun relative to wind turbines, dwellings, and terrain, and thereby predict the possible shadow flicker durations in the vicinity of the wind farm development from a purely geometrical standpoint. This calculation gives the theoretical number of hours of shadow flicker experienced at the dwelling.

The following methodology was used to complete the shadow flicker and blade glint assessment.

[2] *'WTG Layout V5 - 20231220 - Final.zip'* provided by Neoen via email on 20 December 2023
[3] *'GN Dwellings_Update_20231027'* provided by Neoen through email correspondence on 28 June 2023

1. Request for Information, including:
   a. Turbine layout (turbine designations and coordinates)
   b. Turbine model technical parameters (i.e. hub height, rotor diameter, etc.)
   c. Proposed infrastructure/buildings (sensitive receptors) designation and coordinates
2. Input of base information into EMD windPRO 4.0 wind farm modelling software package
3. Selection of shadow flicker calculation parameters
4. Shadow flicker simulation
5. Recommendations on blade glint
6. Reporting

1.4 Information provided

The 135 wind turbine locations used in this assessment has been retrieved from the file *'WTG Layout V5 - 20231220 - Final.zip'* provided by Neoen via email on 20 December 2023.

The 110 receptor locations modelled have been obtained from the file *'GN Dwellings_Update_20231027'* provided by Neoen through email correspondence on 28 June 2023, whilst the landowner agreement status for each sensitive receptor was obtained through email correspondence on 8 January 2024.

Rotor diameter, hub height, blade chord, and maximum tip height information was provided to GHD via email from Neoen on 21 December 2023.

1.5 Reference documents and assessment requirements

GHD has conducted the shadow flicker assessment in accordance with the Draft National Wind Farm Development Guidelines for Australia (2010) (Draft Guidelines), which state that maximum value of shadow flicker duration experienced within 50 m of the centre of a dwelling must not exceed 30 hours per year.

Exception is given if the operator of the wind energy facility has entered into an agreement with a landowner under which the landowner acknowledges and accepts that shadow flicker may exceed 30 hours per annum at the landowner's residence.

Further assessment requirements as per the Draft Guidelines have been outlined in Table 1.

Table 1 Assessment requirements as per Draft Guidelines

Parameter	Limit/Description
Shadow flicker limit	30 h/year at each Receptor (worst case) 10 h/year at each Receptor (expected case)
Zone of influence of shadows	Distance limit of 265 x maximum blade chord in metres (1760 m)
Impact of cloud cover	Not to be included in the windPRO simulation and has not been considered

1.6 Scope and limitations

This report has been prepared by GHD for Neoen and may only be used and relied on by Neoen for the purpose agreed between GHD and Neoen as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Neoen arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD engineers have not visited the Goyder North Renewable Energy Facility site as part of this assessment and have therefore not examined local conditions near the receptors assessed, such as blockage from trees or other obstacles. The shadow flicker worst case is modelled on the basis of no tree coverage or obstacles blocking shadow flicker.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

GHD has prepared this report on the basis of information provided by Neoen and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Shadow Flicker and Blade Glint Assessment

2.1 Shadow flicker

As the blades of a wind turbine rotate during operation, they may cast periodic shadow flicker on the surrounding landscape. Shadow flicker is the fluctuation of light levels that can appear to flicker to an observer at a fixed ground location. The effect will occur under circumstances where the wind turbine location and orientation are such that at certain times of the day, the sun's rays pass behind the swept area of the rotating blades and affect the viewpoint. The extent of the flicker will depend on wind turbine geometry, cloud cover, the time of day, time of year, and geographical position of the site, and is more likely to be an issue for turbines located to the east or west of a receptor.

In accordance with the Draft Guidelines, the shadow flicker experienced within 50 m of the centre of a sensitive receptor must **not exceed 30 hours per year** as a result of the operation of the wind energy facility, according to worst case modelling unless an agreement has been made with the landowner of the dwelling.

2.2 Blade glint

Blade glint is caused by the reflection of sun light from a wind turbine blade which can be experienced by an observer as a repeating flash of light emitted from a wind turbine. The amount of blade glint experienced depends upon the yaw orientation of the turbine (rotor plane of rotation), the pitch angle of the blades, the rotation of the blades, relative position of the sun, the wind turbine's locations, and the dwelling (shadow receptor) location.

As per the Draft Guidelines, wind turbine blades must be finished using a low-reflective treatment such that reflective glinting from the blade surface or strobing reflections caused by blade rotation is mitigated. As many wind turbine blade manufacturers are currently applying the aforementioned treatment to their blades, the risk of blade glint is considered low and no further assessment was undertaken in this report. However, blade specifications should ensure that a low reflective coating is applied to the blades.

2.3 Inputs

The following inputs were used for the shadow flicker assessment:

– Turbine characteristics[4] (refer to Section 2.4)
– Turbine layout[5] (refer to Appendix A)
– Receptor locations (refer to Appendix B)
– Height elevation contours – publicly obtained Australian DEM model (1-arc-second)

2.4 Turbines modelled

At the time of writing this report, the exact turbine model and manufacturer is yet to be determined. As is typical in wind farm development, a procurement process is carried out after planning approval is obtained. Therefore, this assessment should be considered relevant to the conservative turbine parameters utilised and not necessarily a specific turbine type.

Neoen have requested the following turbine variant and hub height to be modelled for this assessment as shown in Table 2.

[4] Email from Neoen dated 21 December 2023
[5] Email from Neoen dated 20 December 2023

Table 2 Wind turbine generator modelled[6]

WTG Qty	Turbine OEM	Turbine Model	Max. Blade Chord (m)	Rotor Diameter (m)	Hub Height AGL (m)	Max. Rotor Tip Height (m)
135	TBD	TBD	6.64	180	160	240

2.5 Shadow receptor locations

Modelled shadow receptor locations have been obtained from the file *'GN Dwellings_Update_20231027'* provided by Neoen through email correspondence on 28 June 2023 and are shown in Appendix B.

[6] Details provided by Neoen through email correspondence on 21 December 2023

3. Calculations and Results

3.1 Assumptions and exclusions

As per the Draft National Guidelines, the shadow flicker model was calculated to a distance of 265 x blade chord length (m) from the turbines and was performed at 1-minute time intervals with a resolution of 10 m to determine the maximum shadow flicker duration within 50 m of the centre of each shadow flicker receptor. The turbine orientation is such that the rotor plane is facing the azimuth at 180° relative to all receptors. An SRTM digital terrain model was used to calculate turbine and sun visibility with visibility line-of-sight algorithm checks set at every 10 m.

A list of inputs and assumptions applied within the model are summarised below and are generally conservative.

Table 3 Draft National Guideline parameters

Parameter	Limit / Description
Shadow flicker limit	30 h/year at each Receptor (worst case) 10 h/year at each Receptor (expected case)
Receptor height	2 m
Receptor model	Greenhouse mode (i.e. the Receptors do not face any specific direction and instead face all directions. This model is conservative and is deemed appropriate as the specific properties of the Receptors – e.g. location, positioning of windows, etc. – are unknown).
Turbine orientation and rotation	Worst case scenario (the turbines are always rotating and perpendicular to the direction of incident sunlight).
Maximum distance of influence	1760 m (265 x maximum blade chord)
Minimum sun angle	3 degrees
Impact of cloud cover	Not considered
Turbine model	Custom (using the specifications outlined in Table 2)
Turbine orientation	The rotor plane (yaw) is always perpendicular to the line from the WTG to the sun.
Residence window size	2 x 2 m[7]
Window orientation	Windows are perpendicular to the wind farm.
Slope of window	90° vertical (normal window)
Grid resolution	10 m
Time step for calculation	1 minute
Day step for calculation	1 day

The above assumptions and inputs are taken from the Draft National Guidelines and are supplemented by standard GHD assumptions.

It is noted that the worst-case shadow flicker model is conservative and does not consider the following:

– Cloud cover
– Impact of wind direction on the orientation of the WTG during periods of potential shadow flicker, and whether this might reduce the shadow flicker experienced at the Receptors

[7] “Windows” are used as per the Draft Guidelines. The worst case was modelled using “Greenhouse Mode”, which simulates the ensure receptor being covered in windows like a greenhouse.

– Any potential changes to the wind farms operating regime to minimise operation of wind turbines contributing to shadow flicker
– Turbine down-time due to wind speeds below the cut-in wind speed
– Turbine down-time during maintenance
– Existing screening in the vicinity of affected properties (i.e. vegetation)
– Any vegetation blocking the visibility of wind turbines

4. Calculations and Results

4.1 Modelled shadow flicker

The shadow flicker assessment completed in windPRO was modelled using both a worst case and expected case scenario. The worst case scenario obtained a shadow flicker model that was highly conservative as assumes that the sun is always shining for the entire day (sunrise to sunset) with zero cloud cover, whilst the expected case uses historical cloud cover statistics.

4.1.1 Worst case shadow flicker

As per the Draft National Guidelines, ‘worst case’ amounts of shadow flicker were calculated with an allowable limit of 30 hours per year. The ‘worst case’ model assumes there is zero cloud cover at all times in addition to the assumptions provided in Section 3.1. Therefore, the ‘worst case’ results are high conservative.

4.1.2 Expected case shadow flicker

The ‘expected case’ modelling differs from the worst-case model as the results are scaled according to the statistical likelihood of cloud cover for different times of day, and month of year. Expected case shadow calculation are based on historic cloud cover statistics taken from Nuriootpa Climate Station (approximately 102 km from the wind farm site). Nuriootpa was selected as it is the closest weather station to Goyder North Renewable Energy Facility.

4.1.3 Results

Due to the significant number of receptor locations assessed, only those with calculated shadow flicker greater than zero are shown below i.e., all other receptors were calculated to have zero hours of shadow flicker. Furthermore, uninhabited structures (i.e. ruins, sheds, etc.) have also been excluded from the results.

Turbine down-time due to winds below the cut-in wind speed was provided by Neoen[8]. GHD, at the request of Neoen, has included this within the shadow flicker calculation as a modified case (as outlined in Table 4). It should be noted that GHD has not analysed the wind record for the project and have not independently verified the accuracy of the turbine downtime data. It is further noted that this approach is not in strict accordance with the draft shadow flicker guidelines, as per Table E-3 (Summary of allowable mitigations) within the Draft Guidelines and is therefore provided for information only.

Table 4 Calculated shadow flicker 135 x WTG at 160 m hub height and 180 m rotor diameter

Receptor ID	Easting (m)*	Southing (m)*	Elevation ASL (m)	Worst Case Shadow Flicker (h/year)	Shadow Flicker (days/year)	Max Shadow Hours per Day (h/day)	Expected Case Shadow Flicker (h/year)	Modified Case (h/year)
Receptor GN05	311137	6287605	580.0	143:14	211	1:09	84:51	57:01
Receptor GN06	314087	6286844	600.0	93:07	168	0:58	54:58	40:54
Receptor GN09	312769	6279026	541.3	114:51	140	1:12	56:37	37:16
Receptor GN59	313127	6295993	575.9	34:58	98	0:30	22:30	14:05

[8] WTG Downtimes.zip emailed on 19/02/24

Receptor ID	Easting (m)*	Southing (m)*	Elevation ASL (m)	Worst Case Shadow Flicker (h/year)	Shadow Flicker (days/year)	Max Shadow Hours per Day (h/day)	Expected Case Shadow Flicker (h/year)	Modified Case (h/year)
Receptor GN54	311807	6292129	533.7	35:29	113	0:27	22:45	15:01
Receptor GN57	310035	6290891	550.0	77:52	94	0:58	52:00	32:30
Receptor GN90	317688	6294500	437.7	65:28	155	0:35	40:06	29:21

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Neoen has confirmed through email correspondence on 8 January 2024.[10] that they either already have or intend to enter into agreements with these landholders prior to commencement of the project.

4.1.4 Shadow flicker map

The below indicative shadow flicker maps highlight the areas inside which worst case shadow flicker is 30 hour/year or greater of shadow flicker (red). Due to the large area of the windfarm, the map has been divided into two sections.

[10] 20240108 - GHD - Landholder Status.zip

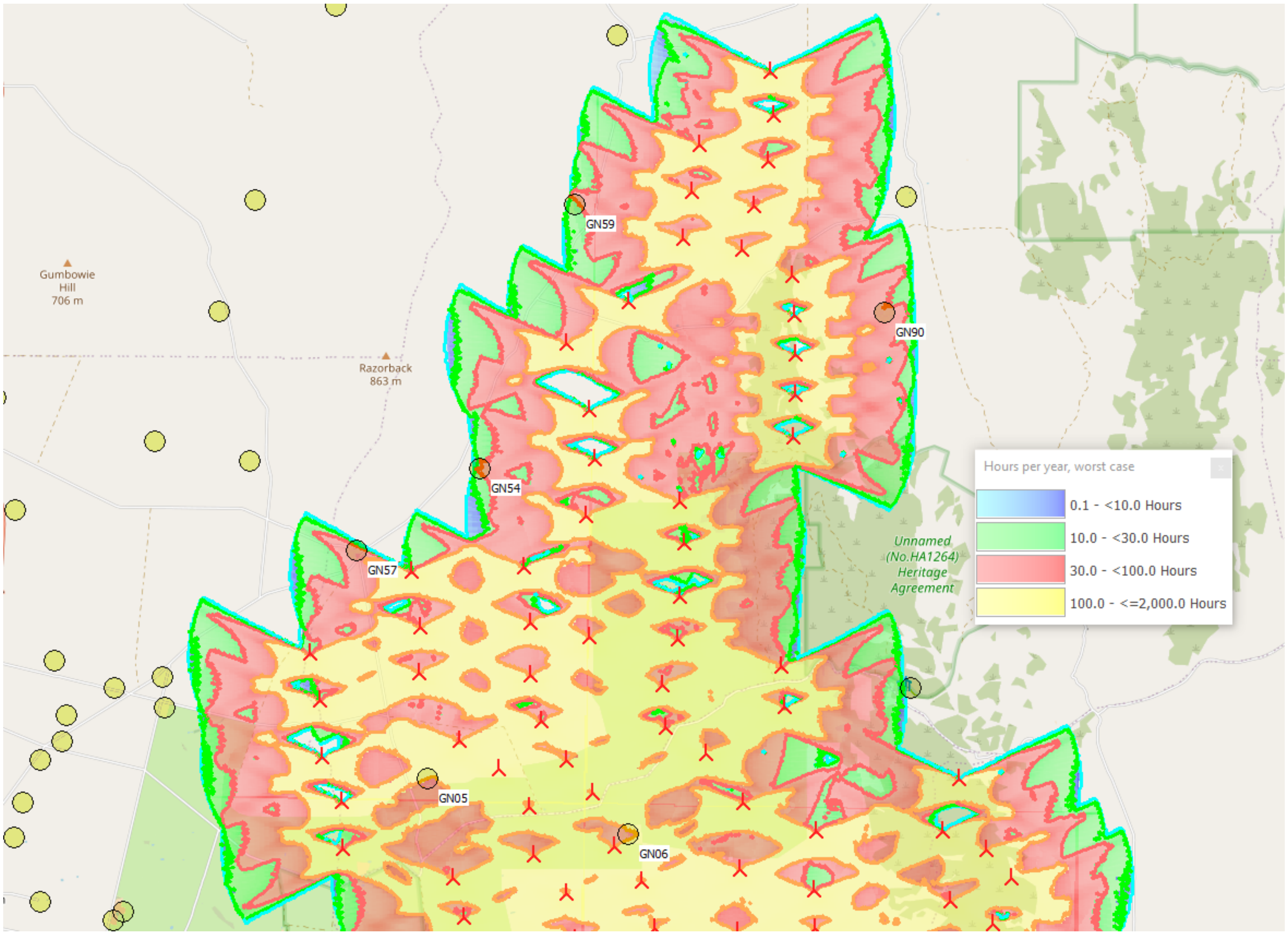

Figure 3 Shadow flicker map (worst case results) – Northern area

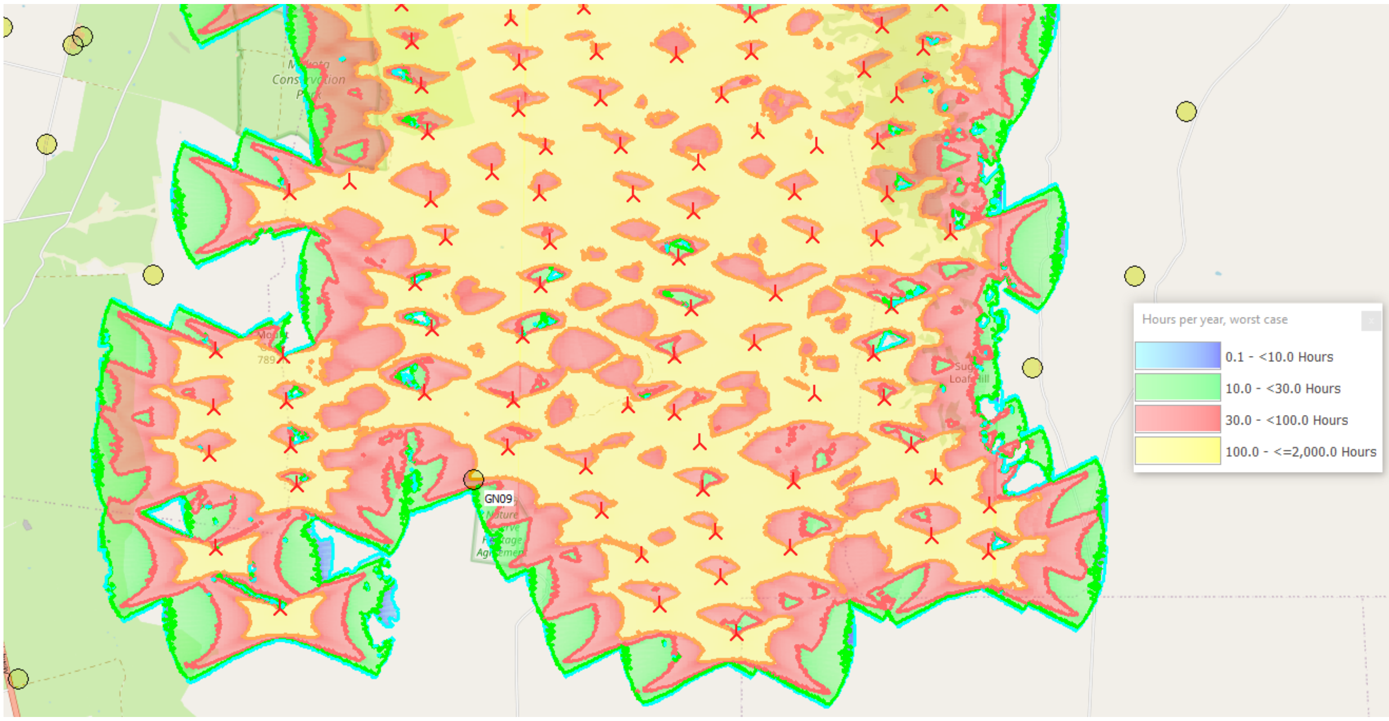

Figure 4 ***Shadow flicker map (worst case results) – Southern area***

4.2 Vegetation

Whilst vegetation was not modelled in the expected case calculation due to modelling limitations, it is noted through satellite imagery and photos taken by Neoen that there are varied levels of vegetation coverage for the different receptor locations. Receptors GN05, GN09, and GN54 have tall trees in the direction of proposed locations for turbines that may screen shadow flicker on those properties. Thus, there is potential for the existing vegetation surrounding the aforementioned Receptors to help mitigate shadow flicker. Other Receptors affected by shadow flicker may require further landscaping or screens to further reduce shadow flicker impact.

5. Conclusions and Recommendations

5.1 Conclusions

Shadow flicker calculations were completed for the Goyder North Renewable Energy Facility to assess the potential impacts to nearby dwellings. Modelling was undertaken in accordance with the Draft National Guidelines, and results show that the specified limit is exceeded for seven dwellings, all of which already do or will have agreements in place with Neoen.

Receptor GN09, GN06, and GN90 have theoretical worst case shadow flicker exceedances of 114.51 hours/year, 93.07 hours/year, and 65.28 hours/year respectively. Receptor GN05, GN54, and GN59 had theoretical worst case exceedances of 143.14 hours/year, 35.29 hours/year, and 34.58 hours/year. Receptor GN57 had a theoretical worst case shadow flicker exceedance of 77.52 hours/year.

When the calculation is based on expected-case sunshine statistics from Nuriootpa Climate Station (approximately 102 km away), Receptor GN09, GN06, and GN90 have exceedances of 56.37 hours/year, 54.58 hours/year, and 40.06 hours/year respectively. Receptor GN05, GN54, and GN59 had expected-case exceedances of 84.51 hours/year, 22.45 hours/year, and 22.30 hours/year. Receptor GN57 had a theoretical expected-case shadow flicker of 52.00 hours/year.

The modified case which was completed at the request of Neoen considers turbine estimated down-time due to wind speeds below the cut-in wind speed (as provided by Neoen) in addition to the expected-case sunshine statistics from Nuriootpa Climate Station. Receptor GN09, GN06, and GN90 have exceedances of 37.16 hours/year, 40.54 hours/year, and 29.21 hours/year, respectively. Receptor GN05, GN54, and GN59 had exceedances of 57.01 hours/year, 15.01 hours/year, and 14.05 hours/year. Receptor GN57 had an exceedance of 32.30 hours/year.

Neoen has confirmed through email correspondence on 8 January 2024.[11] that they either have, or intend to, enter into agreements with each of these landholders prior to commencement of the project.

Vegetation surrounding affected Receptors can aid in further reducing shadow flicker impact, particularly for Receptors with existing trees screening the Receptors in the direction of proposed locations for turbines that would cause shadow flicker on those properties.

In accordance with the Draft Guidelines, blade glint is not expected to an issue provided that wind turbines use non-reflective coatings on the blades of the wind turbines.

It should be noted that the draft guideline methodology is conservative for the worst case scenario and the results from the shadow flicker assessment are not completely representative of the actual shadow flicker created once the wind farm is operational.

5.2 Recommendations

This assessment has been undertaken for 135 specific turbine locations and 110 sensitive receptor locations as provided by Neoen. Planning approvals typically allow some degree of flexibility in turbine siting. Upon finalisation of the turbine locations prior to construction, it is recommended that Neoen undertake an updated shadow flicker assessment to minimise shadow flicker impacts on nearby receptors where possible, and to ensure there is no increase in exceedances. Should there be an exceedance, the expectation is that there is an appropriate agreement in place with the affected landowner and that mitigation measures are considered and/or implemented.

Wind turbine technical specifications and procurement documentation should specify that all wind turbine blades be finished with a low reflectivity treatment to avoid possible effects of blade glint on neighbouring dwellings and communities as reflected in the Scoping Requirements.

[11] 20240108 - GHD - Landholder Status.zip

Additional landscaping or screens should be considered to help reduce shadow flicker impact, particularly for Receptors surrounded by sparse vegetation and little vegetation coverage (i.e. due to trees).

Appendices

Appendix A

Coordinates of proposed wind turbines

WTG ID	Easting (m)*	Southing (m)*	Elevation (m)
WTG_001	308836	6280884	660.0
WTG_002	308819	6280027	658.7
WTG_003	308765	6279332	670.0
WTG_005	308885	6277927	649.7
WTG_006	309885	6277047	640.0
WTG_007	309374	6289384	575.7
WTG_008	309530	6288716	598.4
WTG_009	309582	6287890	600.0
WTG_010	309882	6287238	610.0
WTG_011	309906	6286564	620.0
WTG_012	315944	6297979	500.0
WTG_013	309894	6283283	720.0
WTG_014	309847	6280837	735.7
WTG_015	309907	6280157	712.0
WTG_016	309982	6279481	703.2
WTG_017	310092	6278906	695.1
WTG_020	310807	6283465	677.2
WTG_021	311527	6286167	640.0
WTG_022	311701	6285591	650.0
WTG_023	311865	6284927	710.0
WTG_024	311960	6284242	713.8
WTG_025	312037	6283219	696.1
WTG_026	312268	6282658	700.0
WTG_027	311816	6281971	680.0
WTG_028	312091	6281291	685.7
WTG_029	312003	6280314	650.0
WTG_030	312945	6283657	710.0
WTG_031	310833	6290610	553.2
WTG_032	310987	6289808	568.9
WTG_033	310978	6289141	567.1
WTG_034	311584	6288157	598.2
WTG_035	312165	6287757	606.1
WTG_036	312620	6287219	600.0
WTG_037	312703	6286516	620.0
WTG_038	313193	6285974	650.0
WTG_039	313334	6285312	670.0
WTG_040	313330	6284613	705.8
WTG_041	313756	6284042	705.3

WTG ID	Easting (m)*	Southing (m)*	Elevation (m)
WTG_042	313680	6283356	730.0
WTG_043	313847	6282629	650.0
WTG_044	313716	6281976	655.7
WTG_045	313454	6281203	647.4
WTG_046	313342	6280226	587.4
WTG_047	313275	6279524	590.0
WTG_048	312474	6290713	563.8
WTG_049	312590	6289898	580.0
WTG_050	312608	6289134	610.0
WTG_051	312778	6288478	611.8
WTG_052	313155	6287915	630.1
WTG_053	313542	6287448	630.0
WTG_054	313877	6286668	607.4
WTG_055	314297	6286173	610.0
WTG_056	314493	6285493	613.5
WTG_057	314573	6284790	650.0
WTG_058	314888	6284086	632.6
WTG_059	315086	6283360	620.0
WTG_060	313035	6293970	575.9
WTG_061	313385	6293013	553.6
WTG_062	313478	6292304	540.0
WTG_063	313381	6291473	500.0
WTG_064	313454	6289710	545.5
WTG_065	313939	6294601	592.1
WTG_066	315944	6296681	504.8
WTG_067	314923	6296904	590.0
WTG_068	314828	6296217	593.8
WTG_069	314721	6295525	590.0
WTG_070	315587	6295389	520.0
WTG_071	316358	6294453	488.2
WTG_072	316011	6297355	502.3
WTG_073	314761	6290328	550.0
WTG_074	314738	6291699	530.0
WTG_075	314819	6291097	546.3
WTG_076	314748	6289707	574.9
WTG_077	314531	6289039	595.6
WTG_078	314604	6288421	610.0
WTG_079	315199	6288048	605.8

WTG ID	Easting (m)*	Southing (m)*	Elevation (m)
WTG_080	315747	6287339	606.1
WTG_081	315727	6286377	620.0
WTG_082	315701	6285459	610.0
WTG_083	316069	6283851	625.2
WTG_084	316009	6283119	640.0
WTG_085	315798	6282416	640.0
WTG_086	315999	6281672	613.9
WTG_087	315769	6280940	616.1
WTG_088	315083	6280182	591.1
WTG_089	314461	6279258	560.0
WTG_090	314712	6278602	538.2
WTG_091	315330	6277947	530.0
WTG_092	315603	6277208	510.5
WTG_093	315783	6280087	580.0
WTG_094	316174	6279655	580.0
WTG_095	316229	6278964	553.8
WTG_096	316435	6278309	549.3
WTG_097	316527	6277631	529.6
WTG_098	316788	6276799	504.3
WTG_099	315737	6296023	520.4
WTG_100	316319	6295029	518.1
WTG_101	316397	6293881	500.3
WTG_102	316400	6293287	469.0
WTG_103	316376	6292670	470.0
WTG_104	316273	6289330	520.0
WTG_105	316330	6288741	530.7
WTG_106	316825	6286946	560.0
WTG_107	316815	6286085	599.8
WTG_108	316843	6285534	604.4
WTG_109	316401	6284880	620.0
WTG_110	316956	6284351	620.0
WTG_111	317858	6284146	571.8
WTG_112	317525	6283434	620.1
WTG_113	317813	6282796	620.0
WTG_114	317266	6281915	589.4
WTG_115	316962	6281164	569.4
WTG_116	317899	6280423	520.0
WTG_117	317593	6279100	506.3

WTG ID	Easting (m)*	Southing (m)*	Elevation (m)
WTG_118	317563	6278094	481.5
WTG_119	318681	6286989	550.0
WTG_120	318808	6285971	565.1
WTG_121	318542	6285292	571.9
WTG_122	318905	6287754	550.0
WTG_123	319312	6286727	580.0
WTG_124	319693	6286325	600.0
WTG_125	319434	6285653	592.5
WTG_126	319043	6284925	580.0
WTG_127	318776	6284228	587.8
WTG_128	318939	6283441	600.0
WTG_129	318782	6282765	567.8
WTG_130	319025	6281751	522.7
WTG_131	318765	6281031	529.2
WTG_132	318948	6280379	489.9
WTG_133	319369	6279662	485.4
WTG_134	319751	6279191	474.3
WTG_135	319706	6278304	460.7
WTG_136	319893	6282881	550.0
WTG_137	320572	6278784	497.3
WTG_138	320565	6278092	495.5

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Appendix B

Coordinates of shadow flicker receptors

Receptor ID	Easting (m)*	Southing (m)*	Elevation (m)
GN05	311137	6287605	580.0
GN06	314087	6286844	600.0
GN07	304392	6273402	525.9
GN08	322707	6282279	332.7
GN09	312769	6279026	541.3
GN10	313613	6274935	490.1
GN12	304703	6293022	552.0
GN18	305513	6285699	540.0
GN19	306582	6285454	550.2
GN20	305033	6284863	524.2
GN23	302585	6284800	545.6
GN25	304480	6282877	515.9
GN26	305278	6282672	530.0
GN27	305075	6280454	516.3
GN28	303153	6281099	515.2
GN30	302772	6285874	547.3
GN32	305121	6276353	490.0
GN40	313698	6298470	582.4
GN42	311362	6273430	548.8
GN59	313127	6295993	575.9
GN65	307860	6282007	597.9
GN66	305113	6286619	530.0
GN67	305233	6287141	530.0
GN69	319615	6274472	370.0
GN70	319793	6274461	368.6
GN54	311807	6292129	533.7
GN62	317978	6296195	444.9
GN01	310496	6307099	590.7
GN02	317414	6304989	547.2
GN03	308452	6295963	605.5
GN04	307956	6294335	588.7
GN11	303998	6295519	587.3
GN13	304215	6291928	558.7
GN14	304338	6290084	540.2
GN15	307281	6288549	542.4
GN16	305656	6289198	538.5
GN17	305779	6288033	532.1
GN21	306218	6283947	543.2

Receptor ID	Easting (m)*	Southing (m)*	Elevation (m)
GN24	303220	6283280	513.3
GN29	301986	6278958	532.2
GN31	304972	6277705	495.2
GN33	303141	6275920	540.0
GN34	305401	6274815	487.2
GN35	305999	6274136	480.0
GN36	307737	6273844	507.2
GN37	308312	6273230	494.6
GN38	308604	6273395	514.1
GN39	309084	6273130	510.7
GN41	309243	6273163	514.4
GN43	311615	6272417	499.7
GN44	313142	6272403	475.8
GN45	307239	6288996	542.8
GN46	311444	6304204	630.0
GN47	321184	6280881	375.6
GN48	323434	6284767	350.0
GN49	318544	6310750	470.7
GN50	309991	6304127	661.3
GN51	313685	6301984	598.9
GN52	305034	6291391	547.1
GN53	304687	6290868	544.9
GN55	306536	6288833	546.6
GN56	305835	6288423	535.8
GN57	310035	6290891	550.0
GN58	308447	6292165	587.2
GN95	323592	6270151	294.3
GN61	306725	6285583	550.6
GN63	316346	6301898	514.2
GN64	309640	6272922	511.2
GN68	305470	6287755	530.0
GN71	316172	6300853	511.6
GN90	317688	6294500	437.7
GN91	318167	6289060	502.2
GN72	308764	6272741	492.1
GN73	308824	6272622	490.0
GN100	308905	6272630	491.1
GN74	309049	6272529	497.9

Receptor ID	Easting (m)*	Southing (m)*	Elevation (m)
GN75	309024	6272530	496.4
GN76	309029	6272474	497.0
GN77	308716	6273314	509.9
GN78	307859	6272815	489.1
GN79	307934	6272893	494.2
GN80	308239	6273030	490.0
GN81	308646	6273027	502.9
GN82	307844	6272882	495.4
GN83	307911	6272778	486.7
GN84	308001	6272795	490.0
GN85	308758	6273112	508.5
GN86	308443	6272743	489.3
GN87	308670	6272835	494.1
GN88	308525	6272547	484.1
GN89	308541	6272457	483.9
GN96	323401	6264339	275.6
GN60	319943	6268079	356.3
GN93	318367	6270100	374.1
GN92	314934	6269828	430.5
GN94	315194	6271483	418.8
GN97	319582	6264617	337.4
GN98	309570	6298809	720.6
GN99	305788	6273183	480.0

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ghd.com

The Power of Commitment

Goyder North Wind Farm

Environmental Noise Assessment

14 November 2023
Reference ID: 76-3

echo
Acoustic Consulting

Contents

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Tables

Abbreviations

Assessment	Goyder North Wind Farm Environmental Noise Assessment (*Echo Acoustics - Reference ID: 76-3 13 November 2023*)
dB(A)	Noise level in *A-weighted decibels*
DO	Desired Outcome of the Code
DTS / DPF	Deemed to Satisfy Criteria / Designated Performance Feature
Code	*Planning and Design Code* Version 2023.16 dated 9 November 2023, PlanSA.
Day	A period defined by the *Environment Protection (Commercial and Industrial Noise) Policy 2023* as between 7.00am and 10.00pm.
EP Act	*Environment Protection Act 1993*
EPA	South Australian Environment Protection Authority
Guidelines	*Wind farms environmental noise guidelines 2021 (EPA)*
L_{Aeq}	A-weighted *equivalent* noise level
$L_{Aeq,10\ minute}$	A-weighted *equivalent* noise level over a 10 minute period
L_{A90}	A-weighted *background* noise level
$L_{A90,10\ minute}$	A-weighted *background* noise level over a 10 minute period
MVA	Megavolt Amperes
MW	Mega Watt
Night	A period defined by the *Environment Protection (Commercial and Industrial Noise) Policy 2023* as between 10.00pm and 7.00am.
PO	Performance Outcome of the Code
Policy	The *Environment Protection (Commercial and Industrial Noise) Policy 2023*
Project	Goyder North Wind Farm
Standard	*ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*
WHO Guidelines	World Health Organization's *Guidelines for Community Noise*
WTG	Wind Turbine Generator

Glossary

A-weighting	A mathematical adjustment to the measured noise levels to represent the human response to sound. An *A-weighted noise level* is presented as dB(A)
Background noise level	The noise level exceeded for 90 per cent of a time period. For wind farms, the Guidelines reference a 10-minute period ($L_{A90,10\ minute}$)
Candidate WTG	A candidate WTG is used as an example in an assessment process to indicate the ability of the wind farm to comply with legislative requirements. Candidate WTGs are indicative of WTGs which might be procured at a future design and tender stage
Decibels	The logarithmic unit of measurement to define the magnitude of a fluctuating air pressure wave. Used as the unit for *sound* or *noise level*
Equivalent noise level	The A-weighted noise level which is equivalent to a noise level which varies over a time period. For wind farms, the Guidelines reference a 10-minute period ($L_{Aeq,10}$)

Frequency	Frequency is the number of air pressure wave fluctuations per second. Measured in units of Hertz (Hz)
Involved Receivers	*Receivers* that have a commercial agreement with the project
Noise	An interchangeable term with sound but which is most often described as *unwanted sound.*
Octave Band	The segregation of sound into discrete frequency components. For example, the 63 Hz *octave band* is a low frequency component of sound/noise, and the 2000 Hz *octave band* is a high frequency component of sound/noise. The one-third (or 1/3) octave band is a more finite segregation (1/3rd) of each octave band
Receiver	A *sensitive receiver* where noise impacts are considered. In this instance, the *receivers* are existing and approved dwellings and tourist accommodation
Sensitive receiver	The same meaning as under *Part 8 Administrative Terms and Definitions* of the Code. Defined as: *a. any use for residential purposes or land zoned primarily for residential purposes;* *b. child care facility;* *c. educational facility;* *d. hospital;* *e. supported accommodation;* *f. tourist accommodation.*
Sound	An activity or operation which generates a fluctuating air pressure wave. The ear drum can perceive both the frequency (pitch) and the magnitude (loudness) of the fluctuations to convert those waves to sound
Sound pressure level	The magnitude of sound (or noise) at a position. The sound pressure level can vary according to location relative to the noise source, and operational, meteorological and topographical influences
Sound power level	The amount of sound energy an activity produces for a given operation. The sound power level is a constant value for a given activity. The sound power level is analogous to the power rating on a light globe (which remains constant), whereas the lighting level in a space (*sound pressure level* in this analogy) will be influenced by the distance from the globe, shielding and different locations within the space
Tonality	Noise containing a perceptible pitch component which exceeds accepted objective assessment methods
Uninvolved Receivers	*Receivers* that do not have a commercial agreement with the Project
Warranted sound power level	The sound power level which the WTG supplier guarantees can be achieved inclusive of uncertainties

Introduction

Neoen is developing the proposed Goyder North Wind Farm (the **project**) as part of its wider *Goyder Renewables Zone* concept. The zone includes the *Goyder South Hybrid Renewables Energy Project* approved in 2021 and currently being constructed.

The project is in the Regional Council of Goyder and located north-east of the town of Burra and east of the town of Mount Bryan in South Australia's Mid-North region. The project has the potential for 138 wind turbine generators (**WTG**s) with a hub height of up to 160m providing up to 1000MW of wind generation. The final WTG for the project is yet to be determined and will be confirmed during the detailed design and procurement stage.

Ancillary components of the project which generate noise during operation include transformers at the two substations.

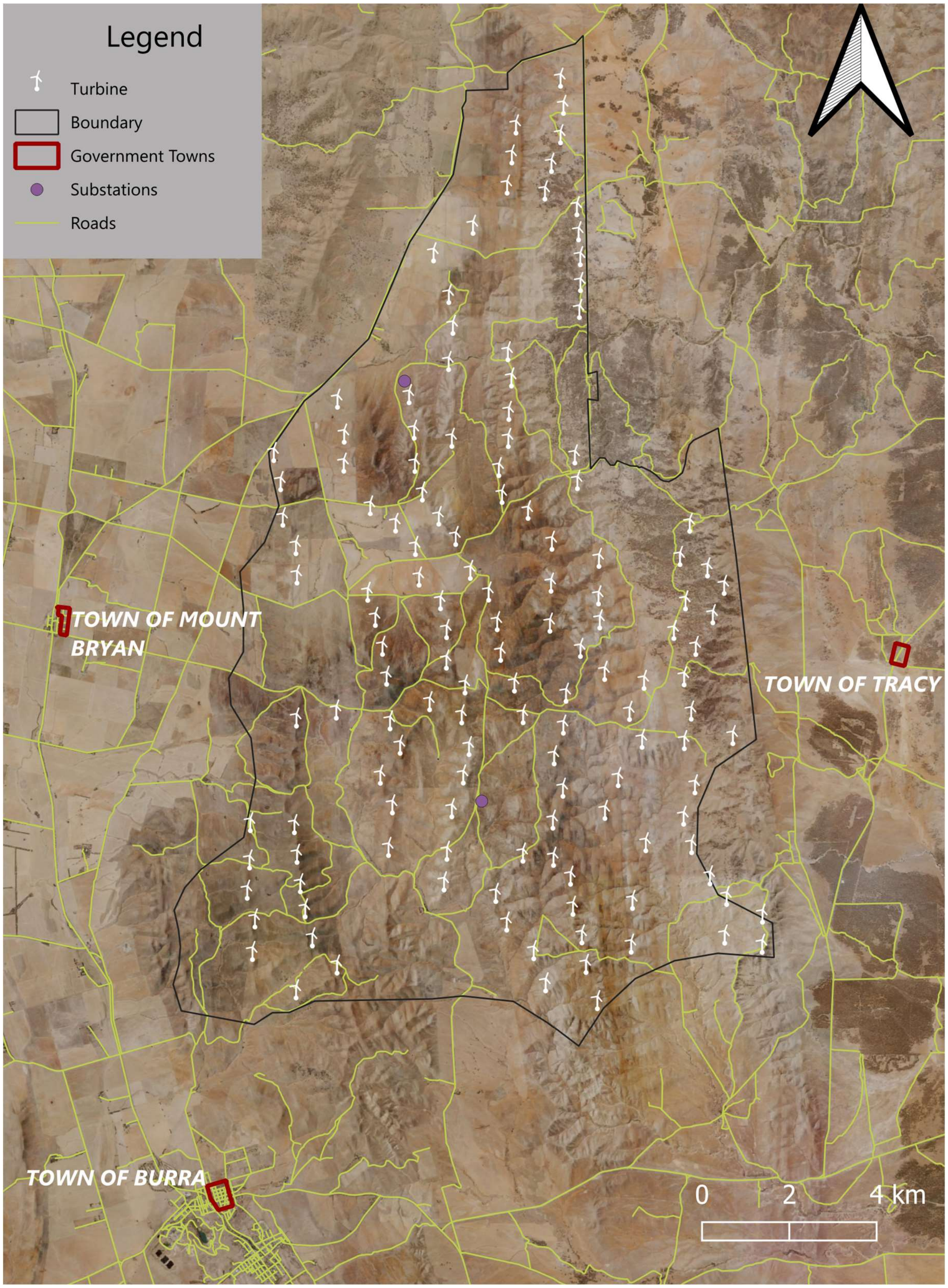
The *Wind farms environmental noise guidelines 2021* provide requirements to protect the *amenity of the surrounding community from adverse noise impacts* from the wind generation component of the project, and the *Environment Protection (Commercial and Industrial Noise) Policy 2023* provides a method of assessing adverse impacts from the ancillary components.

The noise levels generated by renewable energy projects are well understood and can be predicted with accuracy. Environmental noise assessments compare predicted noise levels against the relevant noise requirements. Where the requirements cannot be achieved, the assessments determine whether WTGs and/or transformers can be relocated, shielded, or modified to utilise improved technologies, or removed to achieve compliance.

This environmental noise assessment (the **assessment**) predicts the noise associated with the WTGs and transformers to ensure the acoustic amenity of the surrounding existing and approved dwellings, and tourist accommodation (**receivers**) is not adversely affected by the project.

The WTG layout relative to the surrounding locality is shown in Figure 1 below. The receivers are shown later in the assessment in Figure 2, along with the WTG layout and the predicted noise level contours overlaid.

Figure 1 WTG Layout



Assessment Criteria

The Planning and Design Code

The project is located within a *Rural Zone* of the *Planning and Design Code Version* 2023.16 dated 9 November 2023 (the **Code**). The following provisions within the Code are considered relevant to the environmental noise assessment.

Infrastructure and Renewable Energy Facilities (Part 4 – General Development Policies)

Desired Outcome DO 1

Efficient provision of infrastructure networks and services, renewable energy facilities and ancillary development in a manner that minimises hazard, is *environmentally* and culturally *sensitive* and manages adverse visual impacts on natural and rural landscapes and residential amenity.

Interface between Land Uses (Part 4 – General Development Policies)

Desired Outcome DO 1

Development is located and designed to *mitigate adverse effects* on or from neighbouring and proximate land uses.

Performance Outcome PO 1.2

Development adjacent to a site containing a sensitive receiver (or lawfully approved sensitive receiver) or zone primarily intended to accommodate sensitive receivers is *designed to minimise adverse impacts*.

Performance Outcome PO 2.1

Non-residential development *does not unreasonably impact the amenity of sensitive receivers* (or lawfully approved sensitive receivers) or an adjacent zone primarily for sensitive receivers through its hours of operation having regard to:

a) the nature of the development
b) measures to mitigate off-site impacts
c) the extent to which the development is desired in the zone
d) measures that might be taken in an adjacent zone primarily for sensitive receivers that mitigate adverse impacts without unreasonably compromising the intended use of that land.

Performance Outcome PO 4.1

Development that emits noise (other than music) *does not unreasonably impact the amenity of sensitive receivers* (or lawfully approved sensitive receivers).

Deemed-to-Satisfy Criteria / Designated Performance Feature (DTS/DPF) 4.1

Noise that might affect sensitive receivers achieves the relevant Environment Protection (Noise) Policy criteria.

Environment Protection (Commercial and Industrial Noise) Policy 2023

Interface between Land Uses DTS/DPF 4.1 references the *Environment Protection (Commercial and Industrial Noise) Policy 2023* (the **Policy**).

The Policy applies to the ancillary components of the project (in this case, the transformers at the substations).

The Policy was developed under the *Environment Protection Act 1993* (the **EP Act**). The EP Act incorporates a requirement to ensure the acoustic *amenity of a locality is not unreasonably interfered with*. The Policy provides an objective approach to satisfy this requirement underpinned by the World Health Organization's *Guidelines for Community Noise* (**WHO Guidelines**) as it relates to community annoyance and sleep disturbance.

Compliance with the Policy will satisfy both the EP Act and *Interface between land uses PO 4.1*. With the EP Act and *Interface between land uses PO 4.1* being consistent with the intent of the other relevant Code provisions listed above; compliance with the Policy at the receivers is considered to satisfy all other relevant *Desired Outcomes* and *Performance Outcomes* in the Code related to environmental noise from the ancillary components of the project.

The Policy includes the *Wind farms environmental noise guidelines 2021* (the **Guidelines**), which have been referenced to address the WTG component of the project as detailed in the subsequent section of this assessment.

Noise Criteria

The Policy establishes *indicative noise levels* that apply at receivers for both the day (7.00am to 10.00pm) and night (10.00pm to 7.00am the following day), with the *indicative noise levels* which apply during the night being more stringent than those which apply during the day. The noise levels vary according to the land uses promoted by the zones in which the ancillary equipment and receivers are located.

For new ancillary equipment requiring development approval, the noise levels that apply under the Policy at receivers are the *Indicative Noise Levels* minus 5 dB(A). In this circumstance, the noise levels that apply to receivers:

- in a *Rural Zone* are:
  - An *average noise level* of 52 dB(A) during the day period
  - An *average noise level* of 45 dB(A) during the night period
- in a *Rural Living Zone* are:
  - An *average noise level* of 47 dB(A) during the day period
  - An *average noise level* of 40 dB(A) during the night period

The "average noise level" is an *equivalent noise level* over a default assessment period of 15 minutes. An instantaneous maximum noise level also applies at receivers in a rural living zone; however, due to the constant noise generating nature of the ancillary equipment, this aspect is not relevant to the assessment.

When predicting noise levels for comparison to the Policy, the predicted *equivalent noise levels* are to be adjusted (increased) where the activities exhibit "annoying" characteristics (dominant tonal, impulsive, low frequency content, intermittent or modulation characteristics) in comparison to the surrounding environment.

Wind Farms Environmental Noise Guidelines 2021

The Guidelines provide requirements to protect the *amenity of the surrounding community from adverse noise impacts*. The Guidelines have been developed under the EP Act to specifically address the WTG component of the project. Compliance with the Guidelines is considered to satisfy *Desired Outcomes* and *Performance Outcomes* in the Code related to environmental noise from the WTG component of the project.

Noise Criteria

The Guidelines provide noise criteria which apply at the receivers, depending on their relationship with the project. The noise criteria can be relaxed where receivers have entered into a commercial agreement with the project.

Given the different noise criteria, this assessment delineates and identifies receivers with a commercial agreement as **involved receivers**. All other receivers are identified as **uninvolved receivers**.

The Heysen Trail and Mawson Trial are walking trails in the proximity of the project and are not assessed against the Guidelines on the basis they are transient locations rather than permanent receivers and the noise levels experienced on the trail will be similar to those regularly experienced in the natural environment. For the purposes of conservatism, permanent tourist accommodation buildings that are primarily designed for overnight stays (and approved as such) have been included in this assessment as uninvolved receivers.

Uninvolved Receivers

To minimise the impact on the amenity of receivers, the *predicted* equivalent noise level ($L_{Aeq,10\ minute}$), adjusted for tonality in accordance with these guidelines, should not exceed:

- 35 dB(A) at receivers in a rural living zone, or
- 40 dB(A) at receivers in a rural zone, or
- the background noise ($L_{A90,10\ minute}$) by more than 5 dB(A).

whichever is the greater, at all receivers for wind speeds from cut-in to rated power of the WTG and each integer wind speed in between. These criteria apply for both day and night.

Involved Receivers

The Guidelines do not provide noise criteria at involved receivers. Rather the Guidelines suggest that the following are implemented to avoid an *unreasonable interference*:

- a formal agreement is documented between the involved receiver and the project
- the agreement clearly outlines the expected impact of the noise from the project and its effect upon the involved receiver's amenity
- the expected noise from the project will not result in adverse health impacts (for example, the level does not result in sleep disturbance or serious annoyance outdoors).

To provide an objective assessment of noise at involved receivers, reference is made to the WHO Guidelines which provide recommendations to protect against sleep disturbance in bedrooms and annoyance in outdoor areas. The recommendations of the WHO Guidelines are repeated below:

> *"For a good night's sleep, the equivalent sound level should not exceed 30 dB(A) (inside the bedroom) for continuous background noise"* (note this equates to an outdoor noise level of 45 dB(A) with bedroom windows open under the WHO Guidelines)
>
> and
>
> *"To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}."*

An outdoor noise criterion of 45 dB(A) at the involved receivers will satisfy the recommendations of the WHO Guidelines (including with bedroom windows open). It is noted that higher levels than an outdoor noise criterion of 45 dB(A) can still satisfy the Guidelines subject to specific noise reduction treatments being incorporated to the dwelling.

Cumulative Noise

The noise criteria of the Guidelines are set at a level that accounts for the cumulative effect of other wind farm development and for the increased sensitivity of receivers to a new wind farm. That is, the cumulative noise from other wind farms (such as Hallett) in combination with the project does not need to be assessed subject to the project satisfying the Guidelines.

The Guidelines require that any staged wind farm that belongs to the same owner assess the cumulative impact from the entire wind farm against the noise criteria of the Guidelines. This is to ensure the staging of a wind farm is not used for advantageous purposes.

In this circumstance, given the scale of the project, it will likely be developed in stages, although it is not yet possible to determine the size of each stage as it is dependent on electricity demand. This assessment considers the entire project rather than individually assessing stages, in accordance with the Guidelines.

Furthermore, whilst the approved *Goyder South Hybrid Renewables Energy Project* and the project are not different stages of the same wind farm, the noise levels from both wind farms have been considered for broader information purposes given that they are both Neoen projects.

Project Assessment Criteria

The project assessment criteria to satisfy both the Guidelines and the Policy and in so doing, all relevant provisions of the Code, are summarised below:

Ancillary Components

The noise levels that apply at the receivers during the night are the most relevant given that ancillary equipment will operate at all times, and the night criteria are more stringent than the day.

The relevant noise criterion therefore becomes 45 dB(A) at the closest receivers in the *Rural Zone,* noting that there are no receivers in a *Rural Living Zone* in the immediate proximity of the project (that is, compliance with the criterion of 45 dB(A) for receivers in a *Rural Zone* will satisfy the Policy at all receivers, including those in any other zone).

Wind Farm

The preliminary assessment has not increased the project assessment criteria based on background noise levels. This approach negates the need to conduct background noise monitoring for the purposes of establishing noise criteria and conservatively results in the following project assessment criteria:

- 40 dB(A) at the closest *uninvolved receivers* in a *Rural Zone,* noting that there are no receivers in a *Rural Living Zone* in the immediate proximity of the project (that is, compliance with the criterion of 40 dB(A) for receivers in a *Rural Zone* will satisfy the Guidelines at all receivers, including those in any other zone)
- 45dB(A) at the *involved receivers*.

Further information on background noise monitoring is provided in the Preliminary Noise Monitoring Plan section of this assessment.

Assessment

Wind Turbine Generators

Noise Model

A three-dimensional model of the project has been developed based on the algorithm provided by *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (the **Standard**).

The Standard specifies a method for predicting noise levels at a distance from a source under meteorological conditions favourable to noise propagation, being downwind (wind blowing from the WTGs to receivers) or temperature inversion conditions. The Standard conservatively assumes that these favourable propagation conditions occur simultaneously between all WTGs and all receivers.

The model incorporates the following:

- the locations of receivers as detailed in Table 1
- the cumulative effect of all 138 WTGs operating concurrently, with WTG locations as detailed in Table 2
- topographical ground contours
- inputs detailed below:
    - sound power levels that are representative of the warranted levels for candidate WTGs
    - a WTG hub height of up to 160m above ground level
    - 10°C temperature
    - 70% relative humidity
    - 50% acoustically hard ground and 50% acoustically soft ground
    - barrier attenuation of no greater than 2 dB(A)
    - 4m receiver height at each receiver
    - application of a 3 dB(A) correction where a "concave" ground profile exists.

The above inputs are in accordance with the modelling recommendations of the *Institute of Acoustics* (UK) "*A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*".

Table 1 Receiver Locations and Involvement Status

Receiver ID	Involved	Co-ordinates (MGA Zone 54)		Receiver ID	Involved	Co-ordinates (MGA Zone 54)		Receiver ID	Involved	Co-ordinates (MGA Zone 54)	
		Easting	Northing			Easting	Northing			Easting	Northing
GN01	Uninvolved	310496	6307099	GN35	Involved	305999	6274136	GN68	Uninvolved	305470	6287755
GN02	Uninvolved	317414	6304989	GN36	Uninvolved	307737	6273844	GN69	Involved	319615	6274472
GN03	Uninvolved	308452	6295963	GN37	Uninvolved	308312	6273230	GN70	Involved	319793	6274461
GN04	Uninvolved	307956	6294335	GN38	Uninvolved	308604	6273395	GN71	Uninvolved	316172	6300853
GN05	Involved	311137	6287605	GN39	Uninvolved	309084	6273130	GN72	Uninvolved	308764	6272741
GN06	Involved	314087	6286844	GN40	Involved	313698	6298470	GN73	Uninvolved	308824	6272622
GN07	Involved	304392	6273402	GN41	Uninvolved	309243	6273163	GN74	Uninvolved	309049	6272529
GN08	Involved	322707	6282279	GN42	Involved	311362	6273430	GN75	Uninvolved	309024	6272530
GN09	Involved	312769	6279026	GN43	Uninvolved	311615	6272417	GN76	Uninvolved	309029	6272474
GN10	Involved	313613	6274935	GN44	Uninvolved	313142	6272403	GN77	Uninvolved	308716	6273314
GN11	Uninvolved	303998	6295519	GN45	Uninvolved	307238	6288996	GN78	Uninvolved	307859	6272815
GN12	Involved	304703	6293022	GN46	Uninvolved	311444	6304204	GN79	Uninvolved	307934	6272893
GN13	Uninvolved	304215	6291928	GN47	Uninvolved	321184	6280881	GN80	Uninvolved	308239	6273030
GN14	Uninvolved	304338	6290084	GN48	Uninvolved	323434	6284767	GN81	Uninvolved	308646	6273027
GN15	Uninvolved	307281	6288549	GN49	Uninvolved	318544	6310751	GN82	Uninvolved	307844	6272882
GN16	Uninvolved	305656	6289198	GN50	Uninvolved	309991	6304127	GN83	Uninvolved	307912	6272778
GN17	Uninvolved	305779	6288033	GN51	Uninvolved	313684	6301984	GN84	Uninvolved	308001	6272795
GN18	Involved	305513	6285699	GN52	Uninvolved	305034	6291390	GN85	Uninvolved	308758	6273112
GN19	Involved	306582	6285454	GN53	Uninvolved	304687	6290868	GN86	Uninvolved	308443	6272743
GN20	Involved	305033	6284863	GN54	Involved	311807	6292129	GN87	Uninvolved	308670	6272835
GN21	Uninvolved	306218	6283947	GN55	Uninvolved	306536	6288833	GN88	Uninvolved	308525	6272547
GN23	Involved	302585	6284800	GN56	Uninvolved	305835	6288423	GN89	Uninvolved	308541	6272457
GN24	Uninvolved	303220	6283280	GN57	Involved	310035	6290891	GN90	Involved	317688	6294500
GN25	Involved	304480	6282877	GN58	Uninvolved	308447	6292165	GN91	Uninvolved	318167	6289060
GN26	Involved	305278	6282672	GN59	Involved	313127	6295993	GN92	Uninvolved	314934	6269828
GN27	Involved	305075	6280454	GN60	Involved	319943	6268079	GN93	Uninvolved	318367	6270100
GN28	Involved	303153	6281099	GN61	Uninvolved	306725	6285583	GN94	Involved	315194	6271483
GN29	Uninvolved	301986	6278958	GN62	Uninvolved	317978	6296195	GN95	Uninvolved	323592	6270151
GN30	Involved	302772	6285874	GN63	Uninvolved	316346	6301898	GN96	Uninvolved	323401	6264340
GN31	Uninvolved	304972	6277705	GN64	Uninvolved	309640	6272922	GN97	Involved	319582	6264617
GN32	Involved	305121	6276353	GN65	Involved	307860	6282007	GN98	Uninvolved	309570	6298809
GN33	Uninvolved	303141	6275920	GN66	Involved	305113	6286619	GN99	Uninvolved	305788	6273183
GN34	Uninvolved	305401	6274815	GN67	Involved	305233	6287141	GN100	Uninvolved	308905	6272630

Table 2 WTG Locations

WTG ID	Co-ordinates (MGA Zone 54)		WTG ID	Co-ordinates (MGA Zone 54)		WTG ID	Co-ordinates (MGA Zone 54)	
	Easting	Northing		Easting	Northing		Easting	Northing
001	308836	6280884	047	313275	6279524	093	315783	6280087
002	308819	6280027	048	312474	6290713	094	316174	6279655
003	308765	6279332	049	312590	6289898	095	316229	6278964
004	308942	6278674	050	312608	6289134	096	316435	6278309
005	308885	6277927	051	312778	6288478	097	316527	6277631
006	309885	6277047	052	313155	6287915	098	316788	6276799
007	309374	6289384	053	313542	6287448	099	315737	6296023
008	309530	6288716	054	313877	6286668	100	316319	6295029
009	309582	6287890	055	314297	6286173	101	316397	6293881
010	309882	6287238	056	314493	6285493	102	316400	6293287
011	309906	6286564	057	314573	6284790	103	316376	6292670
012	315944	6297979	058	314888	6284086	104	316273	6289330
013	309894	6283283	059	315086	6283360	105	316330	6288741
014	309847	6280837	060	313035	6293970	106	316825	6286946
015	309907	6280157	061	313385	6293013	107	316815	6286085
016	309982	6279481	062	313478	6292304	108	316843	6285534
017	310092	6278906	063	313381	6291473	109	316401	6284880
018	310258	6278240	064	313454	6289710	110	316956	6284351
019	310824	6277616	065	313939	6294601	111	317858	6284146
020	310807	6283465	066	315944	6296681	112	317525	6283434
021	311527	6286167	067	314923	6296904	113	317813	6282796
022	311701	6285591	068	314828	6296217	114	317266	6281915
023	311865	6284927	069	314721	6295525	115	316962	6281164
024	311960	6284242	070	315587	6295389	116	317899	6280423
025	312037	6283219	071	316358	6294453	117	317593	6279100
026	312268	6282658	072	316011	6297355	118	317563	6278094
027	311816	6281971	073	314761	6290328	119	318681	6286989
028	312091	6281291	074	314738	6291699	120	318808	6285971
029	312003	6280314	075	314819	6291097	121	318542	6285292
030	312945	6283657	076	314748	6289707	122	318905	6287754
031	310833	6290610	077	314531	6289039	123	319312	6286727
032	310987	6289808	078	314604	6288421	124	319693	6286325
033	310978	6289141	079	315199	6288048	125	319434	6285653
034	311584	6288157	080	315747	6287339	126	319043	6284925
035	312165	6287757	081	315727	6286377	127	318776	6284228
036	312620	6287219	082	315701	6285459	128	318939	6283441
037	312703	6286516	083	316069	6283851	129	318782	6282765
038	313193	6285974	084	316009	6283119	130	319025	6281751
039	313334	6285312	085	315798	6282416	131	318765	6281031
040	313330	6284613	086	315999	6281672	132	318948	6280379
041	313756	6284042	087	315769	6280940	133	319369	6279662
042	313680	6283356	088	315083	6280182	134	319751	6279191
043	313847	6282629	089	314461	6279258	135	319706	6278304
044	313716	6281976	090	314712	6278602	136	319893	6282881
045	313454	6281203	091	315330	6277947	137	320572	6278784
046	313342	6280226	092	315603	6277208	138	320565	6278092

Candidate WTGs

The final WTG for the project is yet to be determined and will be confirmed during the detailed design and procurement stages. Three candidate WTGs for the project have been reviewed and commercial sensitivities preclude identification of the specific models or data. Therefore, the assessment has been based on the highest sound power level of any of the three candidate WTGs in each octave band (representing a conservative indication of the noise from the WTGs).

Sound Power Levels

The sound power levels are based on manufacturer's noise level data for three candidate WTGs at each integer hub height wind speed for a hub height of up to 160m above ground level. The highest sound power level of any of the candidate WTGs at any integer hub height wind speed has been utilised and is summarised in Table 3 below.

The sound power level data presented in Table 3 have been utilised in the assessment on the basis that they will be conservatively representative of the warranted sound power levels that could be selected for the project inclusive of uncertainties.

Should the warranted sound power levels of the final WTG increase above those presented in Table 3 (such as may occur due to contractual agreements, uncertainties, or advancements in WTG technology), then the noise assessment should be updated to reflect any such change.

Table 3 Maximum WTG Sound Power Levels

Maximum WTG sound power levels at any integer hub height wind speed (dB(A))								
Total	**Octave band**							
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1k Hz**	**2k Hz**	**4k Hz**	**8k Hz**
109	91	98	101	103	104	102	95	85

Tonality

The assessment has been made on the basis that the final WTG selection will not exhibit tonal characteristics, as tonality at receivers is not a common attribute of contemporary wind farm projects. The available one-third octave band data available for the candidate WTGs correlate with this assumption.

However, given the final WTG selection is yet to be determined, then as for the warranted sound power level data, the final WTG one-third octave band data should be reviewed and the predicted noise levels should be adjusted in accordance with the Guidelines, if required.

Predicted Noise Levels

Noise level predictions have been made using the noise model, inputs and assumptions detailed above and compared with the Project Assessment Criteria, being 40 dB(A) for *uninvolved receivers* in a *Rural Zone* and 45 dB(A) for *involved receivers*.

The highest predicted noise level at each receiver is provided in Table 4 at any integer hub height wind speed. Lower noise levels will occur when the turbines are not operating at rated capacity, being times when there are low wind speeds in the environment.

Table 4 Highest Predicted Noise Levels

Receiver ID	Closest WTG		Criterion	Predicted Noise Level (dB(A))	Receiver ID	Closest WTG		Criterion	Predicted Noise Level (dB(A))	Receiver ID	Closest WTG		Criterion	Predicted Noise Level (dB(A))
	WTG ID	Distance (m)				WTG ID	Distance (m)				WTG ID	Distance (m)		
GN01	012	10624	40	<25	GN35	005	4767	45	28	GN68	009	4115	40	31
GN02	012	7163	40	<25	GN36	006	3859	40	29	GN69	098	3664	45	32
GN03	060	4998	40	28	GN37	006	4131	40	28	GN70	138	3714	45	32
GN04	031	4707	40	30	GN38	006	3872	40	29	GN71	012	2883	40	31
GN05	034	711	45	45	GN39	006	4000	40	28	GN72	006	4452	40	27
GN06	054	274	45	51	GN40	067	1988	45	35	GN73	006	4553	40	27
GN07	005	6378	45	27	GN41	006	3939	40	28	GN74	006	4597	40	27
GN08	136	2886	45	34	GN42	006	3908	45	29	GN75	006	4601	40	27
GN09	047	711	45	43	GN43	006	4945	40	28	GN76	006	4655	40	27
GN10	092	3021	45	34	GN44	092	5399	40	30	GN77	006	3914	40	28
GN11	007	8157	40	<25	GN45	007	2171	40	35	GN78	006	4695	40	27
GN12	007	5921	45	28	GN46	012	7682	40	<25	GN79	006	4592	40	28
GN13	007	5752	40	28	GN47	137	2188	40	37	GN80	006	4344	40	28
GN14	007	5085	40	29	GN48	136	4017	40	33	GN81	006	4209	40	28
GN15	007	2254	40	35	GN49	012	13034	40	<25	GN82	006	4641	40	27
GN16	007	3723	40	31	GN50	012	8559	40	<25	GN83	006	4706	40	26
GN17	009	3806	40	32	GN51	012	4600	40	27	GN84	006	4653	40	27
GN18	011	4478	45	31	GN52	007	4781	40	29	GN85	006	4096	40	28
GN19	011	3505	45	33	GN53	007	4916	40	29	GN86	006	4542	40	27
GN20	013	5115	45	31	GN54	048	1565	45	40	GN87	006	4386	40	28
GN21	013	3740	40	32	GN55	007	2891	40	33	GN88	006	4704	40	27
GN23	001	7377	45	29	GN56	007	3667	40	32	GN89	006	4785	40	27
GN24	001	6107	40	28	GN57	031	846	45	42	GN90	071	1332	45	40
GN25	001	4792	45	30	GN58	031	2848	40	34	GN91	122	1501	40	40
GN26	001	3984	45	31	GN59	065	1612	45	39	GN92	098	7214	40	28
GN27	002	3771	45	31	GN60	098	9274	45	26	GN93	098	6884	40	27
GN28	001	5689	45	28	GN61	011	3330	40	33	GN94	098	5551	45	28
GN29	003	6791	40	27	GN62	100	2029	40	37	GN95	138	8501	40	25
GN30	009	7102	45	29	GN63	012	3940	40	28	GN96	138	14043	40	<25
GN31	005	3922	40	30	GN64	006	4134	40	28	GN97	098	12499	45	<25
GN32	005	4083	45	29	GN65	001	1489	45	37	GN98	067	5683	40	27
GN33	005	6085	40	27	GN66	009	4647	45	31	GN99	006	5634	40	27
GN34	005	4674	40	29	GN67	009	4414	45	31	GN100	006	4527	40	27

The above predicted noise levels indicate the following:

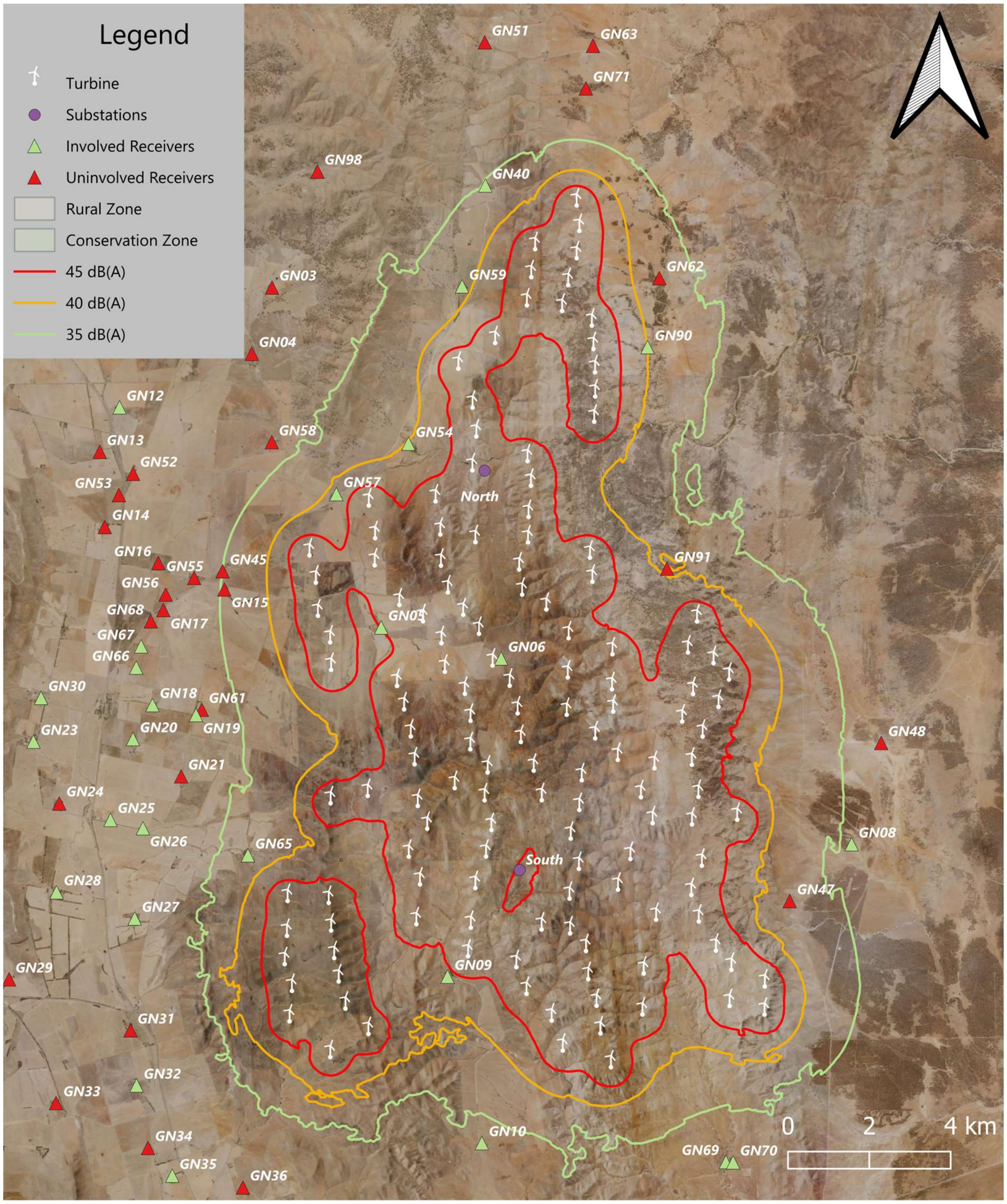
- the 40 dB(A) criterion is achieved at all *uninvolved receivers* for all candidate WTGs
- the 45 dB(A) criterion is achieved at all *involved receivers* with the exception of GN06, where it is understood that there is an agreement in place relating to the dwelling not being inhabited for the life of the project (should the noise be considered unreasonable by the owner). Alternatively specific noise reduction treatments could be incorporated to the dwelling to satisfy the Guidelines.

Based on the above, the project can reasonably satisfy the Guidelines for the conservative assessment scenario of the highest sound power levels based on three candidate WTGs, and across all integer hub height wind speeds up to rated power (highest predicted noise level generation).

The noise assessment should be updated if the warranted sound power levels of the final WTG increase above those presented in Table 3, the final WTG data exhibit tonality, or there are changes to the status of the *involved* receivers.

The highest predicted noise level contours are provided in Figure 2.

Figure 2 Predicted Noise Level Contours



Goyder South Hybrid Renewables Energy Project

Whilst the assessment has considered the cumulative noise from all stages of the project, for information purposes, the noise levels from the *Goyder South Hybrid Renewables Energy Project* have also been considered in combination with the project based on the following:

- each receiver being downwind from all WTGs in both the *Goyder South Hybrid Renewables Energy Project* and the project (conservatively representing wind in multiple and opposite directions at the same time)
- the *Goyder South Hybrid Renewables Energy Project* WTG locations as detailed in Table 5
- sound power levels that are understood to be the levels warranted for the *Goyder South Hybrid Renewables Energy Project* WTGs as detailed in Table 6.

Table 5 *Goyder South Hybrid Renewables Energy Project* WTG locations

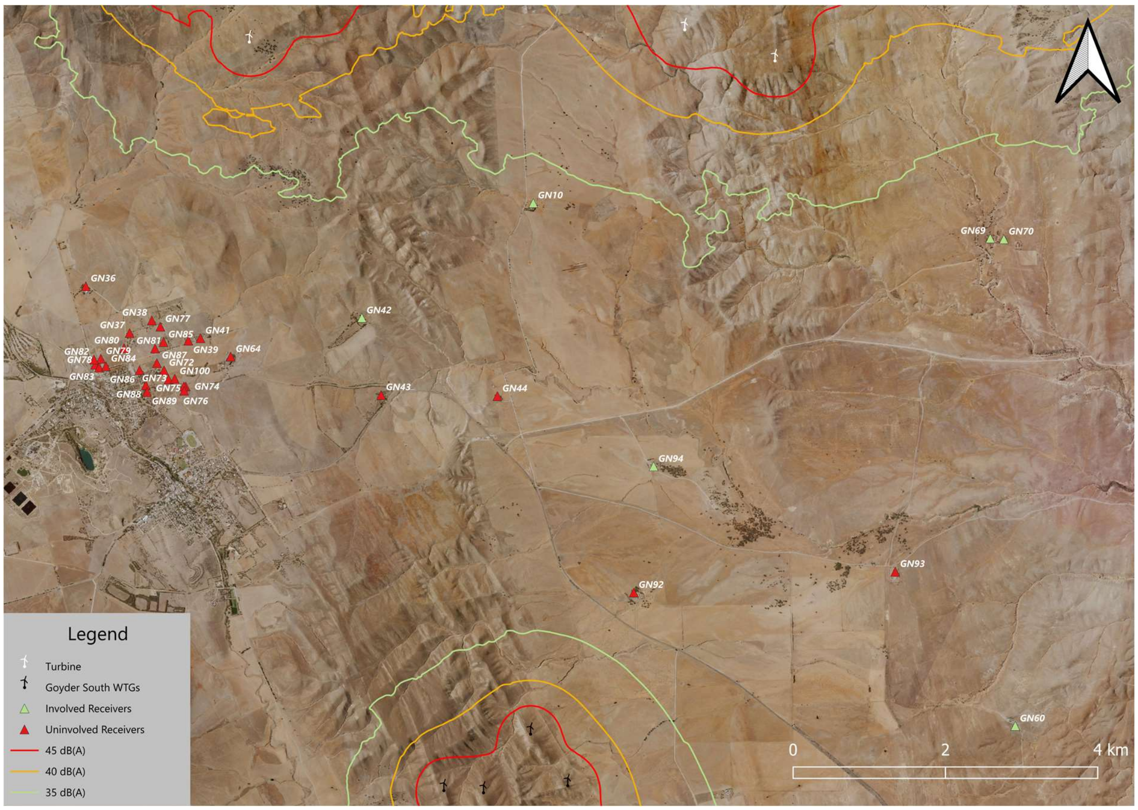
WTG ID	Co-ordinates (MGA Zone 54)		WTG ID	Co-ordinates (MGA Zone 54)		WTG ID	Co-ordinates (MGA Zone 54)	
	Easting	Northing		Easting	Northing		Easting	Northing
B008	311935	6257313	SG034	308244	6257128	B028	314190	6266595
SG001	303409	6261065	SG036	304026	6256887	B029	314169	6258947
SG002	303961	6261018	SG037	311268	6256628	B030	314151	6266010
SG003	304335	6260495	SG040	311394	6256038	B031	314283	6262574
SG007	307499	6260189	SG044	308658	6255242	B032	314590	6263924
SG008	303540	6260147	SG047	308601	6254665	B033	314515	6264569
SG010	304708	6260147	SG048	308641	6254172	B034	314891	6263124
SG011	306714	6260126	SG050	308740	6253633	B035	315092	6262457
SG012	304539	6259650	SG051	308902	6253184	B036	315219	6261998
SG013	307538	6259639	SG052	308932	6252711	B037	315538	6262973
SG014	305783	6259554	SG054	308891	6252195	B038	315687	6258173
SG015	303640	6259623	SG056	309073	6251757	B039	315590	6261270
SG016	306798	6259631	SG072	309129	6251215	B040	315567	6258756
SG017	305241	6259525	B001	310539	6259124	B042	315790	6264124
SG018	304540	6259170	B004	311583	6260345	B043	315801	6259334
SG020	307717	6259195	B005	311591	6258635	B044	315766	6260727
SG022	303740	6259024	B010	312439	6267230	B045	315829	6259808
SG023	304756	6258701	B015	312719	6258192	B046	316022	6260328
SG025	307784	6258669	B017	312960	6267201	B047	316196	6258408
SG027	303989	6258431	B021	313153	6260390	B048	316341	6257906
SG028	307843	6258167	B023	313485	6261299	B049	316526	6259284
SG029	303882	6257895	B024	313578	6267971	B050	316665	6256986
SG031	307903	6257533	B025	313840	6265345	B051	316729	6257632
SG032	310990	6257371	B026	313918	6259459	B052	317106	6258708
SG033	303940	6257424	B027	314066	6267295	SG026	310638	6258527

Table 6 *Goyder South Hybrid Renewables Energy Project* WTG Sound Power Levels

Maximum WTG sound power levels at any integer hub height wind speed (dB(A))								
Total	Octave band (dB(A))							
	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
108	89	94	99	101	103	101	93	77

The combined noise prediction contours are provided in Figure 3 for the receivers located between the *Goyder South Hybrid Renewables Energy Project* and the project. The results indicate that the noise levels are less than 35 (dB(A) at all receivers which are most exposed to both wind farms. The change in noise levels at other receivers (not shown on Figure 3) is negligible even with the conservative assumption that each receiver is downwind from all WTGs in both the *Goyder South Hybrid Renewables Energy Project* and the project.

Figure 3 Combined Noise from *Goyder South Hybrid Renewables Energy Project* and the project



Ancillary Equipment

A three-dimensional model of the ancillary component of the project has been developed based on the algorithm provided by the Standard, accounting for meteorological conditions favourable to noise propagation and the following:

- The locations of transformers as detailed in Table 5
- topographical ground contours
- inputs detailed below:
  - sound power level data for a 270MVA transformer
  - 10°C temperature
  - 70% relative humidity
  - 50% acoustically hard ground and 50% acoustically soft ground.

The predicted noise levels from the substation transformers have been compared against the Policy to ensure the operation does not have adverse impacts on the amenity of receivers.

Transformers

The preliminary noise predictions have been based on two 270 MVA rated transformers at each substation. The locations of the substations are detailed in Table 7 and shown in Figure 2 above.

Table 7 Substation Locations

Substation	Co-ordinates (MGA Zone 54)	
	Easting	Northing
North	312371	6291210
South	314138	6281562

Based on *Australian Standard AS 60076.10:2009 Power transformers – Part 10: Determination of sound levels*, a sound power level of 100 dB(A) has been derived for each of the 270 MVA transformers.

Predicted Noise Levels

Noise predictions have been made using the above assumptions to determine the noise from the indicative transformers at the closest receivers.

The predictions indicate that the highest predicted noise level is 31 dB(A) at the closest receiver (being GN54), with lower noise levels at all other receivers. A noise source with a predicted noise level of 31 dB(A) is unlikely to attract a characteristic adjustment under the Policy. Notwithstanding, even when adjusting the predicted level for a noise characteristic (increase of 5dB(A)), the relevant noise criterion of 45 dB(A) is still easily achieved at all receivers in the *Rural Zone*. Based on the above, the project's ancillary equipment can easily satisfy the Policy.

Preliminary Noise Monitoring Plan

Background noise monitoring is often conducted prior to the consent with the key purpose at this stage of a project being to establish the project assessment criteria of the Guidelines, which consists of a *baseline* level and a *background noise level plus 5 dB(A)* requirement, whichever is the greater. The background noise levels can provide for an increase in criteria above the baseline at higher wind speeds.

The assessment removes reliance on the background noise monitoring regime prior to consent by designing the project layout to achieve the baseline criteria. The approach removes the need to access receivers at an early stage of the project and turns the concept of the background noise environment into a positive aspect for the community (by enabling it to mask any residual audible wind farm noise rather than resulting in an increase in the project criteria).

Notwithstanding the above, a background noise monitoring regime is important prior to the construction of the project, as the compliance checking regime ideally requires preconstruction noise levels to determine compliance with the Guidelines.

Whilst a noise monitoring plan is not essential at this stage of the project, the early consideration of the following features will be made as the project progresses:

- Implementing a monitoring regime which identifies the receivers where the noise levels are predicted to be the highest in each particular direction
- Considering the impact of the construction and operation of the *Goyder South Hybrid Renewables Energy Project* as it relates to the noise monitoring regime
- Conducting background noise monitoring prior to construction of the project
- Conducting pre and post construction measurements at the same locations
- Ensuring the wind shields used for noise monitoring are consistent between the pre and post construction monitoring (reducing any variations from equipment impacting the monitoring results)
- Preparing a strategy for additional compliance noise measurement techniques (which may be used to assist in the determination of the contribution of noise from the wind farm), if required
- Coordinating the wind monitoring strategy and noise monitoring strategy to ensure the hub height wind speed data is being collected, and is comparable prior to, and after, construction of the project.

Conclusion

Environmental noise assessments accurately predict the noise levels from a proposed wind farm and its ancillary components based on established input data and compares those noise levels against specific requirements.

The Goyder North Wind Farm environmental noise assessment considers 138 WTGs and two substations.

The assessment determines the cumulative noise from all stages of the Goyder North Wind Farm can achieve the noise levels required by the SA EPA *Wind farms environmental noise guidelines 2021* at all receivers based on any one of three assessed candidate WTGs.

The combined noise from the *Goyder South Hybrid Renewables Energy Project* and the Goyder North Wind Farm has also been conservatively considered and does not change the outcomes of the assessment.

The ancillary components of the project, being transformers, have been assessed and can easily achieve the requirements of the *Environment Protection (Commercial and Industrial Noise) Policy 2023* to ensure there are no adverse impacts on receivers.

The approach of designing the Goyder North Wind Farm to achieve the criterion of the *Wind farms environmental noise guidelines 2021* without adjustment (increase) for background noise removes the necessity of noise monitoring at this stage of the project.

A noise monitoring plan will outline the approach for the background noise monitoring as the project progresses, and most importantly, enables all parties to ensure data is collected to determine the Goyder North Wind Farm is compliant with the assessment criteria once operational.

Based on the assessment, the proposed Goyder North Wind Farm will satisfy the relevant provisions of the *Planning and Development Code*, and as such, the project will not unreasonably impact on the acoustic amenity of receivers.

The assessment utilises a conservative assessment scenario. If any of the key input assumptions change during the detailed design and procurement stages of the project, then the noise assessment should be updated to reflect these changes.

References

Australian Standard AS 60076.10:2009 Power transformers – Part 10: Determination of sound levels

Environment Protection (Commercial and Industrial Noise) Policy 2023, SA EPA

Guidelines For Community Noise Birgitta Berglund Thomas Lindvall Dietrich H Schwela London, United Kingdom, April 1999, World Health Organization

Guidelines For the Use of The Environment Protection (Noise) Policy 2007, SA EPA June 2009

Institute of Acoustics (UK) "*A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise", 2013*

ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

Planning and Design Code Version 2023.16 dated 9 November 2023, PlanSA

Wind farms environmental noise guidelines (2021), SA EPA

Document Details

Distribution:

Issue date	14 November 2023
Issued to	Neoen
Description	Environmental Noise Assessment

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Acoustic Consulting

Goyder North Renewable Energy Facility - BESS

Environmental Noise Assessment

14 March 2024
Reference ID: 76-7

echo
Acoustic Consulting

Contents

Figures

Tables

Abbreviations

Assessment	Goyder North Renewable Energy Facility – BESS Environmental Noise Assessment (*Echo Acoustics - Reference ID: 76-7, dated 13 March 2024*)
BESS	Battery Energy Storage System including associated transformer(s)
Code	*Planning and Design Code* Version 2024.4 dated 29 February 2024, PlanSA.
dB(A)	Noise level in *A-weighted decibels*
Development application	Development Application 23036148 for the project.
DO	Desired Outcome of the Code
DTS / DPF	Deemed to Satisfy Criteria / Designated Performance Feature
EPA	South Australian Environment Protection Authority
EP Act	*Environment Protection Act 1993*
Guidelines	*Wind farms environmental noise guidelines 2021 (EPA)*
MVA	Megavolt Amperes
MW	Mega Watt
MWh	Mega Watt Hour
PO	Performance Outcome of the Code
Policy	The *Environment Protection (Commercial and Industrial Noise) Policy 2023*
Previous noise assessment	Goyder North Wind Farm Environmental Noise Assessment (*Echo Acoustics - Reference ID: 76-3, dated 14 November 2023*)
Project	Goyder North Renewable Energy Facility
Receiver	A *sensitive receiver* where noise impacts are considered. In this instance, the receivers are existing and approved dwellings and tourist accommodation
Standard	*ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*
Substation	A location containing the BESS and transformers for WTGs
WTG	Wind Turbine Generator

Glossary

A-weighting	A mathematical adjustment to the measured noise levels to represent the human response to sound. An *A-weighted noise level* is presented as dB(A)
Ambient Environment	The environment in the absence of the development
Candidate BESS	A candidate BESS is used as an example in an assessment process to indicate the ability to comply with legislative requirements. A candidate BESS is indicative of equipment which might be procured at a future design and tender stage

Characteristic	A characteristic determined in accordance with the *Environment Protection (Commercial and Industrial Noise) Policy 2023* (the **Policy**) to be fundamental to the nature and impact of the noise. For example, a noise source is deemed to exhibit a characteristic if it produces distinctive tonal, impulsive, low frequency, intermittent or modulating features
Day	A period defined by the Policy as between 7.00am and 10.00pm.
Decibels	The logarithmic unit of measurement to define the magnitude of a fluctuating air pressure wave. Used as the unit for *sound* or *noise level*
Equivalent Noise Level	The A-weighted noise level which is equivalent to a noise level which varies over time. The descriptor is L_{Aeq} and it is the A-weighted *source noise level (continuous)* referenced in the Policy. The L_{Aeq} is also referenced as an average noise level in this assessment for simplicity
Frequency	Frequency is the number of air pressure wave fluctuations per second. Measured in units of Hertz (Hz)
Indicative Noise Level	The noise level assigned by the Policy at a location to represent an impact on the acoustic amenity at that location. No further action is required to be taken under the *Environment Protection Act 1993* for noise levels which are lower than the Indicative Noise Level
Night	A period defined by the Policy as between 10.00pm and 7.00am.
Noise	An interchangeable term with sound but which is most often described as *unwanted sound.*
Sensitive receiver	The same meaning as under *Part 8 Administrative Terms and Definitions* of the Code. Defined as: *a. any use for residential purposes or land zoned primarily for residential purposes;* *b. child care facility;* *c. educational facility;* *d. hospital;* *e. supported accommodation;* *f. tourist accommodation.*
Sound	An activity or operation which generates a fluctuating air pressure wave. The ear drum can perceive both the frequency (pitch) and the magnitude (loudness) of the fluctuations to convert those waves to sound
Sound pressure level	The magnitude of sound (or noise) at a position. The sound pressure level can vary according to location relative to the noise source, and operational, meteorological and topographical influences
Sound power level	The amount of sound energy an activity produces for a given operation. The sound power level is a constant value for a given activity. The sound power level is analogous to the power rating on a light globe (which remains constant), whereas the lighting level in a space (*sound pressure level* in this analogy) will be influenced by the distance from the globe, shielding and different locations within the space

Introduction

Neoen is proposing to develop the Goyder North Renewable Energy Facility (the **project**) as part of its wider *Goyder Renewables Zone* concept. The project is located in the northern Mount Lofty Ranges of South Australia, within the Regional Council of Goyder.

The project has the potential for 138 wind turbine generators (**WTG**s) with a hub height of up to 160m providing up to 1000MW of wind generation. The project will also include three battery energy storage systems and associated transformers (**BESS**s) with a total capacity of 900MW / 3600MWh. Each BESS is located at a substation.

The noise associated with the WTGs, and WTG transformers at the North and South substations was assessed and summarised in the *Echo Acoustics Environmental Noise Assessment Reference 76-3, dated 14 November 2023* (the **previous noise assessment**). The previous noise assessment formed part of the development application (*23036148*) for the project (the **development application**).

The Environment Protection Authority (**EPA**) has requested the predicted noise levels from the BESSs.

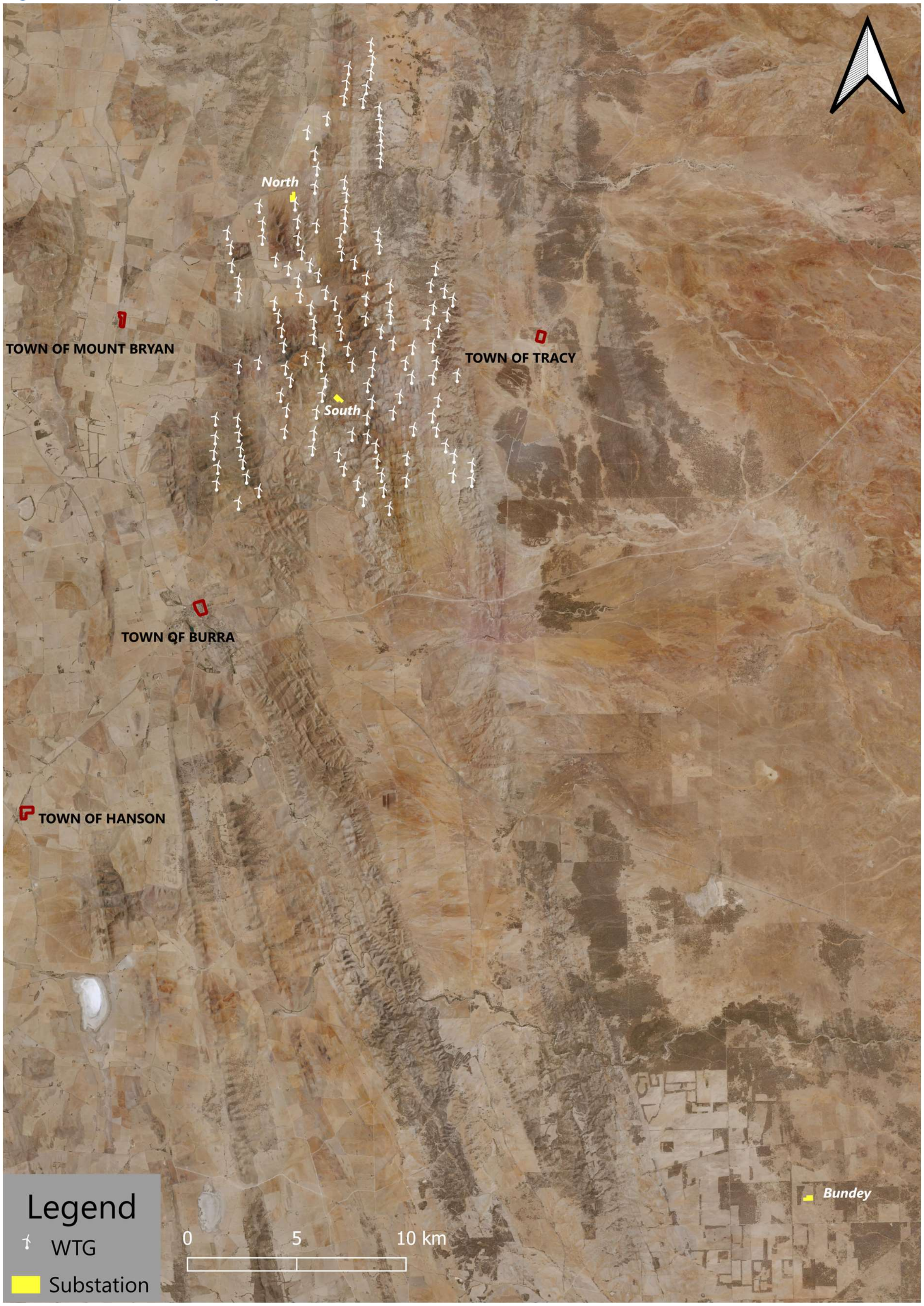
This environmental noise assessment (the **assessment**) predicts the noise associated with the cumulative operation of the BESSs in combination with the WTG transformers at the North and South substations, to ensure the acoustic amenity of the surrounding sensitive receivers (**receivers**) is not adversely affected by the project.

The assessment replaces the consideration of the WTG transformers in the previous noise assessment, as it considers the cumulative impact of the BESSs and the WTG transformers.

Figure 1 provides the general location of the WTGs and substations relative to the surrounding townships of Burra, Mount Bryan, Hanson, and Tracy. The receivers are not shown due to the large separation distances to the substation locations. The separation distance between each receiver and its closest substation is provided in Table 2 of this assessment.

Note that this assessment only considers a BESS at the Bundey substation as other equipment at the Bundey substation is the subject of a separate assessment and approval.

Figure 1 Project Locality



Source Neoen – WTG and Substation Locations

Assessment Criteria

The Planning and Design Code

The project is located within a *Rural Zone* and *Rural Intensive Enterprise Zone* of the *Planning and Design Code Version* 2024.4 dated 29 February 2024 (the **Code**). The following provisions within the Code are considered relevant to the environmental noise assessment.

Infrastructure and Renewable Energy Facilities (Part 4 – General Development Policies)

Desired Outcome DO 1

Efficient provision of infrastructure networks and services, renewable energy facilities and ancillary development in a manner that minimises hazard, is *environmentally* and culturally *sensitive* and manages adverse visual impacts on natural and rural landscapes and residential amenity.

Interface between Land Uses (Part 4 – General Development Policies)

Desired Outcome DO 1

Development is located and designed to *mitigate adverse effects* on or from neighbouring and proximate land uses.

Performance Outcome PO 1.2

Development adjacent to a site containing a sensitive receiver (or lawfully approved sensitive receiver) or zone primarily intended to accommodate sensitive receivers is *designed to minimise adverse impacts*.

Performance Outcome PO 2.1

Non-residential development *does not unreasonably impact the amenity of sensitive receivers* (or lawfully approved sensitive receivers) or an adjacent zone primarily for sensitive receivers through its hours of operation having regard to:

a) the nature of the development
b) measures to mitigate off-site impacts
c) the extent to which the development is desired in the zone
d) measures that might be taken in an adjacent zone primarily for sensitive receivers that mitigate adverse impacts without unreasonably compromising the intended use of that land.

Performance Outcome PO 4.1

Development that emits noise (other than music) *does not unreasonably impact the amenity of sensitive receivers* (or lawfully approved sensitive receivers).

Deemed-to-Satisfy Criteria / Designated Performance Feature (DTS/DPF) 4.1

Noise that might affect sensitive receivers achieves the relevant Environment Protection (Noise) Policy criteria.

Environment Protection (Commercial and Industrial Noise) Policy 2023

Interface between Land Uses DTS/DPF 4.1 references the Environment Protection (Noise) Policy. The most relevant version is the *Environment Protection (Commercial and Industrial Noise) Policy 2023* (the **Policy**). The Policy criteria apply to the BESSs and transformers of the project.

The Policy references the *Wind farms environmental noise guidelines 2021* (the **Guidelines**) to address the WTG component of the project (refer to the previous noise assessment forming part of the development application documentation for further information). The Guidelines apply stringent and specifically tailored criteria to the WTGs and as a result do not need to be considered cumulatively with the BESS and WTG transformers.

The Policy was developed under the *Environment Protection Act 1993* (the **EP Act**). The EP Act incorporates a requirement to ensure the acoustic *amenity of a locality is not unreasonably interfered with*. The Policy provides an objective approach to satisfy this requirement underpinned by the World Health Organization's *Guidelines for Community Noise* as it relates to community annoyance and sleep disturbance.

Compliance with the Policy will satisfy both the EP Act and *Interface between land uses PO 4.1*. With the EP Act and *Interface between land uses PO 4.1* being consistent with the intent of the other relevant Code provisions listed above; compliance with the Policy at the receivers is considered to satisfy all other *Desired Outcomes* and *Performance Outcomes* in the Code relevant to the environmental noise assessment of the BESSs and WTG transformers.

Noise Criteria

The Policy establishes *indicative noise levels* that apply at receivers for both the day (7.00am to 10.00pm) and night (10.00pm to 7.00am the following day), with the *indicative noise levels* which apply during the night being more stringent than those which apply during the day. The noise levels vary according to the land uses promoted by the zones in which the noise sources and receivers are located.

For a new development, the noise levels that apply under the Policy at receivers are the *indicative noise levels* minus 5 dB(A). In this circumstance, the noise levels that apply to receivers in a *Rural Zone*[1] are*:*

- An average *noise level* of 52 dB(A) during the day period
- An *average noise level* of 45 dB(A) during the night period

The "average noise level" is an *equivalent noise level* over a default assessment period of 15 minutes.

When predicting noise levels for comparison to the Policy, the predicted *equivalent noise levels* are to be adjusted (increased) where the BESSs and/or WTG transformers exhibit "annoying" characteristics (dominant tonal, impulsive, low frequency content, intermittent or modulation characteristics) in comparison to the surrounding ambient environment.

[1] The relevant noise criteria are at the closest receivers in the *Rural Zone,* noting that there are no receivers in a *Rural Living Zone* in the immediate proximity of the substations. That is, compliance with the criterion in a *Rural Zone* will satisfy the Policy at all receivers, including those in any other zone.

Assessment

Noise Model

A three-dimensional model of the project has been developed based on the algorithm provided by *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (the **Standard**).

The Standard specifies a method for predicting noise levels at a distance from a source under meteorological conditions favourable to noise propagation, being downwind (wind blowing from the substations to receivers) or temperature inversion conditions. The Standard conservatively assumes that these favourable propagation conditions occur simultaneously between all substations and all receivers.

The model incorporates the following:

- the locations of the substations as detailed in Table 1
- the locations of receivers as detailed in Table 2. The separation distance between each receiver and the closest substation is also provided in Table 2.
- topographical ground contours
- inputs detailed below:
    - one BESS with a capacity of 225MW / 900MWh and a 300MVA transformer at each of the North and South substations with sound power level data detailed separately below
    - one BESS with a capacity of 450MW / 1800MWh and two 300MVA transformers at the Bundey substation with sound power level data detailed separately below
    - two 270MVA transformers at each of the North and South substations for the WTGs with sound power level data detailed below
    - 10°C temperature
    - 70% relative humidity
    - 50% acoustically hard ground and 50% acoustically soft ground.

Table 1 Substation Locations

Substation	Centre point co-ordinates (MGA Zone 54)	
	Easting	Northing
North	312370	6291210
South	314500	6282050
Bundey	336000	6245500

Table 2 Receiver Locations (including distance to closest substation)

Receiver ID	Distance to closest substation (m)	Co-ordinates (MGA Zone 54)		Receiver ID	Distance to closest substation (m)	Co-ordinates (MGA Zone 54)		Receiver ID	Distance to closest substation (m)	Co-ordinates (MGA Zone 54)	
		Easting	Northing			Easting	Northing			Easting	Northing
GN01	15937	310496	6307099	GN50	13074	309991	6304127	GN98	8044	309570	6298809
GN02	14601	317414	6304989	GN51	10785	313684	6301984	GN99	12390	305788	6273183
GN03	6116	308452	6295963	GN52	7339	305034	6291390	GN100	10943	308905	6272630
GN04	5377	307956	6294335	GN53	7692	304687	6290868	H2	21721	317247	6260507
GN05	3811	311137	6287605	GN54	1028	311807	6292129	H6	21380	318057	6257147
GN06	4691	314087	6286844	GN55	6301	306536	6288833	H7	14924	316158	6267222
GN07	13252	304392	6273402	GN56	7105	305835	6288423	H10	14252	322097	6248679
GN08	8214	322707	6282279	GN57	2358	310035	6290891	H11	14671	321666	6248674
GN09	3474	312769	6279026	GN58	4029	308447	6292165	H12	11546	324465	6244839
GN10	7173	313613	6274935	GN59	4773	313127	6295993	H14	11730	324837	6241847
GN11	9393	303998	6295519	GN60	14998	319943	6268079	H15	12182	325968	6238549
GN12	7870	304703	6293022	GN61	7971	306725	6285583	H32	22308	314219	6250367
GN13	8187	304215	6291928	GN62	7437	317978	6296195	H33	21305	315041	6249379
GN14	8112	304338	6290084	GN63	11331	316346	6301898	H34	21060	315214	6248948
GN15	5744	307281	6288549	GN64	10333	309640	6272922	H35	20802	315302	6247665
GN16	7010	305656	6289198	GN65	6534	307860	6282007	H36	18229	317769	6245031
GN17	7318	305779	6288033	GN66	8588	305113	6286619	H37	14446	321912	6248743
GN18	8798	305513	6285699	GN67	8216	305233	6287141	H38	13555	322516	6246967
GN19	8164	306582	6285454	GN68	7718	305470	6287755	H39	7925	328207	6246993
GN20	9702	305033	6284863	GN69	9148	319615	6274472	H40	8064	328143	6247361
GN21	8382	306218	6283947	GN70	9257	319793	6274461	H41	8144	327920	6246593
GN23	11698	302585	6284800	GN71	10293	316172	6300853	H42	9317	327339	6242019
GN24	11236	303220	6283280	GN72	10919	308764	6272741	H43	9111	328390	6240449
GN25	9944	304480	6282877	GN73	10991	308824	6272622	H44	12131	324734	6240954
GN26	9133	305278	6282672	GN74	10960	309049	6272529	H45	11959	325129	6240470
GN27	9462	305075	6280454	GN75	10971	309024	6272530	H46	12320	324757	6240418
GN28	11285	303153	6281099	GN76	11017	309029	6272474	H47	12768	324371	6240183
GN29	12798	301986	6278958	GN77	10458	308716	6273314	H48	12915	324268	6240055
GN30	10982	302772	6285874	GN78	11351	307859	6272815	H49	13174	324168	6239662
GN31	10395	304972	6277705	GN79	11244	307934	6272893	H50	13258	324142	6239527
GN32	10907	305121	6276353	GN80	10959	308239	6273030	H51	12987	324117	6240215
GN33	12836	303141	6275920	GN81	10738	308646	6273027	H52	12898	323975	6240789
GN34	11571	305401	6274815	GN82	11305	307844	6272882	H53	13366	323562	6240560
GN35	11569	305999	6274136	GN83	11351	307912	6272778	H54	13925	322996	6240472
GN36	10603	307737	6273844	GN84	11287	308001	6272795	H65	16810	321759	6254453
GN37	10752	308312	6273230	GN85	10606	308758	6273112	H66	22296	317706	6258265
GN38	10452	308604	6273395	GN86	11086	308443	6272743	H69	12423	324658	6240385
GN39	10421	309084	6273130	GN87	10888	308670	6272835	H113	9000	327013	6246135
GN40	7310	313698	6298470	GN88	11209	308525	6272547	H117	12245	323772	6244705
GN41	10312	309243	6273163	GN89	11277	308541	6272457	H121	20020	315996	6246502
GN42	9176	311362	6273430	GN90	6194	317688	6294500	H122	18288	317706	6245241
GN43	10059	311615	6272417	GN91	6178	318167	6289060	H123	16181	321056	6251734
GN44	9745	313142	6272403	GN92	12233	314934	6269828	H125	10382	325632	6246185
GN45	5590	307238	6288996	GN93	12564	318367	6270100				
GN46	12963	311444	6304204	GN94	10594	315194	6271483				
GN47	6789	321184	6280881	GN95	14980	323592	6270151				
GN48	9340	323434	6284767	GN96	19826	323401	6264340				
GN49	20421	318544	6310751	GN97	18163	319582	6264617				

BESS

The final BESS equipment for the project is yet to be determined and will be confirmed during the detailed design and procurement stages.

Sound Power Levels

Candidate BESS equipment for the project have been reviewed and whilst commercial sensitivities preclude identification of the specific models or data, this assessment has been based on a BESS that represents a conservative (upper end of the likely noise level) selection.

An assumed cumulative sound power level of 124 dB(A) is utilised by the assessment for each battery storage component of the BESS with a capacity of 225MW / 900MWh (at the North and South substations), and cumulative sound power level of 127 dB(A) is utilised by the assessment for the battery storage component of the BESS with a capacity of 450MW / 1800MWh (at the Bundey substation).

A BESS operation will vary in load and usage depending on the time of day and the demand of the electricity network. The assumed cumulative sound power level is associated with continuous full load operation of all BESS components with cooling fans at 100% capacity, and so represents a conservative assessment methodology, particularly for the night period.

In practice, operation of all BESS components with cooling fans at 100% capacity will not typically occur and utilising manufacturer's data in combination with cooling fan requirements for similar systems, a reduction in the order of 6 dB(A) can apply for typical operation during the day, and a reduction in the order of 13 dB(A) can apply for typical operation during the night (when there is a further reduced requirement for cooling). The actual noise level reductions are subject to further site-specific investigations and adaptation of manufacturer's data to the actual installation.

Tonality

The noise from the BESSs can exhibit tonal noise characteristics when in close proximity. However, given the BESS has a large number of individual cooling fans that will operate at different speeds, tonality is unlikely to be a characteristic when considered at the separation distances equivalent to the receivers from the BESSs.

Notwithstanding, this assessment has conservatively included an adjustment (increase) of 5 dB(A) to the predicted noise levels to account for the potential that tonality could occur with all equipment operating at the *same* capacity.

Transformers

The noise predictions have been based on:

- one 300 MVA rated transformer (associated with each BESS) at both the North and South substations
- two 300 MVA rated transformers at the Bundey substation (associated with the BESS)
- two 270 MVA rated transformers (associated with the WTGs) at both the North and South substations.

Based on *Australian Standard AS 60076.10:2009 Power transformers – Part 10: Determination of sound levels*, a sound power level of:

- 101 dB(A) has been derived for each of the assessed 300 MVA transformers associated with the BESSs
- 100 dB(A) has been derived for each of the assessed 270 MVA transformers associated with the WTGs

Predicted Noise Levels

Noise level predictions have been made using the noise model, inputs and assumptions detailed above and compared with the noise criteria, being 52 dB(A) during the day and 45 dB(A) during the night.

The predicted noise level at each receiver is provided in Table 3 with an adjustment (+5 dB(A)) for tonality.

The predicted noise levels indicate the noise criteria can be achieved at all receivers except for GN54 (marked as red in the table below) when accounting for operation of all BESS components with cooling fans at 100% capacity.

GN54 is located approximately 1km from the nearest BESS and exceeds the criteria by 4 dB(A) during the day and 11 dB(A) during the night for a BESS system at the upper end of the likely noise level selection, with the BESS cooling fans at 100% capacity and a 5 dB(A) adjustment (addition to the predicted noise levels) for tonality (under the assumption that all fans operate at the same speed).

It is noted that when applying the noise level reductions expected when accounting for typical discharge and cooling requirements (being a reduction in the order of 6 dB(A) for typical operation during the day, and a reduction in the order of 13 dB(A) for typical operation during the night), compliance could be achieved at GN54 (and easily achieved at all other receivers).

In addition, in the circumstance where the cooling fans operate at different speeds (as expected during typical operation), then the adjustment (increase) of 5 dB(A) applied to the predicted noise levels in Table 3 is unlikely to apply, resulting in an even greater margin of compliance.

Table 3 Predicted Noise Levels

Receiver ID	Criterion Day/Night (dB(A))	Predicted Noise Level (dB(A))	Receiver ID	Criterion Day/Night (dB(A))	Predicted Noise Level (dB(A))	Receiver ID	Criterion Day/Night (dB(A))	Predicted Noise Level (dB(A))
GN01	52/45	<25	GN50	52/45	<25	GN98	52/45	<25
GN02	52/45	<25	GN51	52/45	<25	GN99	52/45	<25
GN03	52/45	26	GN52	52/45	<25	GN100	52/45	<25
GN04	52/45	29	GN53	52/45	<25	H2	52/45	<25
GN05	52/45	35	GN54	52/45	56	H6	52/45	<25
GN06	52/45	34	GN55	52/45	26	H7	52/45	<25
GN07	52/45	<25	GN56	52/45	<25	H10	52/45	<25
GN08	52/45	<25	GN57	52/45	41	H11	52/45	<25
GN09	52/45	36	GN58	52/45	34	H12	52/45	<25
GN10	52/45	<25	GN59	52/45	31	H14	52/45	<25
GN11	52/45	<25	GN60	52/45	<25	H15	52/45	<25
GN12	52/45	<25	GN61	52/45	<25	H32	52/45	<25
GN13	52/45	<25	GN62	52/45	<25	H33	52/45	<25
GN14	52/45	<25	GN63	52/45	<25	H34	52/45	<25
GN15	52/45	28	GN64	52/45	<25	H35	52/45	<25
GN16	52/45	<25	GN65	52/45	25	H36	52/45	<25
GN17	52/45	<25	GN66	52/45	<25	H37	52/45	<25
GN18	52/45	<25	GN67	52/45	<25	H38	52/45	<25
GN19	52/45	<25	GN68	52/45	<25	H39	52/45	<25
GN20	52/45	<25	GN69	52/45	<25	H40	52/45	<25
GN21	52/45	<25	GN70	52/45	<25	H41	52/45	26
GN23	52/45	<25	GN71	52/45	<25	H42	52/45	<25
GN24	52/45	<25	GN72	52/45	<25	H43	52/45	<25
GN25	52/45	<25	GN73	52/45	<25	H44	52/45	<25
GN26	52/45	<25	GN74	52/45	<25	H45	52/45	<25
GN27	52/45	<25	GN75	52/45	<25	H46	52/45	<25
GN28	52/45	<25	GN76	52/45	<25	H47	52/45	<25
GN29	52/45	<25	GN77	52/45	<25	H48	52/45	<25
GN30	52/45	<25	GN78	52/45	<25	H49	52/45	<25
GN31	52/45	<25	GN79	52/45	<25	H50	52/45	<25
GN32	52/45	<25	GN80	52/45	<25	H51	52/45	<25
GN33	52/45	<25	GN81	52/45	<25	H52	52/45	<25
GN34	52/45	<25	GN82	52/45	<25	H53	52/45	<25
GN35	52/45	<25	GN83	52/45	<25	H54	52/45	<25
GN36	52/45	<25	GN84	52/45	<25	H65	52/45	<25
GN37	52/45	<25	GN85	52/45	<25	H66	52/45	<25
GN38	52/45	<25	GN86	52/45	<25	H69	52/45	<25
GN39	52/45	<25	GN87	52/45	<25	H113	52/45	<25
GN40	52/45	<25	GN88	52/45	<25	H117	52/45	<25
GN41	52/45	<25	GN89	52/45	<25	H121	52/45	<25
GN42	52/45	<25	GN90	52/45	26	H122	52/45	<25
GN43	52/45	<25	GN91	52/45	27	H123	52/45	<25
GN44	52/45	<25	GN92	52/45	<25	H125	52/45	<25
GN45	52/45	28	GN93	52/45	<25			
GN46	52/45	<25	GN94	52/45	<25			
GN47	52/45	<25	GN95	52/45	<25			
GN48	52/45	<25	GN96	52/45	<25			
GN49	52/45	<25	GN97	52/45	<25			

Noise Reduction Measures

The noise predictions indicate that noise reduction would be required for one receiver (GN54) utilising conservative inputs.

It is noted that when applying the noise level reductions expected for typical discharge and cooling requirements, compliance could be achieved at GN54 such that no additional noise reduction measures would be required.

The exact noise reduction measures for the project will need to be determined based on the manufacturer's sound power level data for the final BESS equipment selections when accounting for the cooling requirements for the site.

The landowner of GN54 is also understood to have a commercial agreement with the project, and so there are also options available for compliance in comparison to a receiver that does not have a commercial agreement, such as noise attenuating modifications to the dwelling construction (for example, glazing or insulation upgrades).

Once the final BESS equipment selections have been made, and the noise levels that are applicable to site-specific conditions have been determined (including the presence of tonality), then the residual extent of noise reduction measures (if any) at GN54 can be confirmed.

If required, the residual noise reduction measures could comprise glazing or insulation upgrades at the GN54 dwelling, or localised shielding of the key BESS components, subject to the final equipment selection and arrangement.

Final Noise Model

Based on the above, this assessment indicates that compliance with the Policy can be reasonably achieved at all receivers subject to final design, and so it is recommended that the assessment be updated once the final equipment selections and operational characteristics are known.

A condition could be placed on the project to ensure the assessment is updated. An example of such a condition is provided below for adaptation by the authorities:

> *An acoustic engineer shall prepare a report prior to construction which confirms that the combined operation of the BESSs and transformers for the Goyder North Renewable Energy Facility achieve the noise levels established by Part 5 Clause 19 of the Environment Protection (Commercial and Industrial) Noise Policy 2023 (the Policy) at all existing or approved dwellings or overnight tourist accommodation at the time of this consent when measured and adjusted in accordance with Part 3 of the Policy. The report shall be based on manufacturer's noise level data for procured equipment adjusted to suit the operational characteristics of the installation. Where there is insufficient manufacturer's noise level data, a noise level measurement of a comparable installation shall be used. The report shall detail all noise reduction measures required to ensure compliance with this condition. For the purposes of this condition, an acoustic engineer is defined as an engineer eligible for Membership of the Australian Acoustical Society*

Conclusion

This assessment has been made to consider the noise from the BESSs and WTG transformers proposed as part of the Goyder North Renewable Energy Facility.

The assessment utilises a conservative scenario for candidate BESS equipment. The assessment determines the noise from the cumulative operation of the BESSs, and WTG transformers of the Goyder North Renewable Energy Facility can achieve the requirements of the *Environment Protection (Commercial and Industrial Noise) Policy 2023* at all receivers except for one with the BESS components operating at 100% capacity, and with an adjustment (5 dB(A) increase) for the presence of tonality (due to the fans operating at the same speed).

Operation of all BESS components with cooling fans at 100% capacity will not typically occur in practice, and noise level reductions can apply for typical operation. When accounting for the noise levels that can apply for typical operation, compliance with the *Environment Protection (Commercial and Industrial Noise) Policy 2023* is expected to be achieved at all receivers.

Whilst the assessment indicates that compliance with the *Environment Protection (Commercial and Industrial Noise) Policy 2023* can be reasonably achieved at all receivers, it is subject to final design, and so it is recommended that the assessment be updated once the final equipment selections and operational characteristics are known. A condition for an updated assessment has been drafted, as a method to ensure the assessment is updated once the final equipment selections and operational characteristics are known.

References

Australian Standard AS 60076.10:2009 Power transformers – Part 10: Determination of sound levels

Environment Protection (Commercial and Industrial Noise) Policy 2023, SA EPA

Guidelines For Community Noise Birgitta Berglund Thomas Lindvall Dietrich H Schwela London, United Kingdom, April 1999, World Health Organization

Guidelines For the Use of the Environment Protection (Commercial and Industrial Noise) Policy 2023, SA EPA

ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

Planning and Design Code Version 2024.4 dated 29 February 2024, PlanSA

Document Details

Distribution:

Issue date	14 March 2024
Issued to	Neoen
Description	Environmental Noise Assessment

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Acoustic Consulting

Goyder North Renewable Energy Facility

Document no: IW204800-CT-RPT-0002
Revision no: 4

Neoen

Goyder North Renewable Energy Facility – Traffic Impact Assessment
9 February 2024

Goyder North Renewable Energy Facility

Client name:	Neoen		
Project name:	Goyder North Renewable Energy Facility – Traffic Impact Assessment		
Client reference:		Project no:	IW204800
Document no:	IW204800-CT-RPT-0002	Project manager:	Chris Babadimas
Revision no:	4	Prepared by:	Hugh Gallagher
Date:	9 February 2024	File name:	Goyder North TIA_v8

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
1	31/08/23	Draft for Comment	HG	NA	NA	NA
2	01/09/23	Updated Following Client Comment	HG	NA	NA	NA
3	24/11/23	Updated Following Client Comment	CB	HG	NA	NA
4	09/02/24	Updated Following Additional Information	CB	HG	NA	NA

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
1	NA	31/08/23	Neoen	Draft for Client Comment
2	NA	01/09/23	Neoen	Updated Following Client Comment
3	NA	24/11/23	Neoen	Updated Following Client Comment
4	NA	09/02/24	Neoen	Updated Following Additional Information

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Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to document the outcomes of the traffic impact assessment for the Goyder North Renewables Energy Zone in accordance with the scope of services set out in the contract between Jacobs and Neoen.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

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Contents

Appendices

1. Introduction

1.1 Background

Jacobs have been engaged by Neoen to undertake a Traffic Impact Assessment suitable to inform the development application planned for the Goyder Renewables Zone – Goyder North Renewable Energy Facility.

The Goyder Renewables Zone comprises two projects:

- Zone 1 – Goyder North
- Zone 2 – Goyder South

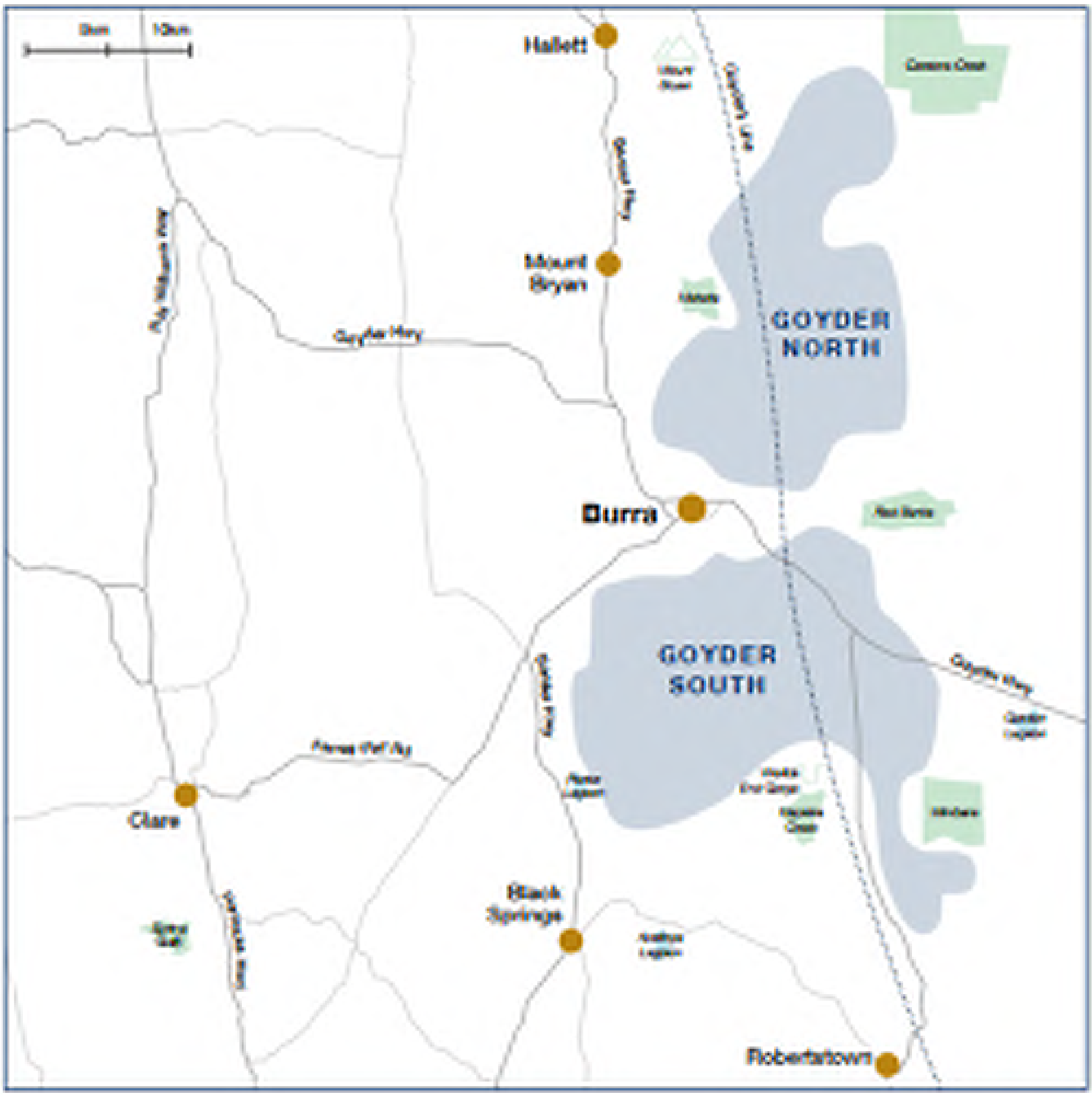


Figure 1.1: Goyder Renewables Zone

Goyder South was granted Development Approval in 2021 and construction of Stage 1 commenced in 2022. Consequently, the associated traffic impacts are not covered in this report.

Upon full completion, the Goyder North Renewable Energy Facility (for brevity, referred to as Goyder North within this report) will incorporate138 turbines for up to 1,000MW of wind generation, four 225MW / 900MWh batteries (total 900MW / 3,600MWh), plus supporting infrastructure.

1.2 Overview

This technical report documents the Traffic Impact Assessment (TIA) for Goyder North. The document outlines the traffic and transport impacts of construction, operation and decommissioning traffic of the development site and provides recommendations to mitigate the impacts.

This TIA is an expression of the professional opinion of Jacobs, based upon details that were available during the execution of the assessment. It is not a final conclusion and should only be taken as a guideline in terms of consideration for actual transport setup and route to be used, and / or modifications to be undertaken. Those details will need to be finalised in a Traffic Management Plan as a Condition should the development be approved. Jacobs does not take responsibility in the case where any assumptions and considerations made in this document are not accurate for execution.

This document does not include calculations for any bridge infrastructure load-bearing capacities. Any description of bridges in this document is for guideline only. Jacobs recommends engaging a structural engineer, to verify the structural capacity of any such installations highlighted as areas of concern in this report, and the incorporation of these findings into the Traffic Management Plan.

This TIA is based on observations made of each route on a site visit on 11 October 2022. All parties should be aware that road conditions could change anytime between the date of route observations and the project execution, for reasons including adverse weather, road modifications or repairs by authorities and general deterioration.

1.3 Other Related Documentation

This report should be read in conjunction with the documents detailed in Table 1 1, as produced by Jacobs to inform the Goyder Renewables Energy Zone development application.

Table 1 1: Related documentation

Document	Type	Title / Description	Author	Date of Issue
IW204800-CT-RPT-0001	Report	Goyder South –Traffic Impact Assessment, Goyder Renewables Energy Zone	Jacobs	17 December 2022
AREA_TMP_D1_D2_D3	Report	Goyder South – Traffic Management Plan	GE Renewables	December 2021

2. Proposed Development

The Goyder North component of the proposed Goyder Renewables Zone is wholly within the Regional Council of Goyder. The centre of the project site is located 10km northeast of Burra and covers an area of approximately 180km^2.

The project will be developed in stages, but will ultimately generate 1,000 MW of wind power, with 138 turbines, four 225MW / 900MWh BESS (battery energy storage system) (total 900MW / 3,600MWh), plus meteorological masts, buried collector cables, electrical substations, an operations and maintenance building and an overhead transmission line. Power generated will be connected to the existing ElectraNet Transmission network.

The following figure illustrates the indicative site area, wind turbine locations and the BESS locations. Not shown in the figure below are two of the four BESS locations. The third and fourth batteries are not located within the site plan below, but will be located adjacent to the Bundey Substation, approximately 47km south-east of the centre of this site. For brevity, these two batteries will be referred to as the Bundey Batteries within this report. The Bundey Batteries are shown on the subsequent figure.

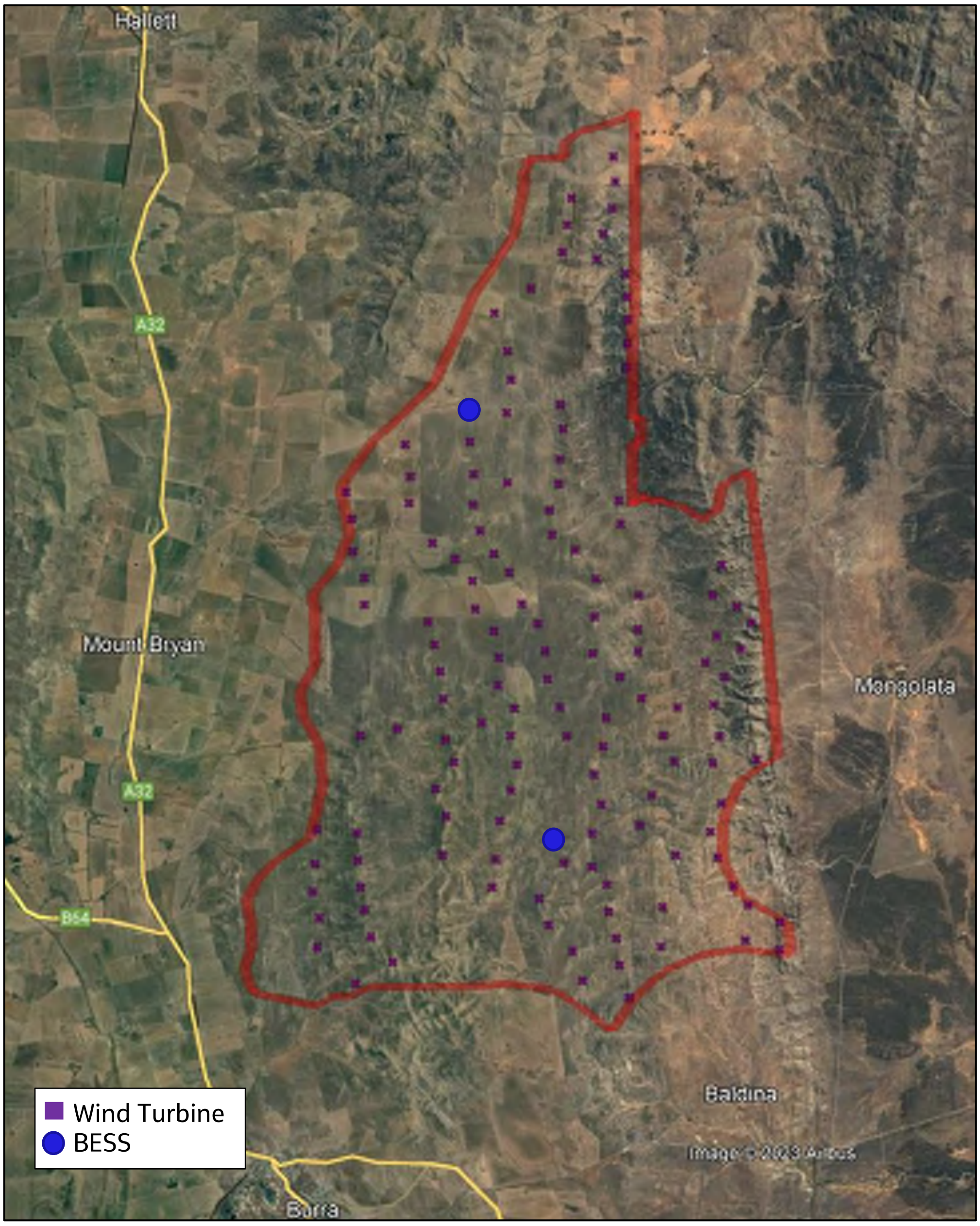


Figure 2.1: Site Layout and Turbine Locations

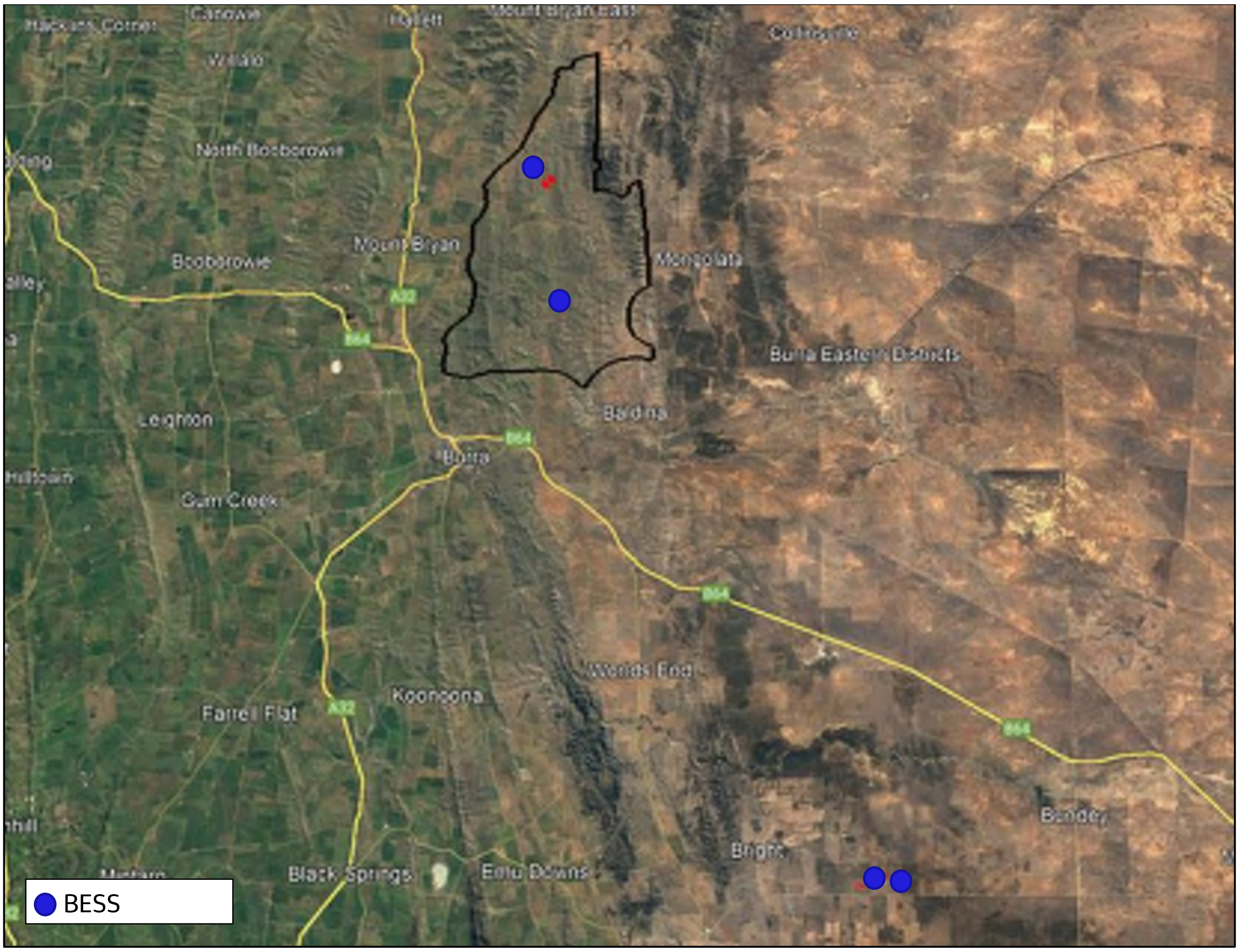


Figure 2-1: BESS Locations

3. Existing Area Conditions

3.1 Study Area

The Goyder North development area was primarily selected due to the world-class wind resources and appropriate land use (primarily grazing land). The development area also has the following benefits:

- Accessibility due to the proximity of the Barrier Highway, Goyder Highway and Wilkins Highway.
- Proximity to the new substation which will be purpose-built for the SA-NSW interconnector.

3.2 Study Area Land Use

The Goyder North development area is primarily designated as agricultural land use by Plan SA. The land is largely low-intensity grazing land, sparsely populated and increasingly marginal for agricultural use.

It is noted that the township of Burra, located to the south of the Goyder North site, is largely designated as a State Heritage Area, as illustrated in Figure 3 1. From a traffic perspective, the Barrier Highway route to the site is via Burra, but there is a heavy vehicle bypass of the town via Copperhouse Street and West Street, currently gazetted for 36.5m road trains and one of DIT's principal routes for overdimensional loads, ensuring that the Burra town centre would not be impacted by development traffic should the Barrier Highway route be selected.

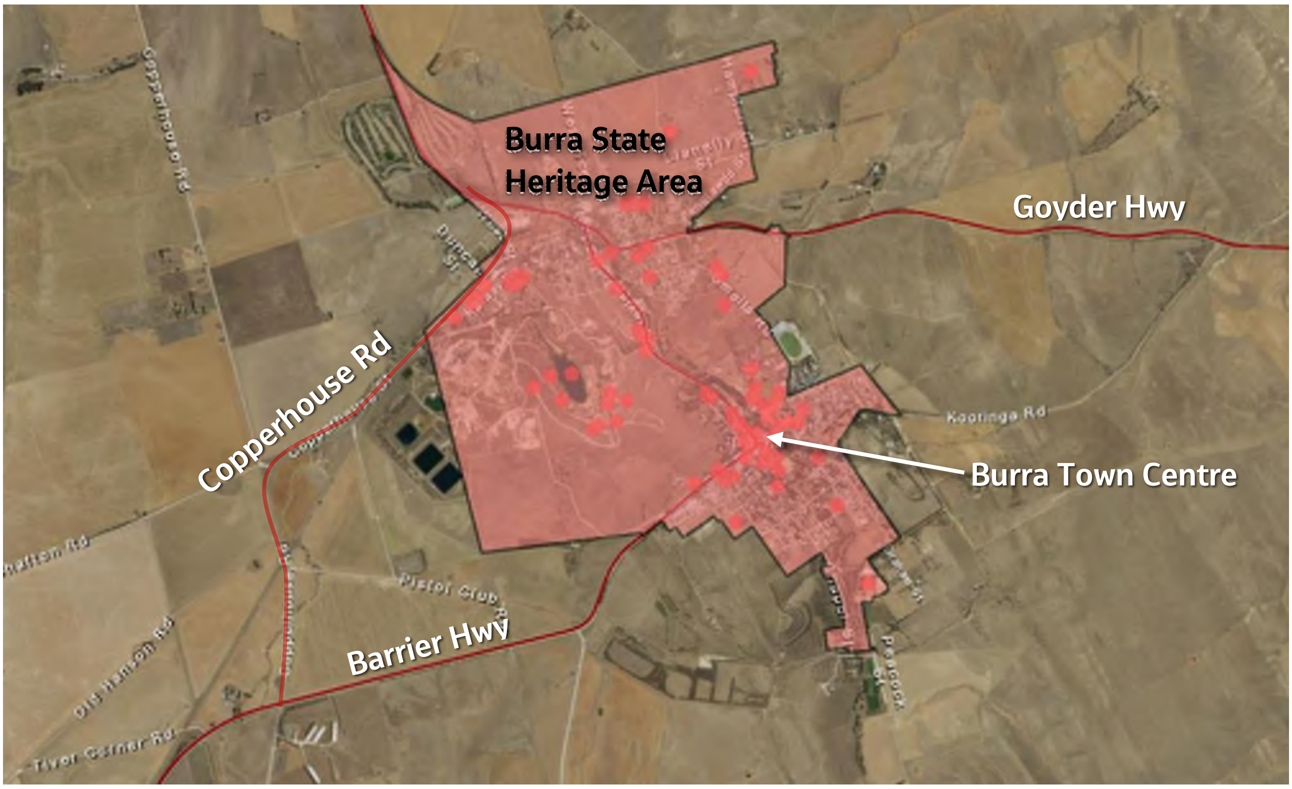


Figure 3.1: Burra State Heritage Area

In addition to the Burra State Heritage Area, it is noted that the Mokota Conservation Park is located within the Goyder North site area, however no turbines or any infrastructure is to be located within the park, with the closest turbines approximately 300m from the park's southern boundary. Furthermore, the park is not considered to be a significant trip generator. The location of the state heritage area and conservation park in relation to the site is illustrated in the following Figure 3.2, below.

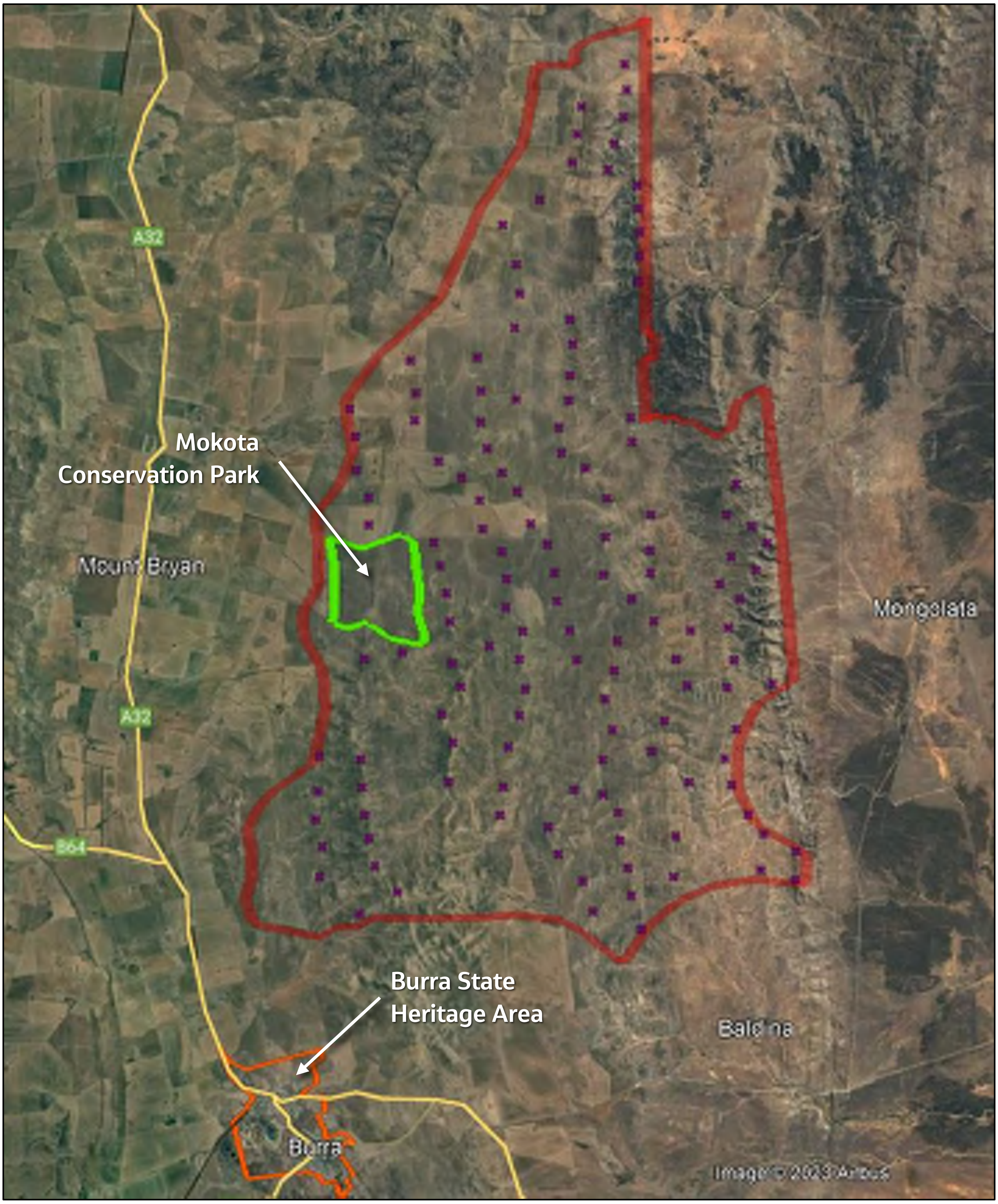


Figure 3.2: Goyder North Site Area in relation to Burra State Heritage Area & Mokota Conservation Park

3.3 Site Accessibility

It is proposed to access the site from Barrier Highway. Local access roads from the highway provide the most direct access to the site and considered to be the most suitable to accommodate oversize and over mass (OSOM) vehicles. Seven local routes were assessed and are discussed in Section 3.5.

Three route options were assessed for construction vehicles to access the Barrier Highway. It is assumed that OSOM vehicles will originate at Port Adelaide, travel via the Port River Expressway and then through the routes proposed below to reach the local access points. The route options are as follows:

- Designated Route 1 (D1):
  - Northern Connector – Northern Expressway – Sturt Highway – Horrocks Highway – Barrier Highway – Copperhouse Road (Burra bypass) – Goyder Highway – Barrier Highway
- Designated Route 2 (D2):
  - Northern Connector – Northern Expressway – Sturt Highway – Horrocks Highway – Thiele Highway – East Terrace (bypass of Kapunda) – Thiele Highway – Three Chain Road (bypass of Eudunda) – Worlds End Highway – Goyder Highway – Barrier Highway
- Designated Route 3 (D3):
  - D3a
    - Northern Connector – Princes Highway – Wilkins Highway – Jamestown Bypass – Wilkins Highway – Barrier Highway
  - D3b
    - Salisbury Highway – Port Wakefield Road – Princes Highway – Wilkins Highway – Jamestown Bypass – Wilkins Highway – Barrier Highway

Routes D3a and D3b are both being assessed due to the different vertical clearances of the bridges for each route, which is a consideration for the OSOM vehicle movements. The difference between routes D3a and D3b is at the start of the trip, where vehicles could use the Northern Connector (D3a) or use Salisbury Highway and Port Wakefield Road (D3b) to reach the Princes Highway and the continue to the destination.

The routes assessed for the Goyder South TIA were broadly similar to the above, diverging only around Burra. The Goyder South TIA drew the following conclusions on the routes:

- Route D1 was considered suitable for the transport of oversize and over mass vehicles, as well as currently gazetted vehicles.
- Route D2 was considered suitable for use solely by currently gazetted vehicles.
- Route D3a was considered suitable for the transport of oversize and over mass vehicles, as well as currently gazetted vehicles.

These conclusions, in particular the routes suitable for the transport of OSOM vehicles, align with DIT's designated principal routes for overdimensional loads. A DIT map illustrating these routes is provided in Appendix A.

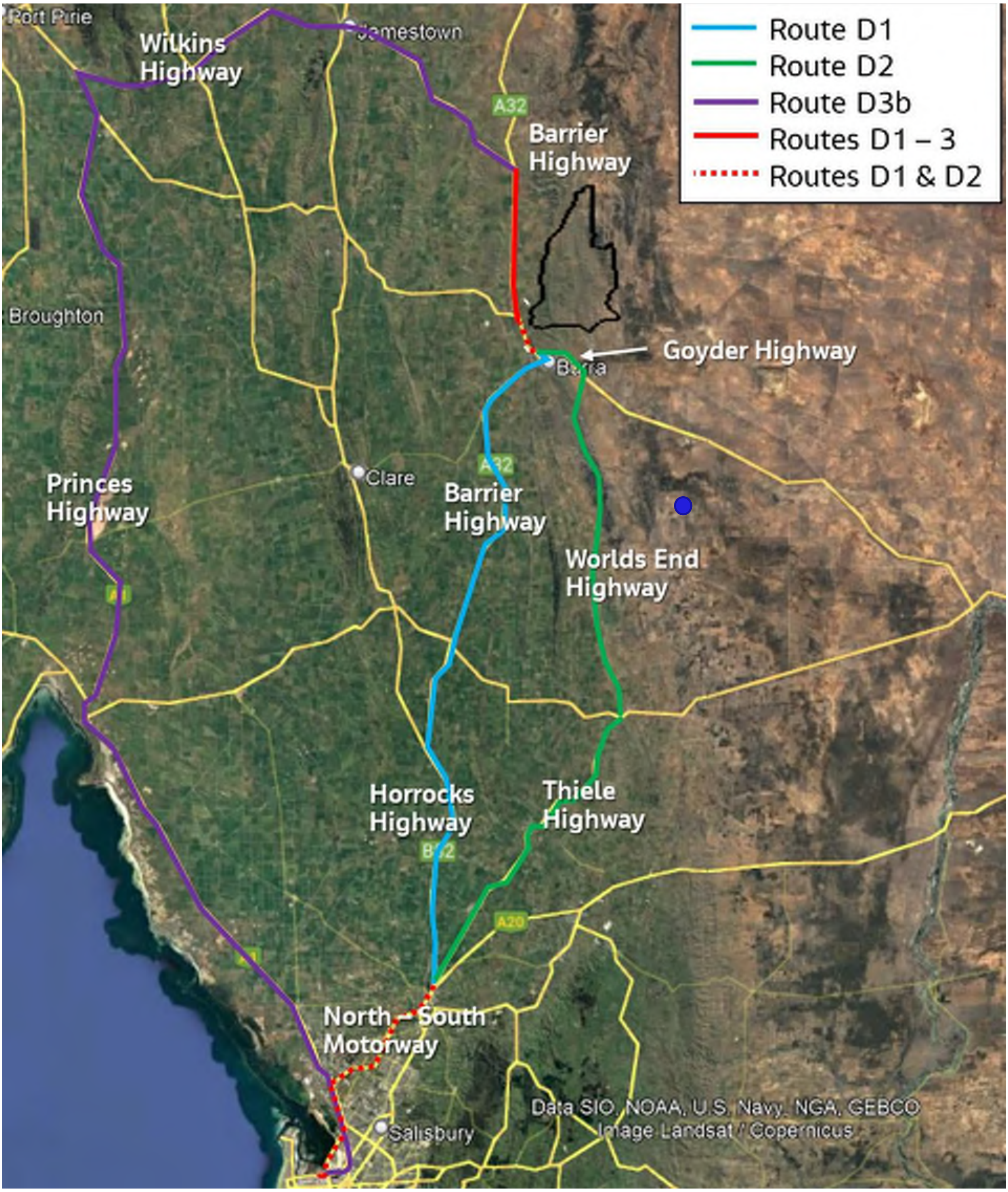


Figure 3.3: Designated Routes to Goyder North

Following the TIA, a Route Assessment was undertaken for Goyder South by Ares Project Services (included in Appendix B). The assessment recommended that under normal road conditions, route D1 was the preferred route for all components. During Horrocks Highway roadworks, which are currently underway, it was recommended that blades (the only components to exceed the 36.5m gazettal limit) be transported via route D3 and other components via D2. The only remaining roadworks on the Horrocks Highway that affect route D1 are overtaking lane extensions at Tarlee and Templers and construction of a new overtaking lane at Stockport, all of which are expected to be completed by mid-2024. It is not anticipated that these works would impact the transportation of general components. The suitability of transporting blades via route D1 would need to be determined as part of the traffic management plan for the development.

Due to the Horrocks Highway roadworks, the Department for Infrastructure and Transport (DIT) nominated route D3 for the transport of all components. It is understood that this route was selected as route D2 would require vehicles to travel through Burra town centre.

3.4 Existing Arterial Road Conditions

The existing roads and highways forming part of the designated routes to Goyder North are described in the following section. The description of the existing road conditions includes information regarding the road location, speed limits, line markings, gazetted routes, notable bridge structures, traffic volumes, property access, and other significant characteristics.

3.4.1 Northern Connector & Northern Expressway (D1, D2, D3a)

The Northern Connector & Northern Expressway are under the care and control of DIT. They extend from the Port River Expressway in the south to Gawler in the north. These roads form part of the state principal routes for oversize and overmass loads. Therefore, for the purpose of this assessment, the below description will focus on the oversize and overmass limits which are relevant to this assessment only.

Figure 3-1: Northern Connector & Northern Expressway Bridge Structures

There are several bridge structures where the designated route passes under the bridge structure. These are marked in Figure 3-1 above. The lowest vertical clearance of all the bridge structures is 5.3m.

3.4.2 Salisbury Highway & Port Wakefield Road (D3b)

The Salisbury Highway & Port Wakefield Road are under the care and control of DIT. They extend from the Port River Expressway in the south to the Northern Connector in the north. The continuation of Port Wakefield Road further north has been assessed separately under the ‘Princes Highway’ in Section 3.4.11. These roads form part of the state principal routes for oversize and overmass loads. Therefore, for the purpose of this assessment, the below description will focus on the oversize and overmass limits which are relevant to this assessment only.

Figure 3-2: Salisbury Highway & Port Wakefield Road Bridge Structures

There is a bridge structure along the designated route. This is at the start of the route, where the Port River Expressway ends, and the Salisbury Highway begins. The vertical clearance of this bridge structure is 7.2m.

3.4.3 Horrocks Highway (D1)

Horrocks Highway is an arterial road under the care and control of DIT. The highway extends from Gawler in the south to Wilmington in the north. For the purpose of this assessment, the below description will focus on Horrocks Highway from its intersection at Sturt Highway (at Gawler) to the turn-off onto Barrier Highway, approximately 7 km south of Riverton.

Figure 3-3: Relevant section of the Horrocks Highway

The highway has a sealed width of approximately 10m, with 3.7m wide lanes and sealed shoulders. These lane and carriageway widths meet the Austroads desirable widths (3.5m). A 110 km/h speed limit applies to the highway, except for where it passes through the local towns of Roseworthy, Templers, and Tarlee, where 60km/h, 80km/h, and 60km/h speed limits apply respectively. The majority of the Horrocks Highway in the study area has single broken barrier lines with several sections of double two-way barrier lines and alternating double one-way barrier lines.

There are eight bridge structures along the Horrocks Highway, as illustrated in Figure 3-1. As the Horrocks Highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structures are suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

The highway section is also currently gazetted for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

The most recent DIT traffic data volumes for Horrocks Highway are listed in Table 3-1 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-1: DIT traffic data for Horrocks Highway, between its intersection with Thiele Highway and Barrier Highway (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Barrier Highway	Tarlee Road	3000	2022	15.5%
2	Tarlee Road	Templers Road	3300	2019	11%
3	Templers Road	Roseworthy Road	3900	2022	15.5%
4	Roseworthy Road	Thiele Highway	6500	2019	11%

Several rural properties are noted to have direct access points to/from the Horrocks Highway.

3.4.4 Barrier Highway (Horrocks Highway to Burra) (D1)

Barrier Highway is an arterial road under the care and control of DIT. The highway extends from the centre of Burra to approximately 7km South of Riverton. Barrier Highway passes through several towns, listed from south to north below:

- Riverton
- Saddleworth
- Manoora
- Burra

Figure 3-4: Relevant section of the Barrier Highway

The sections of the highway which pass through these towns are relatively straight and do not have any noted restrictions for permitted heavy vehicles. The section of the Barrier Highway from its intersection at Copperhouse Road to the town centre of Burra is omitted from the details below because it would not be used by construction traffic, which would instead use the Copperhouse Road bypass (Section 3.4.5).

Barrier Highway has a sealed width of approximately 9m, with 3.7m wide lanes and sealed shoulders. A 110km/h speed limit applies to the highway, except for where the speed reduces at the towns. The majority of the Barrier Highway has single broken barrier lines, with the remaining areas a mixture of alternating double one-way barrier lines and double two-way barrier lines.

There are six bridge structures along this section of the Barrier Highway. As the Barrier Highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structures are suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

The Barrier Highway also forms part of the current gazetted routes for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

The most recent DIT traffic data volumes for Barrier Highway are listed in Table 3-2 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-2: DIT traffic data for Barrier Highway, between its intersection with Horrocks Highway and Copperhouse Road (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Copperhouse Road	Farrell Flat Road	1300	2019	21%
2	Farrell Flat Road	Saddleworth Road	1000	2022	23%
3	Saddleworth Road	Belvidere Road	2500	2022	16.5%
4	Belvidere Road	Riverton Road	1800	2022	16.5%
5	Riverton Road	Horrocks Highway	1800	2022	16%

Several rural properties and businesses are noted to have direct access points to/from the Barrier Highway.

3.4.5 Burra Bypass – Copperhouse Road / Copperhouse Street / West Street (D1)

The Burra bypass changes its road/street name along its length. Starting from the southern intersection with Barrier Highway and travelling north, for the first 1.5km section it is called Copperhouse Road. From that point continuing on for 2km the road is called Copperhouse Street. For the last 500m the road is called West Street before intersecting with the Goyder Highway. It is one continuous road/street. For the purpose of this assessment it will be referred to as Copperhouse Road.

Copperhouse Road is a sealed road under the care and control of the Regional Council of Goyder. The road extends from approximately 3km south-west of Burra centre at the southern intersection with the Barrier Highway, to approximately 2.5km north-west of Burra centre at the northern intersection with the Goyder Highway. Copperhouse Road is used as a heavy vehicle bypass for Burra township.

Figure 3-5: Burra bypass – Copperhouse Road / Copperhouse Street / West Street

In 2021, improvements were made to the southern intersection of Barrier Highway and Copperhouse Road. The most notable improvement is an auxiliary left turn lane on the Barrier Highway, for vehicles turning left onto Copperhouse Road.

Copperhouse Road has a sealed width of approximately 8m, with 3.5m wide lanes and unsealed shoulders. Along the first 1.5km (starting from the southern intersection with Barrier Highway) there is a 110km/h speed limit. For the next 1km there is a speed limit of 80km/h, and for the remaining section of the road to the intersection with Goyder Highway, there is a 60km/h speed limit. The lower speed limit is due to the road entering a residential area. The majority of Copperhouse Road has double or single barrier lines, with short sections of single broken barrier lines and alternating double one-way barrier lines.

Copperhouse Road forms part of the current gazetted routes for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, OSM 4.0m Wide up to 93.5t Low Loader vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

The traffic volumes along Copperhouse Road are unknown. Noting the reported volumes along Barrier Highway to the south and Goyder Highway to the north, the volumes along this road are predicted to be in the order of 300 to 500 vehicles per day, with between 30% to 43% commercial vehicles.

Several rural properties and businesses are noted to have direct access points to/from Copperhouse Road.

3.4.6 Goyder Highway (D2)

Goyder Highway is an arterial road under the care and control of DIT. The highway extends from the centre of Burra to the border of South Australia and Victoria.

Figure 3-6: Relevant section of the Goyder Highway

In the vicinity of the assessment area (between Burra and the intersection of Goyder Highway and Worlds End Highway), the highway has a sealed width of approximately 10m, with 3.7m wide lanes and sealed shoulders. A 110km/h speed limit applies to the highway, except for Burra, where it drops briefly to 80km/h and then to 50km/hr in the Burra township. The majority of the Goyder Highway in the assessment area has single broken barrier lines and double two-way barrier lines, with also several short sections of alternating double one-way barrier lines.

There are four bridge structures along the Goyder Highway. As the Goyder Highway is currently gazetted for OSM 4.5m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structures are suitable for the transport of over size and/or over mass vehicles up to this gazetted level. It is noted that a bridge restriction speed of 10 km/h applies to the bridge 0.8 km east of Sancreed Street in Burra North for 3 and 4 Axle Cranes.

The Goyder Highway also forms part of the current gazetted routes for GML and HML vehicles up to 36.5m Road Trains, and PBS Level 3A vehicles.

The most recent DIT traffic data volumes for Goyder Highway are listed in Table 3-3 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-3: DIT traffic data for Goyder Highway, between its intersection with Barrier Highway and Worlds End Highway (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	West Street (Copperhouse Road bypass)	Barrier Highway	1200	2019	16.5%
2	Barrier Highway	Landore Street	800	2019	20%
3	Landore Street	Kooringa Road	470	2019	25.5%
4	Kooringa Road	Eastern Road	650	2019	20%
5	Eastern Road	Worlds End Highway	600	2019	23.5%

Several rural properties are noted to have direct access points to/from the Goyder Highway.

3.4.7 Worlds End Highway (D2)

Worlds End Highway is an arterial road under the care and control of DIT. The 52km highway extends from Eudunda to approximately 13km South-East of Burra, where it connects to the Goyder Highway. The Worlds End Highway also passes through Robertstown approximately 22km North of Eudunda.

Figure 3-7: Worlds End Highway

The highway has a sealed width of approximately 8m, with 3.7m wide lanes and unsealed shoulders. A 110km/h speed limit applies to the highway, except for Robertstown, where it drops briefly to 80km/h and then to 50km/h in the township. The majority of the Worlds End Highway has single broken barrier lines, with the remaining areas a mixture of alternating double one-way barrier lines and double two-way barrier lines.

There are several vertical geometry constraints along Worlds End Highway. These constraints are due to dips and low points in the road which are also possible floodways. The location of the constraints are marked on the above route picture (constraints 1 and 2 shown as blue boxes in Figure 3-5), and shown in Figure 3-6 below.

Figure 3-8: Vertical geometry constraints looking south along the Worlds End Highway. Constraint 1 located south of Hallelujah Hills Road (left), constraint 2 located north of Powerline Road (right).

Due to these constraints, the route to the development area travelling in a northbound direction from Adelaide via the Thiele Highway (and the bypasses of Kapunda (via East Terrace) and Eudunda (via Three Chain Road) townships, refer sections 3.4.9 and 3.4.10) is likely to restrict the transport of the wind turbines blades and other over-length components (to be transported via vehicles over 26m length) due to risk of vehicles "bottoming-out" through the fords located to the towards the southern end of the proposed development site along Worlds End Highway (between Hallelujah Hills Road and Powerline Road), but should be subjected to further investigation by the engaged transport company once vehicles and componentry sizes are confirmed.

The Worlds End Highway forms part of the current gazetted routes for GML and HML vehicles up to 26m B Doubles, PBS Level 2A vehicles, and OSM 23m 42.5t Low Loader vehicles. The route is considered suitable for the remainder of the construction traffic that meet these gazetted road levels.

A 90^{o} right turn was also observed along the Worlds End Highway as it passes through Robertstown, as shown in Figure 3-7. This right turn would also possibly pose an issue for the transport of the over-length wind turbines blade components.

If this turn movement does pose an issue for restricted access vehicles, East Road which bypasses the township could be considered as an alternate route. However, this route is only gazetted for 19m HML vehicles from its junction at Worlds End Highway to the south to Commercial St / Geranium Plain Road intersection to the north. East Street, the 50m road segment which connects East Road to Worlds End

Highway to the north does not currently form part of the restricted access vehicle network, as such, use of this route for heavy vehicles would require additional approvals and permits.

Figure 3-9: 90 Degree turn of Worlds End Highway passing through Robertstown (and alternate bypass route marked by dashed line)

There is one bridge structure along the Worlds End Highway (at Burra Creek). As the Worlds End Highway is currently gazetted for OSM 23m 42.5t Low Loader vehicles, it is assumed that the bridge structure is suitable for the transport of over size and/or over mass vehicle loads up to this gazetted level.

The most recent DIT traffic data volumes for Worlds End Highway are listed in Table 3-4 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-4: DIT traffic data for Worlds End Highway, between its intersection with Goyder Highway and Australia Plains Road (Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Goyder Highway	Powerline Road	130	2019	27.5%
2	Powerline Road	East Road	170	2019	22.5%
3	East Road	Second Avenue	550	2019	15.5%
4	Second Avenue	Cutting Road	370	2019	15%
5	Cutting Road	Australia Plains Road	550	2019	15.5%

It should be noted that the Worlds End Highway provides the only direct access to/from the Worlds End Gorge and Worlds End Hike-in Camp Site.

3.4.8 Thiele Highway (D2)

Thiele Highway is an arterial road under the care and control of DIT. The highway extends from Gawler to Morgan (approximately 115km) and passes through Kapunda and Eudunda. The turn-off to Worlds End Highway is located at Eudunda.

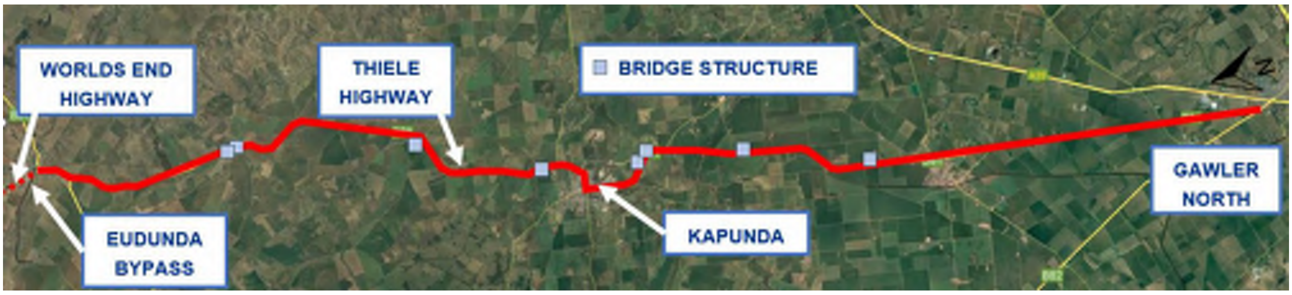


Figure 3-10: Relevant section of the Thiele Highway

From Gawler to Eudunda, the highway has a width of approximately 10m, with 3.7m wide lanes and varying unsealed and sealed shoulders. A 110km/h speed limit applies to the highway, except for when vehicles pass through Kapunda and Eudunda, where the speed limit drops to 50km/hr. The majority of the Thiele Highway has single broken barrier lines, with the remaining areas a mixture of alternating double one-way barrier lines and double two-way barrier lines.

There are eight bridge structures along the Thiele Highway. As the highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structure is suitable for the transport of over size and/or over mass vehicle loads up to this gazetted level.

The section of Thiele Highway also forms part of the current gazetted routes for GML and HML vehicles up to 26m B Doubles, PBS Level 2A, and 3 Axle Cranes.

The most recent DIT traffic data volumes for Thiele Highway are listed in Table 3.5 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-5: DIT traffic data for Thiele Highway, between its intersection with Horrocks Highway and Australia Plains Road (Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Horrocks Highway	Gray Street	5000	2022	11%
2	Gray Street	Hanson Street	3800	2019	8.5%
3	Hanson Street	Greenock Road	2900	2022	14.5%
4	Greenock Road	Perry Road	3200	2022	10%
5	Perry Road	South Terrace	4400	2012	5%
6	South Terrace	Truro Road	2400	2022	12.5%
7	Truro Road	Curio Highway	1400	2022	11.5%
8	Curio Highway	Gunn Street	1600	2022	12%
9	Gunn Street	Kapunda Street	1100	2019	12.5%
10	Kapunda Street	Barwell Street	750	2019	12.5%
11	Barwell Street	Australia Plains Road	650	2019	14.5%

Several rural properties are noted to have direct access points to/from Thiele Highway.

3.4.9 Bypass of Kapunda Township – East Terrace (D2)

East Terrace is an approximate 4km long road which can be used as a bypass of Kapunda. It is under the care and control of the Light Regional Council. Driving north-east, the first 2km of the road is unsealed, and the next 2km of the road is sealed. East Terrace connects two locations of the Thiele Highway, approximately 3km south of Kapunda centre and approximately 1.5km north-east of Kapunda centre.

Figure 3-11: Kapunda bypass – East Terrace

On the unsealed section of East Terrace, the road width is approximately 8m wide. Given the unsealed nature of the road, the default rural speed limit of 100 km/h applies to this road.

The sealed section of East Terrace has a sealed width of approximately 8m, with 3.7m wide lanes and minor sealed shoulders. The road is posted with 80km/h speed limit signage. The sealed section of East Terrace was recently upgraded in 2017, which involved new line markings, signage, and shoulder widening. Around the bends and intersections, there is a single barrier line. On the other sections, the straights, there is single broken lines. There are also standard edge lines along the entire sealed section and a safety barrier towards the southern end.

The entire length of East Terrace forms part of the current gazetted routes for GML vehicles up to 26m B Doubles and OSM 25m 59.5t Low Loader vehicles.

The sealed section of East Terrace (with connection to Thiele Highway south via Perry Road) also forms part of the current gazetted routes for GML and HML vehicles up to 26m B Doubles, PBS Level 2B and OSM 23m 42.5t Low Loader vehicles.

It is also noted that the continuation of the Thiele Highway through the township (and not using the bypass via East Terrance) is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader Vehicles and 3 Axles Cranes.

There are no records available to provide traffic volume information.

Several rural properties are noted to have direct access to/from East Terrace. East Terrace also provides the only direct access to Mantina Quarries and Kapunda Christchurch Anglican Cemetery.

3.4.10 Bypass of Eudunda Township – Three Chain Road (D2)

Three Chain Road is an approximate 2.5km sealed road which can be used as a bypass of Eudunda. Three Chain Road is under the care and control of the Regional Council of Goyder. The road connects Thiele Highway (approximately 1km south-east of Eudunda centre) to Worlds End Highway (approximately 1.5km north of Eudunda centre).

Figure 3-12: Eudunda bypass – Three Chain Road

The Three Chain Road bypass was constructed in 2017 to improve freight movement in the region. The works also included a new junction at the Thiele Highway intersection, and an improved junction at the Worlds End Highway intersection.

An 80km/h speed limit applies to the majority of the road, where a 50km/h speed limit applies in the vicinity of the intersections at the highways at both ends. Towards the ends of the road it has double barrier linemarking. Along the majority of the road there is a single broken barrier line, or a double one-way barrier line with alternating overtaking directions.

Three Chain Road forms part of the current gazetted routes for GML and HML vehicles up to 26m B Doubles, and PBS Level 2A vehicles. It is noted that the road is not currently gazetted for OSM vehicles, although the Thiele Highway and Worlds End Highway are both currently gazetted for OSM 23m 42.5t Low Loader vehicles, these two routes are not connected about Eudunda.

It is also noted that Bruce Street which provides connection to Thiele Highway and Worlds End Highway through the Eudunda town centre (i.e. not the bypass via Three Chain Road) is currently gazetted for OSM 40t Special Purpose Vehicles. There are no records available to provide traffic volume information.

Three rural properties are noted to have direct access points to/from Three Chain Road.

3.4.11 Princes Highway (D3)

Princes Highway, also known as Augusta Highway or Port Wakefield Road, is an arterial road under the care and control of DIT. The Princes Highway forms part of the Highway ring-route of Australia and is the primary highway linking Adelaide to Port Augusta and onwards Darwin and Perth. The highway extends from Gawler in the south to Wilmington in the north. For the purposes of this assessment, the below description will focus on Princes Highway from its intersection at the Northern Connector to the turn-off onto Wilkins Highway, approximately 15km south-east of Port Pirie.

Figure 3-13: Relevant section of the Princes Highway

The highway has a sealed width of approximately 10m, with 3.7m wide lanes and sealed shoulders. A 110km/h speed limit applies to the highway, except for where it passes through several local towns where a speed limit of 60km/h inside the towns and 80km/h on approach to the towns applies. The majority of the Princes Highway in the study area has single broken barrier lines with several sections of double two-way barrier lines and alternating double one-way barrier lines. There are also northbound and southbound overtaking opportunities provided along the highway.

There are many bridge structures along the Princes Highway. As the Princes Highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structures are suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

A new overpass, the Port Wakefield Overpass, was constructed and opened to traffic in December 2021. The D3 route will take vehicles underneath the overpass. The vertical clearance of the overpass is 7.5m.

The highway section is also currently gazetted for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3B vehicles, 5 Axle Cranes (Level 2) and 6 Axle Cranes (Day Travel).

The most recent DIT traffic data volumes for Princes Highway are listed in Table 3-6 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-6: DIT traffic data for Princes Highway, between its intersection with Old Port Wakefield Road and Wilkins Highway (Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Old Port Wakefield Road	Mallala Road	14900	2022	21.5%
2	Mallala Road	Dublin Road	10400	2022	21%
3	Dublin Road	Shrike Road	8800	2022	21.5%
4	Shrike Road	North Street	8800	2022	21.5%
5	North Street	Balaklava Road	9700	2018	22.5%
6	Balaklava Road	Port Wakefield Ramp Over Augusta Highway (southern)	9300	2022	22.5%
7	Port Wakefield Ramp Over Augusta Highway (southern)	Port Wakefield Ramp to Port Augusta	3500	2022	30%
8	Port Wakefield Ramp to Port Augusta	Blyth Road	3600	2022	30.5%
9	Blyth Road	Barunga Road	3200	2023	34.5%
10	Barunga Road	Condowie Plain Road	3200	2023	31.5%
11	Condowie Plain Road	Ellis Street West	3500	2021	31.5%
12	Ellis Street West	Clements Road	3100	2023	32.5%
13	Clements Road	Venning Road	3400	2023	29.5%
14	Venning Road	Goyder Highway	3000	2023	33.5%
15	Goyder Highway	Wilkins Highway	4400	2023	27.5%

3.4.12 Wilkins Highway (D3)

Wilkins Highway is an arterial road under the care and control of DIT. The highway extends from its intersection to the Princes Highway to the west, to Barrier Highway to the east.

Figure 3-14: Relevant section of the Wilkins Highway

The highway has a sealed width of approximately 9m, with 3.7m wide lanes and sealed shoulders. A 110km/h speed limit applies to the highway, except in Jamestown, Caltowie and Gladstone, where the speed limits reduce to 80km/h on the approach and 60km/h within the towns. The majority of the Barrier Highway has single broken barrier lines, with the remaining areas a mixture of alternating double one-way barrier lines and double two-way barrier lines.

There are eight bridge structures along the Wilkins Highway. As the Wilkins Highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structures are suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

The highway section is also currently gazetted for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

The most recent DIT traffic data volumes for Wilkins Highway are listed in Table 3-7 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-7: DIT traffic data for Wilkins Highway, between its intersection with Princes Highway and Barrier Highway (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Princes Highway	Gladstone Laura	1300	2023	21%
2	Gladstone Laura	Possum Park Road	1900	2023	19%
3	Possum Park Road	Horrocks Highway	950	2023	24%
4	Horrocks Highway	Caltowie Road	850	2009	15.5%
5	Caltowie Road	Laura-Caltowie Road	800	2023	26.5%
6	Laura-Caltowie Road	East Terrace	1000	2023	25%
7	East Terrace	Willliams Road	1000	2023	24%
8	Willliams Road	Appilla Road	1300	2013	15.5%
Jamestown Bypass – See Section 3.4.11					
9	Od5 Road	Jamestown-Whyte Yarcowie Road	270	2018	18%
10	Jamestown-Whyte Yarcowie Road	Barrier Highway	280	2019	17%

Several rural properties are noted to have direct access points to/from the Wilkins Highway.

3.4.13 Jamestown Bypass (D3)

The Jamestown Bypass consists of Appila Road, Boundary Road, Mannanarie Road and Od5 Road. Appila Road and Mannanarie Road are under the care and control of DIT. Boundary Road and Od5 Road are under the care and control of the Northern Areas Council. All bypass roads are sealed. The Jamestown Bypass is a designated heavy vehicle bypass which has heavy vehicle bypass/detour signage at either end of the bypass.

Figure 3-15: Jamestown Bypass – Appila Road, Boundary Road, Mannanarie Road, Od5 Road

Appila Road has a sealed width of approximately 8m, with 3.5m wide lanes and unsealed shoulders. The southern section of the road has a speed limit of 60km/h, the centre section has a speed limit of 80km/h, the centre section has a speed limit of 100km/h. Single broken, solid/broken, double broken. The majority of Appila Road has double two-way or single barrier lines, with short sections of single broken barrier lines and alternating double one-way barrier lines. Boundary Road has a sealed width of approximately 8m, with 3.5m wide lanes and unsealed shoulders. The road has a 60km/h speed limit, with single broken barrier lines. Mannanarie Road has a sealed width of approximately 8m, with 3.5m wide lanes and unsealed shoulders. The road has a 60km/h speed limit, with single broken barrier lines. Od5 Road has a sealed width of approximately 8m, with 3.5m wide lanes and unsealed shoulders. The road has an 80km/h speed limit, with alternating single broken and double solid barrier lines.

There is one bridge structure along the bypass. As the bypass is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structure is suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

The bypass is also currently gazetted for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

It is also noted that the continuation of the Wilkins Highway through the township (and not using the bypass) is currently gazetted for GML and HML vehicles up to 26m B Double and PBS Level 2A vehicles.

Traffic volumes are only available for Appila Road and Mannanarie Road, listed in Table 3-8 below.

Table 3-8: DIT traffic data for Appila Road, between its intersection with Wilkins Highway and Boundary Road, and for Mannanarie Road, between its intersection with Boundary Road and Od5 Road (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Wilkins Highway	Reservoir Terrace	600	2013	23.5%
2	Reservoir Terrace	Boundary Road	350	2018	14%
3	Boundary Road	Od5 Road	800	2019	20%

3.4.14 Barrier Highway (Burra to Hallett) (D1-D3)

Barrier Highway is an arterial road under the care and control of DIT. For the purpose of this assessment, the below description will focus on Barrier Highway from Burra to Hallett.

Figure 3-16: Relevant section of the Barrier Highway (Burra to Hallett)

The highway has a sealed width of approximately 9m, with 3.7m wide lanes and sealed shoulders. A 110km/h speed limit applies to the highway, except in Hallett, Mount Bryan and Burra, where the speed limits reduce to 80km/h on the approach to the towns and 60km/h within the towns. The majority of the Barrier Highway has single broken barrier lines, with the remaining areas a mixture of alternating double one-way barrier lines and double two-way barrier lines.

There is one bridge structure along the Barrier Highway, marked in Figure 3-14

As the Barrier Highway is currently gazetted for OSM 4.0m Wide up to 93.5t Low Loader vehicles, it is assumed that the bridge structure is suitable for the transport of over size and/or over mass vehicles up to this gazetted level.

The highway section is also currently gazetted for GML and HML vehicles up to 36.5m Road Trains, PBS Level 3A vehicles, 5 Axle Cranes (Level 1) and 6 Axle Cranes (Day Travel).

The most recent DIT traffic data volumes for Barrier Highway are listed in Table 3-9 below (sourced from Location SA Viewer). Each section in the table refers to a different section along the highway, where reference points for the start and finish are at its intersecting road.

Table 3-9: DIT traffic data for Barrier Highway, between its intersection with Wilkins Highway and Copperhouse Road Highway (data sourced from Location SA Viewer)

Section	Start (Intersecting Road)	Finish (Intersecting Road)	Vehicles per Day (VPD) Two Way	Year Collected	Percent Commercial Vehicles
1	Wilkins Highway	Goyder Highway	850	2019	24.5%
2	Goyder Highway	Copperhouse Road	1500	2019	22%

Several rural properties are noted to have direct access points to/from the Barrier Highway.

3.5 Existing Site Access Road Conditions

Potential site access routes were identified through a preliminary desktop analysis, with seven routes shortlisted for on-site assessment. All proposed site access roads to the Goyder North site are existing local access roads accessed via Barrier Highway north of Burra.

No routes accessing the site from the south via Goyder Highway were considered suitable, as route D2 is not one of DIT's designated principal routes for overdimensional roads and use of the route for OSOM vehicles was previously not supported.

3.5.1 Preliminary Site Access Desktop Assessment and Shortlisting

A preliminary site access desktop assessment was undertaken to narrow down the large number of potential routes from the Barrier Highway to the site, to form the shortlist for the detailed access assessment. The shortlisting process involved consideration of the following criteria:

- No new road construction required to access the site boundary.
- Suitable intersection geometry at the intersection with the Barrier Highway.
- Suitable road characteristics from the Barrier Highway to the site boundary. Including minimal horizontal curve or vertical constraints, and suitable existing road condition.
- Number of residential properties fronting the road.
- Minimising land / farmland which would be encroached upon to accommodate vehicle turning movements. In the event where land must be encroached upon, Neoen shall discuss with the land owner to agree on alterations to be made if required.
- Minimise constraints which would need to be addressed. For example, tree trimming or culvert assessment.
- Preference for other site road accesses which intersect to the same 'link' road as then one road site boundary. For example, for several roads that intersect the Barrier Highway which then meet at one 'link' road, the accesses which better serve the 'link' road are shortlisted.
- The following roads intersecting with the Barrier Highway (from North to South) were not shortlisted with primary associated reasoning provided: Boundary Road – Poor existing road condition and a significant horizontal geometry constraint. The 'link' road is better served by other accesses (i.e. Razorback Road).
  - Belcunda Road (North) – The construction of a road to link to the site would require cutting through farmland and would need to avoid creeks, water reservoirs and farming facilities. The 'link' road is better served by other accesses (e.g. Polville Road). Route serves as a frontage to residential properties.

- Belcunda Road (South) – Tree trimming requirements, significant horizontal and vertical constraints, road construction would be required for direct access to the site boundary. The 'link' road is better served by other accesses (e.g. Polville Road). Route serves as a frontage to residential properties.

The shortlisted routes for assessment are illustrated in the following figure and existing conditions and route suitability are detailed in the following sections (from North to South).

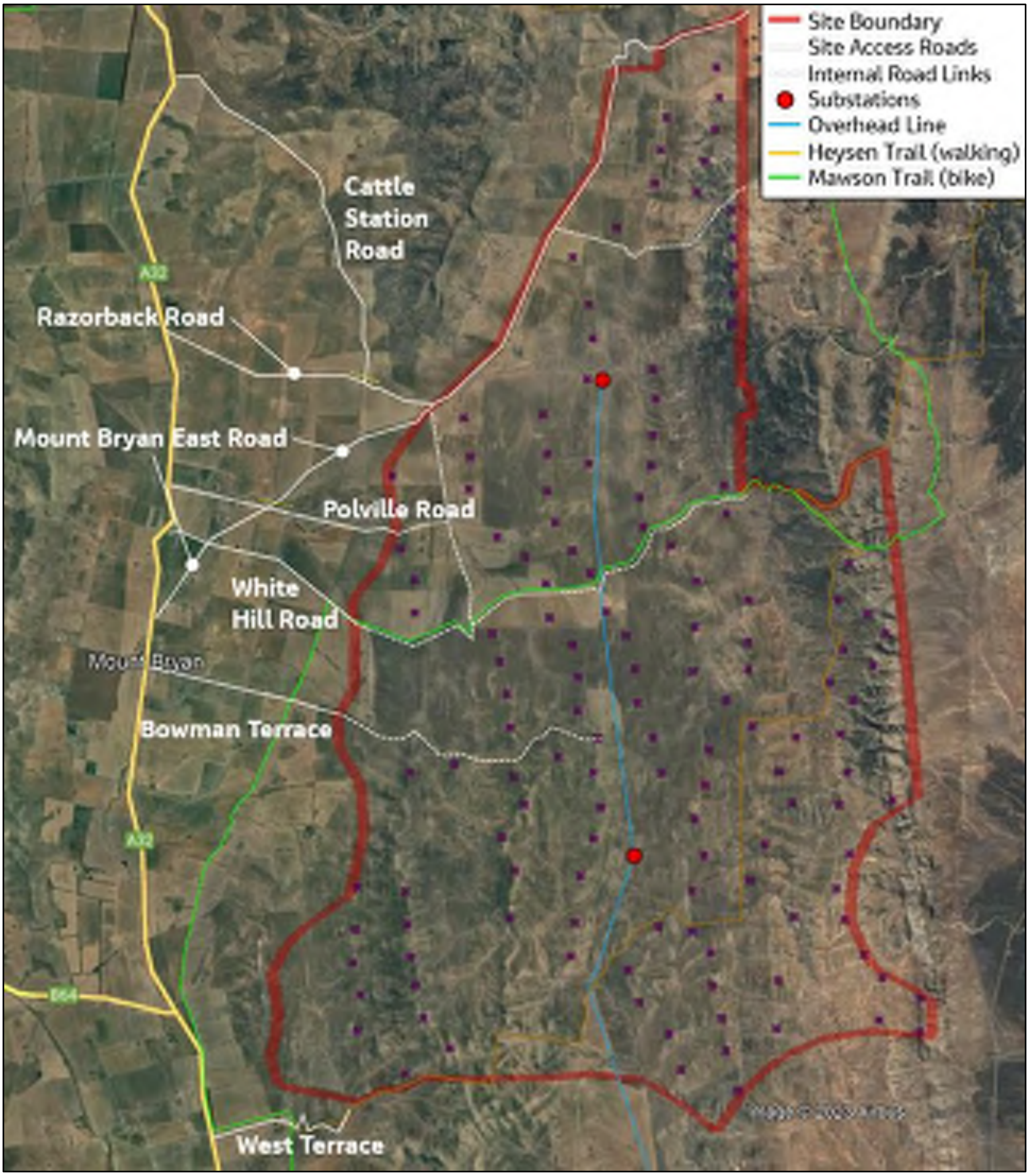


Figure 3-17: Assessed Site Access Roads

3.5.2 Cattle Station Road

Cattle Station Road is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 3.5km south of Hallett and 12km north of Mount Bryan. Vehicles would access Cattle Station Road from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travel 8.2km to the four-way intersection with Razorback Road, turn left onto Razorback Road, then proceed a further 1.5km to the site boundary at Mount Bryan East Road.

Cattle Station Road forms a narrow three arm junction with Barrier Highway. Due to the width of the intersection, access widening is likely to be required to accommodate OSOM vehicles. Clear sightlines are available to the north. To the south, the road curves but sightlines are unimpeded by obstructions.

The route has a tight curve with a tree located on the inside of curve approximately 500m from the Barrier Highway. Tree removal and curve widening are likely to be required, but it is noted that curve widening would encroach into existing farmland. Curve widening is also likely to be required at the intersection with Razorback Road, which would also encroach into existing farmland.

Cattle Station Road has an approximate width of 6m. Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

Three rural properties appear to have direct access to/from Cattle Station Road (plus an additional property with access to Razorback Road on the route to the site.

3.5.3 Razorback Road

Razorback Road is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 9km south of Hallett and 6.7km north of Mount Bryan. Vehicles would access Razorback Road from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travelling directly along the road for 5.9km to the site boundary at Mount Bryan East Road.

Razorback Road forms a wide four-way intersection with Barrier Highway and Petherton Road, with Petherton adding to the turning area, particularly for vehicles approaching from the north. Due to the width of the intersection, access widening may not be required, however some may be required for the southern approach, where Razorback Road intersects with Barrier Highway at an acute angle. Clear sightlines are available to the north and south.

The route has a relatively straight alignment, with an approximate width of 9m. Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

One rural property appears to have direct access to/from Razorback Road.

Razorback Road is preferred over Cattle Station Road as a site access route, due to the more direct routing and wider curves. In addition, traffic using Cattle Station Road would still need to utilise Razorback Road to access the site.

Razorback Road intersects with Mount Bryan East Road at the site boundary and continues north along the site perimeter with minor curvature and a typical width of 8m, providing access to the northern portion of the site and linking to White Field Road, which bisects the northern portion of the site, providing access.

3.5.4 Polville Road

Polville Road is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 12.5km south of Hallett and 3.5km north of Mount Bryan. Vehicles would access Polville Road from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travelling along the road for 2.1km to the intersection with Mount Bryan East Road and Old Belcunda Road. Vehicles would continue straight through the intersection and along Old Belcunda Road for a further 2.7km to the site boundary.

Polville Road forms a moderately wide three-arm perpendicular junction with Barrier Highway. A Stobie pole is located immediately to the north of the junction, which may need to be relocated if OSOM access is required from the north. Clear sightlines are available to the north. To the south, the road curves and sightlines are impeded by the trees on Polville Road near the Barrier highway junction.

The route has a relatively straight alignment, with an approximate width of 5m. Trees are located on both sides of the roadway for the first 150m from Barrrier Highway, which may need to be trimmed to accommodate larger vehicles. To access the site, at the intersection with Mount Bryan East Road and Old Belcunda Road vehicles can either turn left onto Mount Bryan East Road, or continue straight through the intersection and along Old Belcunda Road. For either route, curve widening or possibly realignment of the Polville Road approach will be required.

Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

Three rural properties appear to have direct access to/from Polville Road (including Old Belcunda Road).

3.5.5 White Hill Road

White Hill Road is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 13.6km south of Hallett and 2.4km north of Mount Bryan. Vehicles would access White Hill Road from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travelling along the road for 4.5km to the site boundary.

White Hill Road forms an offset four-arm intersection with Barrier Highway and Hilldrop Road. White Hill Road intersects at an acute angle from the north, which would facilitate access for vehicles approaching from the south. For vehicles approaching from the north via Route D3, in particular OSOM vehicles, significant modifications would be required to accommodate turning movements. The intersection is located in the middle of a reverse curve and while there are no major obstructions, sightlines are impeded by the curves.

The road curves to the south approximately 180m from the intersection, but the radius is considered to be sufficiently wide to minimise the likelihood of curve widening being required. Beyond this curve, the route has a relatively straight alignment. The road has an approximate width of 6m leading to the Mount Bryan East Road intersection, increasing to 7-8m east of this. Road quality deteriorates slightly east of the Lines Road / Back Road intersection, but the 7-8m width is maintained.

Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

The Mawson Trail follows White Hill Road for approximately 675m from the intersection with Lines Road / Back Road to the site boundary. The Trail then traverses the site from east to west along White Hill Road. The Mawson Trail is likely to have higher volumes of walkers and bike riders than other roads within the site and consequently, if White Hill Road is utilised, additional safety management may be required to ensure the safety of all Trail users.

No rural properties appear to have direct access to/from White Hill Road.

3.5.6 Mount Bryan East Road

Mount Bryan East Road is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 15.5km south of Hallett and 500m north of Mount Bryan. Vehicles would access Mount Bryan East Road from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travelling directly along the road for 7.1km to the site boundary, which is a continuation of Mount Bryan East Road. Alternative access options are available by turning right onto White Hill Road after 1.9km, or Old Belcunda Road after 3.4km.

Mount Bryan East Road forms a narrow three-arm junction with Barrier Highway. The intersection is perpendicular, but after 25m, Mount Bryan East Road angles to the north, which would pose an access challenge for OSOM vehicles approaching from the north, as an almost U-turn movement would be required. Widening at the intersection with Barrier Highway is likely to be required.

After the Barrier Highway junction, the route has a relatively straight alignment, with an approximate width of 8m. Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

Four rural properties appear to have direct access to/from Mount Bryan East Road.

As noted, Mount Bryan East Road continues north along the site perimeter with minor curvature and a typical width of 8m, providing access to the northern portion of the site and linking to White Field Road, which bisects the northern portion of the site, providing access.

3.5.7 Bowman Terrace / Gum Hill Road

Bowman Terrace is a sealed road under the care and control of the Regional Council of Goyder. The seal extends for approximately 330m, from which point it becomes Gum Hill Road and is unsealed for the remainder of its length. The road is located to the east of Barrier Highway and effectively forms the southern boundary of the Mount Bryan township. Vehicles would access Bowman Terrace from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3), travelling directly along the road for 4.2km to the site boundary.

Bowman Terrace forms a wide four-way intersection with Barrier Highway and Mokota Road. Due to the width of the intersection, access widening may not be required. Clear sightlines are available to the north and south and the speed limit in the vicinity of the intersection is 60km/h, compared to 110km/h at all other assessed intersections.

The route has a relatively straight alignment, with an approximate width of 6m. Road quality deteriorates from east of Kolinda Road to Lines Road, where a gate bars further eastward travel. The road is quite undulating and tree trimming would be required in a number of locations to accommodate heavy vehicle movement. Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

The Mawson Trail intersects with Gum Hill Road at Lines Road. While the level of interaction is minimal, due to the likely higher volumes of walkers and bike riders on the Trail, additional safety management may be required to ensure the safety of all Trail users.

A number of properties are located close to Bowman Terrace, which would likely be highly impacted by increased traffic, particularly heavy vehicle traffic.

Due to the proximity to the Mount Bryan township, Bowman Terrace / Gum Hill Road is recommended for general access vehicle use only.

3.5.8 West Terrace

West Terrace is an unsealed road under the care and control of the Regional Council of Goyder. The road is located to the east of Barrier Highway, approximately 10km south of Mount Bryan and 3.9km north of Burra. Vehicles would access West Terrace from Barrier Highway (turning right when approaching via Route D1 or D2, and left from Route D3). To access the site, vehicles would travel 2km to the intersection with the Heysen Trail, which would be used for 400m before turning north onto an unnamed road to access the site.

West Terrace forms a four-way intersection with Barrier Highway and Leighton Road. Access widening may be required to accommodate restricted access and oversize vehicles. Clear sightlines are available to the north and south.

The route has a relatively straight alignment for the first 1.6km, but is narrow, with a typical width of 3-4m. Road quality is poor and the road is quite undulating. From 1.6km onwards, there are several tight radius turns and the road narrows further, to as little as 2m.

Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network for the first 2km, beyond which the route is not gazetted. There are no records available to provide traffic volume information.

The Mawson Trail follows West Terrace for approximately 1.9km from the intersection with Barrier Highway to the intersection with the Heysen Trail, which would be used by site traffic for 400m.

The Mawson Trail and Heysen Trail are likely to have higher volumes of walkers and bike riders than other roads within the site and consequently, if West Terrace were utilised, additional safety management may be required to ensure the safety of all Trail users.

No properties are located close to West Terrace, but the “Midnight Oil House” tourist attraction is accessed via the road, close to Barrier Highway.

Due to the geometry of the road and its interaction with two recreational trails, it is not recommended that access is provided via West Terrace.

3.5.9 Powerline Road

Powerline Road provides access to the Bundey Batteries and the existing Bundey Substation, from the World End Highway on Route D2. Powerline Road is an unsealed road under the care and control of the Regional Council of Goyder. Powerline Road forms a four-way intersection the Worlds End Highway and Fettke Road. Clear sightlines are available to the north and south.

Given the unsealed nature of the road, the default rural speed limit of 100km/h applies. The road currently forms part of the gazetted HML 19m network. There are no records available to provide traffic volume information.

Powerline Road provides access to the Bundey Substation, adjacent to the proposed Bundey Batteries. The road will only be used to access these battery sites, and the Bundey Substation which will be expanded as part of this project, which will not require any non-gazetted or over-size or over-mass vehicles during its construction.

Figure 3-18: Assessed Site Access Road for the Bundey Batteries

3.6 Crash History

A review of the available recorded crash data in the vicinity of the Goyder North development area from Location SA Map Viewer indicates numerous road crashes along the designated routes. The data is recorded from 2018 to the end of 2022. The injury, serious injury and fatal road crash statistics, as well as road crash locations where there were two or more crashes, are summarised below for the roads and highways along the D1, D2, D3 routes and site access roads. All routes have experienced crashes, but there are not considered to be areas of sufficient concern to impact route choice selection. A detailed breakdown of crashes is provided in Appendix C.

Barrier Highway (between Horrocks Highway and Copperhouse Road):

- 11 injury crashes, 7 serious injury crashes, 1 fatal crashes.
  - Intersection of Barrier Highway and Winders Road
    - Crashes: 2 injury crashes
    - Crash type: All right-angle collisions

Goyder Highway (between Copperhouse Road and Worlds End Highway):

- 1 injury crashes, 1 serious injury crashes, 0 fatal crashes.
  - Intersection of Goyder Highway and The Crescent
    - Crashes: 1 injury crash, 1 serious injury crash
    - Crash type: All right-angle collisions

Worlds End Highway:

- 0 injury crashes, 2 serious injury crashes, 1 fatal crashes.
  - No locations with two or more crashes.

Princes Highway (between Northern Connector and Wilkins Highway):

- 92 injury crashes, 36 serious injury crashes, 15 fatal crashes
  - Intersection of Princes Highway and Old Port Wakefield Road
    - Crashes: 9 injury crashes, 2 serious injury crashes
    - Crash type: right turn, right angle, rear end and hit fixed object
  - Intersection of Princes Highway and Ryan Road
    - Crashes: 3 injury crashes
    - Crash type: All right-angle collisions
  - Intersection of Princes Highway and McEvoy Road
    - Crashes: 1 injury crash, 1 serious injury crash
    - Crash type: right angle and side swipe
  - Intersection of Princes Highway and Angle Vale Road
    - Crashes: 4 injury crashes
    - Crash type: right angle and rear end
  - Intersection of Princes Highway and Brooks Road
    - Crashes: 1 serious injury crash, 1 fatal crash
    - Crash type: All right-angle collisions
  - Intersection of Princes Highway and Mallala Road
    - Crashes: 2 injury crashes
    - Crash type: All right-angle collisions
  - Intersection of Princes Highway and Copper Coast Highway (pre-Port Wakefield overpass).
    - Crashes: 3 injury crashes, 2 serious injury crashes, 1 fatal crash

    - Crash type: All right-angle collisions
  - Intersection of Princes Highway and Goyder Highway
    - Crashes: 2 injury crashes, 1 fatal crash
    - Crash type: All right-angle collisions

Copperhouse Road:

- 0 injury crashes, 1 serious injury crashes, 0 fatal crashes.
  - No locations with two or more crashes.

4. Transportation Requirements for Development

4.1 Development Lifespan Phases

There are three phases involved over the lifespan of the Goyder North development. These phases are the construction phase, operational phase, and the decommissioning / renewal phase.

4.1.1 Phase 1 – Construction

The construction phase for the Goyder North development area is anticipated to be a 3-4-year process and will have impact on the surrounding road network. The construction phase of the project is divided into two stages. Each proposed stage involves the development of a different area of the Goyder North site.[1] Each stage is planned to deliver approximately 500MW of wind generation via 69 turbines, and 450MW / 1800MWh of BESS.

Each construction stage is expected to take 24 – 36 months. Depending on the assessment process, Stage 1 is proposed to start during mid/late-2025.

Stage 2 is proposed to start after completion of Stage 1 construction and commissioning. This timeline is subject to the timing of Stage 1 to reach financial close, which depends on numerous factors such as the availability of Power Purchase Agreements.

The principal construction traffic and transport activities that will be carried out during the construction stages will be required to travel along the designated routes listed in Section 3.3. These activities include the following:

- Delivery of the wind turbine components, including foundation materials.
- Delivery of the substation and power connection equipment.
- Delivery of construction equipment and materials.
- Delivery of batteries and associated infrastructure.
- Transport of construction staff.

4.1.2 Phase 2 – Operations

The operations phase of the proposed Goyder North development area is forecasted to last approximately 30 years. The traffic and transport movements associated with the operation and maintenance of the site are recommended to travel along the designated routes listed in Section 3.3. These movements include the following:

- Staff travelling to the site for regular inspections.
- Routine servicing and maintenance of wind turbines.
- Replacement of wind turbine components.
- Possible maintenance of roads and access tracks.
- Maintenance of battery and substation facilities.

4.1.3 Phase 3 – Decommissioning

The wind turbines have an approximate lifespan of 30 years. Towards the end of this lifespan a decision will be made on whether to decommission the site, involving removal of existing turbines and other related site equipment, or to renew the site, involving installation of new turbines (requiring a new Development Approval). The construction traffic and transport movements involved in this phase will likely be less that during Construction Phase 1 (most of the concrete associated with the turbines is anticipated to be left in the ground and covered over rather than removed and transported by road, to minimise ecological disturbance).

[1] The exact geographical areas of each development stage has not yet been determined.

4.2 Equipment Specifications

The construction phase of the Renewables Zone will have an impact on the existing road network, in particular due to the size and weight of the particular components such as the wind turbine components and substation equipment. Depending on the equipment being transported during these phases (particularly the construction phase), over size and/or over mass (OSM) permits will need to be obtained through the National Heavy Vehicle Regulator (NHVR) and Department for Infrastructure and Transport (DIT). Any vehicles exceeding the following criteria will require OSM a permit:

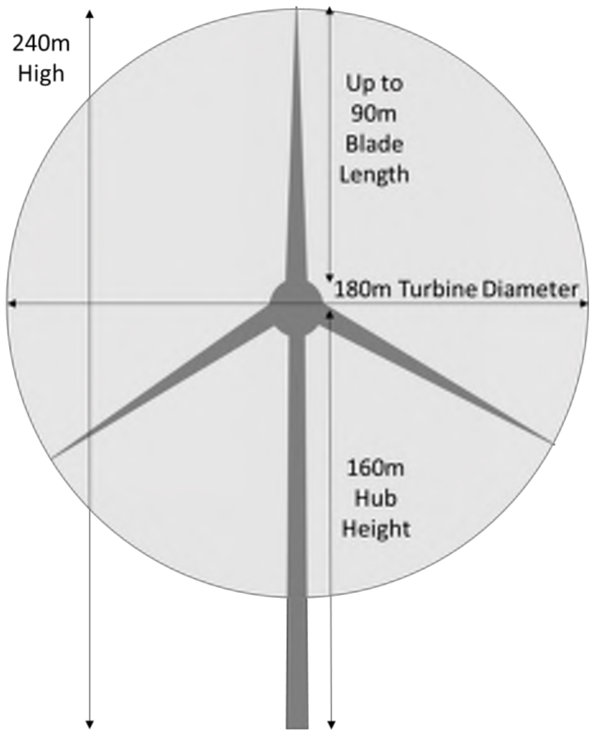
- Over mass limit: 42.5 tonnes
- Over size limits:
  - Width: 2.5m
  - Height: 4.3m
  - Length: 19m (for a combination other than B-double, road train, car carrier).

4.2.1 Wind Turbines

The wind turbines proposed will have a maximum blade tip height of up to 240m. The turbine will comprise of blades of up to approximately 90m in length and a hub height of up to approximately 160m. Each turbine consists of the following components:

- 5-8 tower sections (including one base section, one top section, and three mid-sections);[2]
- 1 turbine hub;
- 1 nacelle;
- 1 cooler top;
- 1 drive train;
- 3 blades.

Some turbines may comprise smaller, lighter components. However, this assessment takes a conservative approach by considering the maximum possible dimensions for all stages.



[2] Please note that this assumes a steel tower construction. Some manufacturers specify concrete towers (or concrete and steel) at certain hub heights. Neoen has informed Jacobs that where some or all segments are concrete, overall traffic figures are unlikely to change materially as the segments are more numerous, but smaller.

Figure 4-1: Maximum dimensions of Wind Turbine Generators proposed for Goyder North

The maximum potential approximate weight and dimensions of the individual wind turbine components listed above and whether the component requires OSM vehicles to transport the components are summarised in Table 4-1 and Table 4-2 below.

Table 4-1: Wind turbine component dimensions, weight, and requirements for over mass and over size vehicles

Component	Max Height (m)	Max Length (m)	Max Width (m)	Max Weight (tonnes)	Over Mass Vehicle Required	Over Size Vehicle Required
Nacelle (w/o Drive Train)	4.35	18.176	6.5*	90.985	✓	✓
Drive Train	3.0	7.5	2.7	105.36	✓	✓
Cooler Top	3.0	5.2	2.3	2.333	x	x
Hub	4.88	4.98	4.401	78.277	✓	✓
Blades	4.0	90	4.5	31.3	x	✓

*includes width for side compartment.

Table 4-2: Wind turbine tower dimensions, weight, and requirements for over mass and over size vehicles

Component	Max Diameter (m)	Max Length (m)	Max Weight (tonnes)	Over Mass Vehicle Required	Over Size Vehicle Required
5 Section Towers					
Tower Section (max weight)	6.0	25.76	90	✓	✓
Tower Section (max length)	4.15	33	65	✓	✓
7 Section Towers (149m Tower)					
Tower Section (max weight)	6.0	17.08	83	✓	✓
Tower Section (max length)	4.4	30	58	✓	✓

4.2.2 Substation Infrastructure

The project will include at least two 'collector' substations located centrally to each stage of wind farm development. The approximate weight and dimensions of the individual substation related components listed above and whether the component requires OSM vehicles to transport the components are summarised in Table 4-3 below.

Table 4-3: Substation component dimensions, weight, and requirements for over mass and over size vehicles

Component	Max Height (m)	Max Length (m)	Max Width (m)	Max Weight (tonnes)	Over Mass Vehicle Required	Over Size Vehicle Required
Substation Transformer	5	8.5	4.5	130	✓	✓

4.2.3 Other Components

All other components involved in the construction phase which are not listed above do not require OSM vehicles to transport.

4.3 Vehicle Types and Permits

4.3.1 Over Mass and Over Size Permits

The key focus for the transport of materials/components to the site revolves around the size and weight of the wind turbine components and substation equipment. The delivery of these components will require an over size permit, over mass permit, or both permits (as specified in Section 4.2) obtained from NHVR and DIT. Conditions employed for the transport of over mass and/or over size loads will involve:

- Pilot and escort requirements – to provide advanced warning to approaching traffic through appropriate signage,
- Police escort requirements – required for the safe movement of other traffic.
- Night travel restrictions.

4.4 Sight Distance Requirements

Appropriate vehicle sight distance at key intersections and site access points is an important requirement. Delivery vehicles will often be slow moving and take time to clear the road, hence it is critical for oncoming vehicles to have sufficient time to reduce speed and avoid a collision.

The required stopping sight distance under Austroads guidelines is 279m for heavy vehicles and 241m for passenger vehicles, based on the following assumptions:

- Minimum reaction time of 2.5s (design worst-case);
- Design speed of 120 km/hr (for a posted speed limit of 110 km/h); and
- Coefficient of deceleration of 0.36 (desirable minimum value).

The assessment of the sight distances for the key intersections and site access points using the values above are discussed in Section 6.

5. Projected Traffic Generation and Impacts

5.1 Generated Traffic

5.1.1 Construction Phase 1 Traffic Generation

Estimated construction vehicle trip movements per construction stage are detailed in the tables following. The movements are shown per stage of 500MW wind, and per 450MW / 1800MWh of BESS, instead of over the entire construction phase for Goyder North (two stages). This is due to:

- A stage comprising 500MW of wind will, with today's turbine technology, consist of approximately 69 turbines.
- The two construction stages are assumed to be of equal size and therefore equal for vehicles movements generated;
- The two construction stages are expected to have minimal overlap. This overlap will not be over the peak of the construction stages, noting that the peak traffic generated is expected to be over a 14-month period in the middle of the stage;
- The shorter timeframe of 24 months for the construction stage has been used as a conservative assessment.
- Therefore, a single construction stage has been considered instead of the entire construction phase (two stages) to inform the assessment of traffic impact on the existing road users.

An increase of 10% has been applied by Jacobs to the estimated one-way trips for construction vehicles listed in the tables below (see Revised Estimated Total trips (one way) column). This is to allow for any unforeseen increases in trip movements during the construction phase. The 10% contingency has not been applied to the tower sections, blades, hubs and nacelles as there is a fixed number of these components for the project.

Table 5-1: Estimated total construction traffic per stage for wind turbine components

Components		Estimated Total Construction Traffic per Stage for Turbine components over one construction stage (24-36 months).		
		Estimated Total Trips (One Way).	Revised (Additional 10%) Estimated Total Trips (One Way).	Vehicle Type to Transport Components
Tower Sections (7 per WTG)**	Length up to 33.0 meters Diameter up to 6.3 meters Weight up to 90,000 kgs	490	490#	Heavy Duty Semi-trailer (Over Size / Over Mass)
Blades (3 per WTG)***	Length up to 90 meters	210	210#	Extended Articulated Vehicle (Over size)
Hubs & Transformers*	Length up to 8.5 meters Width up to 4.5 meters Height up to 5.0 meters Weight up to 130,000 kgs	70	70#	Heavy Duty Semi-trailer (Over Size / Over Mass)
Drive Trains	Length up to 7.5 meters Width up to 2.7 meters Height up to 3.0 meters Weight up to 105,360 kgs	70	70#	Heavy Duty Semi-trailer (Over Size / Over Mass)
Nacelle*	Length up to 18.18 meters Width up to 6.5 meters Height up to 4.35 meters Weight up to 98,985 kgs	70	70#	Heavy Duty Semi-trailer (Over Size / Over Mass)
Cooler Top	Length up to 3.0 meters Width up to 5.2 meters	70	70#	Semi-trailer

Components		Estimated Total Construction Traffic per Stage for Turbine components over one construction stage (24-36 months).		
		Estimated Total Trips (One Way).	Revised (Additional 10%) Estimated Total Trips (One Way).	Vehicle Type to Transport Components
	Height up 2.3 meters Weight up to 2,333 kgs			
Tools – Shipping Containers		378	416	Semi-trailer
Crane equipment		53	59	Trucks
		3	3	Cranes
Pilot Vehicles		1749	1749#	Light Vehicles
Total Light Vehicle Movements (one-way)		**1749**	**1749**	**Car / Light Vehicles**
Total Heavy Commercial Vehicle (HCV) Movements (one-way)		**378 + 70 + 53 = 501**	**416 + 70 + 59 = 545**	**HCVs**
Total Over Size / Over Mass Vehicle Movements (one-way)		**910**	**910**	**OSM Vehicles**

* *assumed one pilot vehicle required based on component dimensions (number of pilots may be more than one, and to be determined on a case by case basis for each load)*

** *assumed two pilot vehicles required based on component dimensions (number of pilots may be more than two, and to be determined on a case by case basis for each load)*

*** *assumed three pilot vehicles required based on component dimensions (number of pilots may be more than three, and to be determined on a case by case basis for each load)*

\# *based on fixed number of components to be transported*

Table 5-2: Estimated total construction traffic per stage for other construction materials

Components	**Estimated Total Construction Traffic for Other Construction Materials over one construction stage (24-36 months)**			**Comment**
	Estimated Total Trips (One Way)	Revised Estimated Total Trips (One Way)	Vehicle Type	
Foundations and Road Materials				
WTG foundations and substation foundations (Concrete materials: sand, cement, potable water)	1959	2155	Semi-trailer / B-double	Materials delivered to the on-site concrete batch plant, then batched and delivered to the foundation in a concrete agitator
Reinforcement	210	231	Semi-trailer	
Pavement materials for access tracks and hardstands	2099	2309	Semi-trailer / B-double	Estimated trips for 50% material imported from off-site quarry. Assume 50% imported and 50% sourced on-site.
Pavement materials for benches	212	234	Semi-trailer / B-double	Site facilities bench, concrete batch plant bench, substation bench, laydown area bench, O&M building bench
Water for dust suppression and material conditioning	1260	1386	Semi-trailer tanker	

Components	Estimated Total Construction Traffic for Other Construction Materials over one construction stage (24-36 months)			Comment
	Estimated Total Trips (One Way)	Revised Estimated Total Trips (One Way)	Vehicle Type	
Misc deliveries	53	59	Semi-trailer / B-double	Drainage infrastructure, fencing, gates, conduits, etc
<u>Electrical Equipment</u>				
Substation transformers	3	3#	Heavy Duty Semi-trailer (Over mass / Over size)	Typical Physical Parameters of 240MVA transformers: Height (m) = 5.0 Width (m) = 4.5 Length (m) = 8.5 Weight (Tonnes) = 130
Kiosk transformers	1	1	Semi-trailer / B-double	
Underground cables	106	117	Semi-trailer / B-double	Typical Physical Parameters - MV cable drum: Height (m) = 3.3 Width (m) = 2.2 Weight (Kg) = 7800
Misc. substation equipment – substation building	1	1#	Heavy Duty Semi-trailer (Over mass / Over size)	Typical Physical Parameters - substation building: Length (m) = 30 Width (m) = 5.5 Height (m) = 3.5 Weight (Kg) = 120,000
Battery components	936	1030	Semi-trailer / B-double	
Pilot Vehicles	8	8#	Light Vehicles	
Total Light Vehicle Movements (one-way)	**8**	**8**	**Car / Light Vehicles**	
Total Heavy Commercial Vehicle (HCV) Movements (one-way)	**6835**	**7519**	**HCVs**	
Total Over Size / Over Mass (OSM) Vehicle Movements (one-way)	**4**	**4**	**OSM Vehicles**	

based on fixed number of components to be transported

Table 5-3: Estimated total construction traffic per stage for <u>construction staff traffic and site establishment / demobilisation</u>

Components	Estimated Total for Construction Staff and Work Site Activity over one construction stage (24-36 months)			Comment
	DA Estimated Total Trips (One Way)	Revised Estimated Total Trips (One Way)	Vehicle Type	
Site Establishment – Site Facilities	21	23	Semi-trailer / B-double	Portable office modules, water tanks, generator, etc
Site Establishment – Construction Equipment	32	35	Semi-trailer / B-double	Standard excavators, rollers, trenching machines, etc
Site Establishment – Construction Equipment – OSM**	11	12	Heavy Duty Semi-trailer (Over mass / Over size)	Large excavators, bulldozers, etc
Site Demobilisation – Site Facilities	21	23	Semi-trailer / B-double	Portable office modules, water tanks, generator, etc
Site Demobilisation – Construction Equipment	32	35	Semi-trailer / B-double	Standard excavators, rollers, trenching machines, etc
Site Demobilisation – Construction Equipment – OSM**	11	12	Heavy Duty Semi-trailer (Over mass / Over size)	Large excavators, bulldozers, etc
Staff and Contractors	43195	47515	Car / Light Vehicles	Assumed 100 vehicles per day for a peak of 6 months, 50 vehicles per day for 12 months, and 25 vehicles per day for 6 months
Staff and Contractors – Battery Components	7800	8580	Car / Light Vehicles	
Pilot Vehicles	42	47	Light Vehicles	
Total Light Vehicle Movements (one-way)	51,037	56,141	**Car / Light Vehicles**	
Total Heavy Commercial Vehicle (HCV) Movements (one-way)	106	117	**HCVs**	
Total Over Size / Over Mass (OSM) Vehicle Movements (one-way)	21	23	**OSM Vehicles**	

** *assumed two pilot vehicles required (number of pilots may be more than two, and to be determined on a case by case basis for each load)*

5.1.2 Operation and Maintenance Phase 2 Traffic Generation

The traffic associated with the long-term operation of the Goyder North development will be minimal. This phase involves the *commissioning and testing* and then the ongoing *operations and maintenance*. The commissioning and testing will require attendance by a number of technical and maintenance staff on a daily basis for a period of up to 6 months directly after the Construction Phase 1 is complete. The vehicles used will be typically commercial vehicles such as light vehicles and four-wheel drives.

As the commissioning and testing is completed, the development phase will move into the operations phase. The traffic generated during the operations phase is significantly lower than the construction phase and the traffic impacts on the surrounding area will therefore be minimal. The traffic generated during the operations phase will consist largely of the following:

- Permanent on-site operations personnel (most likely living locally) travelling to and from their homes to the operations and maintenance (O&M) compound/site office on a daily basis in light vehicles and four-wheel drives.
- Routine inspection and maintenance by operations personnel (most likely living locally) travelling from the O&M compound/site office to the substations, turbines and solar arrays on a daily basis in light vehicles and four-wheel drives. Note that only a few turbines or a small section of solar array would be subject to inspection and maintenance per day.
- Heavy maintenance or repair deliveries travelling to the O&M compound/site office, substations, turbines and panel arrays on an as-required (rare) basis to deliver key spares, consumables or components. Some trips may be from interstate where items are not available locally.

5.1.3 Decommissioning / Renewal Phase 3 Traffic Generation

Two options may be considered towards the end of the lifespan of the Goyder North project. These options are (1) to decommission the site, or (2) to renew the site. Regardless of which option is chosen, both options will require the removal of the wind turbines and solar panels. Traffic generation will likely be less that during the construction phase (as most of the concrete associated with the turbines foundations is anticipated to be left in the ground and covered over to minimise ecological disturbance). If the project is renewed, a separate Development Application will be required, which is outside the scope of this TIA.

The traffic generation and impacts should be re-assessed around the time when the site will be decommissioned or renewed, as the baseline traffic conditions on the road network will likely change over the lifespan of Goyder North.

5.2 Traffic Impacts

The impact of the generated traffic during the construction stage has been divided into three categories:

- Light Vehicle traffic (e.g. 4WDs and cars) associated with staff movements to and from the construction site.
- Heavy Commercial Vehicles (e.g. >2-tonne trucks, semi-trailers, dump trucks etc.) associated with deliveries to site that will travel on State controlled roads.
- Over size and/or Over mass vehicles associated with haulage of large turbine components (e.g. blades, nacelles, tower sections) to site that may only travel under NHVR and DIT permit.

To evaluate impacts of generated traffic on the capacity of the adjacent road system, the estimated trips from Section 5.1.1 have been converted to daily traffic volumes in each category in the table below.

Table 5-4: Traffic generated during each construction stage (one-way)

Vehicle Type	Total Generated Traffic	Traffic During Peak Construction Period (months 5 - 18) (14 months = 350 working days)	Peak Daily Traffic between Months 5 and 18
Light Vehicles	1,749 + 8 + 56,141 = 57,898	46,319	133 trips/day
Heavy Commercial Vehicles (HCVs)	545 + 7,519+ 117 = 7153	6,545	19 trips/day
Over Size / Over Mass (OSOM) Vehicles	910 + 4 + 23 = 937	750	3 trips/day
Total	65,988	53,614	155 return vehicle trips/day

Note:

- It is assumed (as a worst case) that 80% of activity occurs within the fourteen (14) month peak construction period between Months 5 – 18.
- A six (6) day working week has been assumed.
- Each OSM vehicle is assumed to be accompanied by up to three pilot vehicles (which has been factored into the light vehicle numbers).

- While construction staff dwellings will be dispersed throughout the area, to provide a conservative assessment it has been assumed that all construction staff will follow the same routes as heavy and OSOM vehicles.

These generated daily trips (doubled to reflect two-way movements, i.e. 310 trips per day) may then be compared to the current daily traffic volumes along the three proposed routes (D1, D2 and D3). A worst-case scenario is assumed where the traffic movements are solely along the routes, and not shared between them.

Table 5-5: Traffic impact along assessed highways and roads

Start (Intersecting Road)	Finish (Intersecting Road)	Existing VPD	Total (Existing + Generated) VPD	Traffic Increase (Existing vs. Total)	Existing HV%	Total HV% (Existing + Generated)
Horrocks Highway (D1)						
Barrier Highway	Tarlee Road	3000	3310	10.33%	15.50%	15.50%
Tarlee Road	Templers Road	3300	3610	9.39%	11%	11%
Templers Road	Roseworthy Road	3900	4210	7.95%	15.50%	15.50%
Roseworthy Road	Thiele Highway	6500	6810	4.77%	11%	11%
Barrier Highway (Horrocks Highway to Burra) (D1)						
Copperhouse Road	Farrell Flat Road	1300	1610	23.85%	21%	19.50%
Farrell Flat Road	Saddleworth Road	1000	1310	31.00%	23%	20.50%
Saddleworth Road	Belvidere Road	2500	2810	12.40%	16.50%	16%
Belvidere Road	Riverton Road	1800	2110	17.22%	16.50%	16%
Riverton Road	Horrocks Highway	1800	2110	17.22%	16%	15.50%
Goyder Highway (D2)						
Barrier Highway	Landore Street	800	1110	38.75%	20%	17.50%
Landore Street	Kooringa Road	470	780	65.96%	25.50%	20.50%
Kooringa Road	Eastern Road	650	960	47.69%	20%	18%
Eastern Road	Worlds End Highway	600	910	51.67%	23.50%	20%
Worlds End Highway (D2)						
Goyder Highway	Powerline Road	130	440	238.46%	27.50%	17.50%
Powerline Road	East Road	170	480	182.35%	22.50%	17%
East Road	Second Avenue	550	860	56.36%	15.50%	15%
Second Avenue	Cutting Road	370	680	83.78%	15%	14.50%
Cutting Road	Australia Plains Road	550	860	56.36%	15.50%	15%
Thiele Highway (D2)						
Horrocks Highway	Gray Street	5000	5310	6.20%	11%	11%
Gray Street	Hanson Street	3800	4110	8.16%	8.50%	9%
Hanson Street	Greenock Road	2900	3210	10.69%	14.50%	14.50%
Greenock Road	Perry Road	3200	3510	9.69%	10%	10.50%

Perry Road	South Terrace	4400	4710	7.05%	5%	5.50%
South Terrace	Truro Road	2400	2710	12.92%	12.50%	12.50%
Wilkins Highway (D3)						
Princes Highway	Gladstone Laura	1300	1610	23.85%	21%	19.50%
Gladstone Laura	Possum Park Road	1900	2210	16.32%	19%	18%
Possum Park Road	Horrocks Highway	950	1260	32.63%	24%	21.50%
Horrocks Highway	Caltowie Road	850	1160	36.47%	15.50%	15%
Caltowie Road	Laura-Caltowie Road	800	1110	38.75%	26.50%	22.50%
Laura-Caltowie Road	East Terrace	1000	1310	31.00%	25%	22%
East Terrace	Williams Road	1000	1310	31.00%	24%	21.50%
Williams Road	Appila Road	1300	1610	23.85%	15.50%	15.50%
Refer to Jamestown Bypass						
Od5 Road	Jamestown-Whyte Yarcowie Road	270	580	114.81%	18%	16%
Jamestown-Whyte Yarcowie Road	Barrier Highway	280	590	110.71%	17%	15.50%
Jamestown Bypass (D3)						
Wilkins Highway	Reservoir Terrace	600	910	51.67%		
Reservoir Terrace	Boundary Road	350	660	88.57%		
Boundary Road	Od5 Road	800	1110	38.75%		
Barrier Highway (Burra to Hallett section) (D1, D2, D3)						
Wilkins Highway	Goyder Highway	850	1160	36.47%	18%	17%
Goyder Highway	Copperhouse Road	1500	1810	20.67%	17%	16.50%
Princes Highway (D3)						
Old Port Wakefield Road	Mallala Road	14900	15210	2.08%	21.50%	21%
Mallala Road	Dublin Road	10400	10710	2.98%	21%	21%
Dublin Road	Shrike Road	8800	9110	3.52%	21.50%	21%
Shrike Road	North Street	8800	9110	3.52%	21.50%	21%
North Street	Balaklava Road	9700	10010	3.20%	22.50%	22%
Balaklava Road	Port Wakefield Ramp Over Augusta Highway (southern)	9300	9610	3.33%	22.50%	22%
Port Wakefield Ramp Over Augusta Highway (southern)	Port Wakefield Ramp to Port Augusta	3500	3810	8.86%	30%	28.50%
Port Wakefield Ramp to Port Augusta	Blyth Road	3600	3910	8.61%	30.50%	29%

Blyth Road	Barunga Road	3200	3510	9.69%	34.50%	32.50%
Barunga Road	Condowie Plain Road	3200	3510	9.69%	31.50%	30%
Condowie Plain Road	Ellis Street West	3500	3810	8.86%	31.50%	30%
Ellis Street West	Clements Road	3100	3410	10.00%	32.50%	30.50%
Clements Road	Venning Road	3400	3710	9.12%	29.50%	28%
Venning Road	Goyder Highway	3000	3310	10.33%	33.50%	31.50%
Goyder Highway	Wilkins Highway	4400	4710	7.05%	27.50%	26.50%

Note: D2 routes do not include OSOM vehicles

From a traffic capacity viewpoint, the impact of the construction traffic is not considered significant. Although the % increase on some roads is substantial and sometimes more than doubled the existing volume, the roads have spare capacity to accommodate the increase volume, therefore impact is not considered significant.

The roads and highways operating levels based on the existing and development-generated traffic volumes from the table above are as follows:

- Horrocks Highway: Level of Service (LOS) "A" (i.e. uncongested) for existing traffic and with construction traffic.
- Barrier Highway (Horrocks Highway to Burra): Level of Service (LOS) "A" for existing traffic and with construction traffic.
- Goyder Highway: Level of Service (LOS) "A" for existing traffic and with construction traffic.
- Worlds End Highway: Level of Service (LOS) "A" for existing traffic and with construction traffic.
- Thiele Highway: Level of Service (LOS) "A" for existing traffic and with construction traffic.
- Wilkins Highway: Level of Service (LOS) "A" for existing traffic and with construction traffic.
- Barrier Highway (Burra to Hallett): Level of Service (LOS) "A" for existing traffic and with construction traffic.

The OSM vehicles will operate under pilot and may be pulled over when necessary to minimise traffic delay.

Although the impact is not considered significant, the following section of this report makes some recommendations for intersection upgrades to safely accommodate the construction and passing by traffic during the project.

6. Traffic Impact Assessment and Recommended Upgrades

The following section details the suitability of the designated routes regarding the impacts of traffic and transport related activities associated with the Goyder North project during the construction, operational and decommissioning / renewal phases of the project.

The project will generate additional traffic during the construction and operational phases, with the traffic generated during the construction phase to be far greater than that generated during the ongoing operational phase. The extra movement of traffic has been considered in this assessment.

The assessment comprises the following:

- The minimum intersection geometry requirements based on vehicle through and turning volumes.
- An assessment of the specific site access points with proposed recommended upgrades, where necessary.
- An assessment of the designated routes leading to the development area with proposed recommended upgrades, where necessary.

6.1 Site Access Assessment and Recommended Upgrades

6.1.1 Site Access Upgrade Requirements

The standards for the upgrades of intersections are described below. The process of selecting an appropriate treatment includes consideration of:

- Safety of road users
- Traffic volumes
- Objectives for the road network
- Topography and natural/built environment
- Speed environment

The following information regarding turn treatment types and selection is taken from the Austroads Guide to Traffic Management. The three types of unsignalised at-grade turn treatments, including considerations in selection between treatments are as follows:

- Basic: Suitable for rural locations with low cross and turning volumes.
- Auxiliary: Suitable for rural locations where high-speed, low-volume traffic occurs and the volume and slow manoeuvring of turning traffic is sufficient to create a conflict with following traffic.
- Channelised: Suitable when turning traffic movements are heavy with frequent queuing, and where conflicting vehicle paths need to be separated.

The warrants for the preferred minimum treatments are shown in Figure 6 1, these warrants were used for treatment selection for the route network intersection upgrades. As the available information regarding traffic volumes on the major roads/highways is for vehicles per day, assumptions have been made for vehicles per hour based on the vehicles per day value. The assumption made is that the vehicles per hour volume is 20% of the vehicles per day volume (worst-case scenario). This number was chosen with consideration to peaks which may occur in the morning or afternoon when residents are travelling to/from work.

Assumptions have also been made regarding the turning volumes as there is no known information. Given the low amount of rural property access from the site access points, it is assumed that the existing turning volumes per hour are 5% of the existing vehicles per hour value (worst-case scenario). An assumption has also been made that the estimated construction vehicles per hour is 20% of the estimated construction vehicles per day (calculated in Section 5). It has also been assumed that the construction vehicles per hour equals the turn volumes per hour.

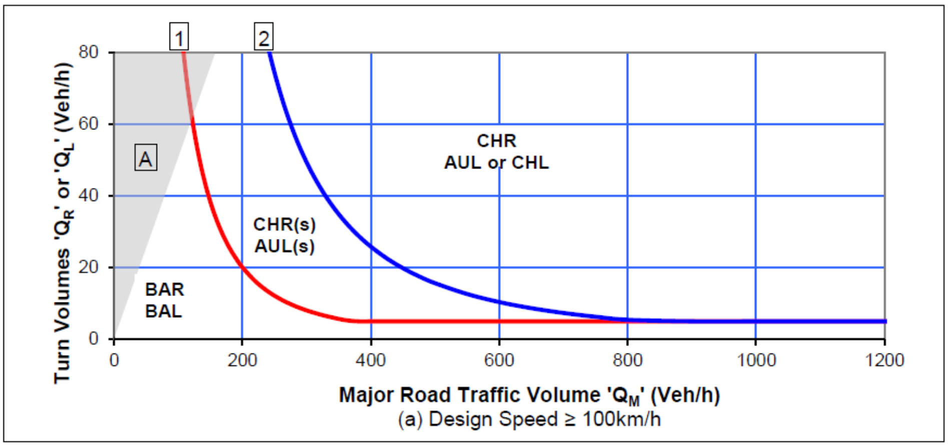


Figure 6-1: Austroads warrants for turn treatments on major roads at unsignalised intersections

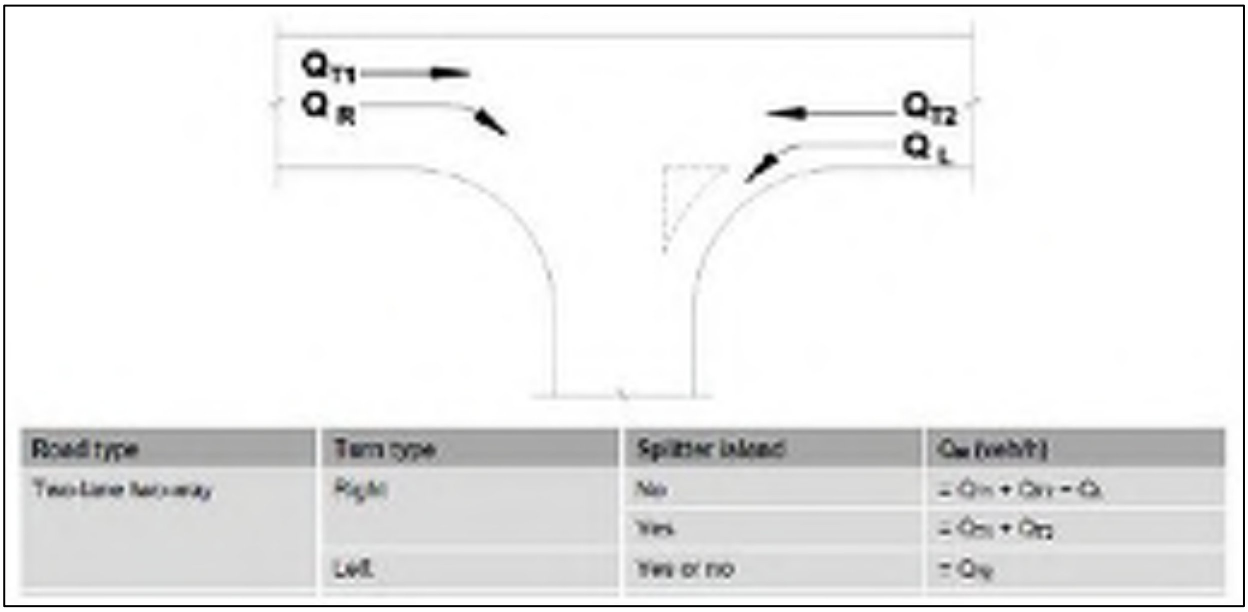


Figure 6-2: Calculation of major road traffic volume QM (Austroads - Guide to Traffic Management)

6.1.2 Assessed Site Access Points

Following the existing conditions assessment for the shortlisted site access roads (Section 3.5), two roads were removed from the shortlist for this detailed access assessment. These roads are Cattle Station Road and West Terrace. Cattle Station Road was removed due to the narrow three arm junction with the Barrier Highway which would require widening, the curve widening along the road which would require encroachment onto existing farmland, and there are several rural properties which have direct access to the road. West Terrace was removed because of the poor road geometry and characteristics and its interaction with recreational trails. The detailed access assessment has been undertaken on the following five potential access points (T1 – T5) located along Barrier Highway, illustrated in the following figure. An access assessment was also undertaken for access point T6 located on the Worlds End Highway, which provides access to the Bundey Batteries.

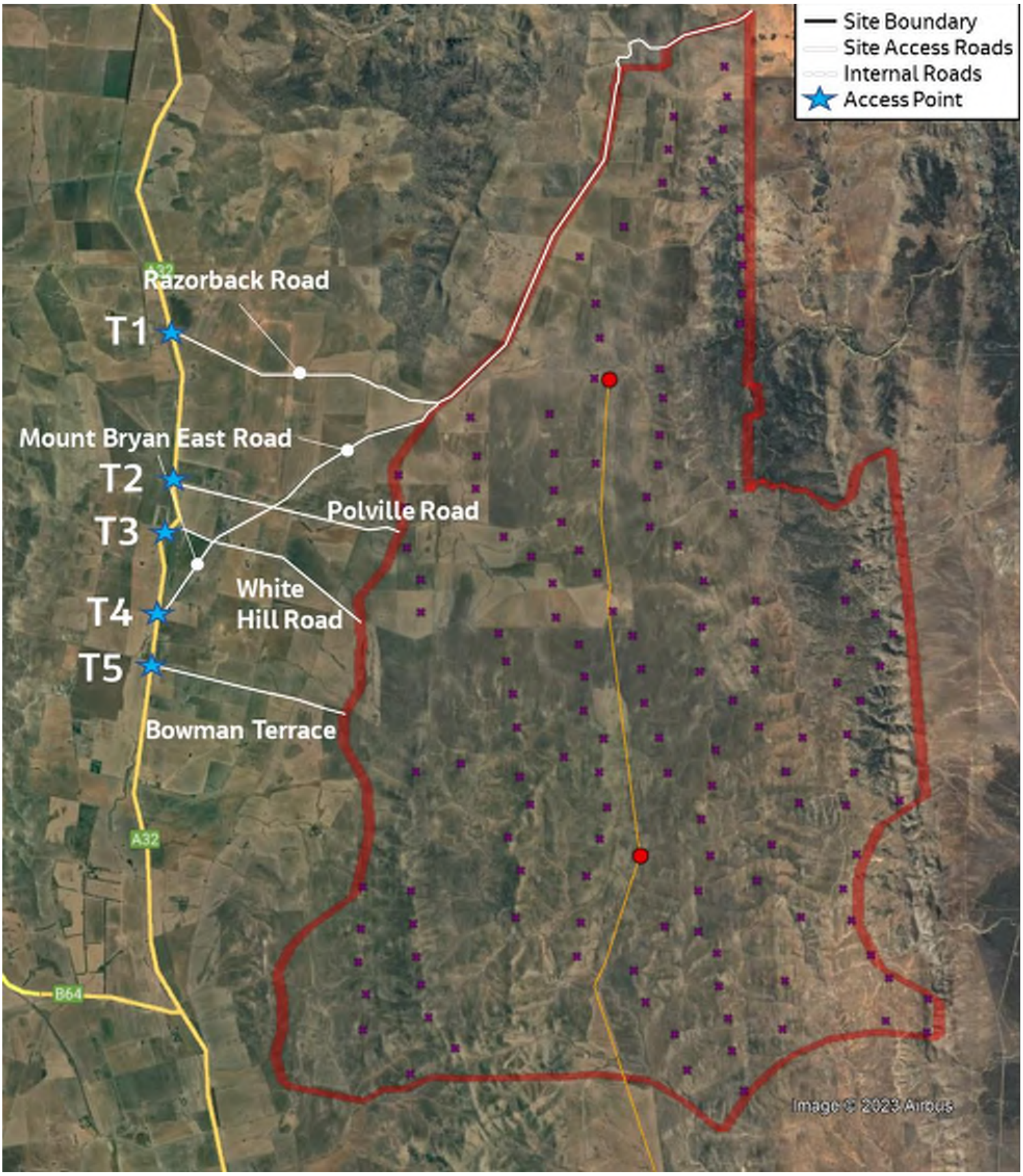


Figure 6-3: Assessed Site Access Points

6.1.3 Access Point T1

This existing access point is at the intersection of Barrier Highway and Razorback Road, with access on the eastern side of the highway. The following figure illustrates the access arrangement.

Figure 6-4: Aerial & Road Level (Looking North) Imagery of Access T1. Credit: Google Earth 2023

At this location, the Barrier Highway has a sealed width of approximately 8.6m, with 3.3m wide lanes, plus unsealed shoulders and a 110km/h speed limit. In the vicinity of the existing intersection, the highway also has continuity line marking permitting overtaking, which commences for 260m north and 720m south of the intersection. The highway also has continuous edge lines along the whole length. Razorback Road has a 10m sealed apron extending from Barrier Highway. Little significant vegetation was observed on the side of the road.

Two-way traffic volume on Barrier Highway in this location is 850vpd, with 24.5% heavy vehicles. There is expected to be additional generated traffic of up to 310 two-way vpd (266 light vehicles, 38 heavy vehicles, 6 OSM vehicles) during the peak of the construction phase. This is a significant increase compared to its existing volumes, but can be accommodated by the current configuration. Table 6-1 below shows the known and assumed movement volumes considered for turn treatment assessment.

Table 6-1: Major road traffic volume (VPD / VPH) and Turn Volumes for Access Point T1.

Existing Vehicles Per Day (VPD)		Assumed Existing Vehicles Per Hour (VPH)		Estimated Construction Vehicles Per Hour (VPH)	Total Vehicles Per Hour (VPH)
850		170		62	232
		Assumed Turn Volumes Per Hour		**Estimated Construction Turn Volumes Per Hour**	**Total Turn Volumes Per Hour**
		9		31	40
Q_{T1}	Q_{T2}	Q_R	Q_L	$Q_{M(R)} = Q_{T1} + Q_{T2} + Q_L$	$Q_{M(L)} = Q_{T2}$
76	76	40	9	161	76

It is assumed that all construction light, heavy and OSM vehicles will approach the T1 access from the south.

Given the total vehicles and turn volumes per hour in the table above, based on the turn warrants outlined in Figure 6 1, it is recommended that the intersection is upgraded to incorporate a basic right turn (BAR) on the Barrier Highway. Should OSOM vehicles be required to travel via Route D3 instead of the preferred Route D1, it is recommended that a basic left turn (BAL) is also installed on the Barrier Highway.

While the intersection of Razorback Road and Barrier Highway is wide, as Razorback Road intersects with Barrier Highway at an acute angle some widening may be required to accommodate OSOM vehicle movements. The extent of any widening will be determined as part of the Traffic Management Plan.

Additional recommendations to improve safety at the access point are as follows:

- Provide 48m unbroken line on both approaches to the intersection to prevent overtaking, with a 10m break at the intersection, as per the DIT Pavement Marking Manual.
- Provide a 50m sealed apron along Razorback Road.

6.1.4 Access Point T2

This existing access point is at the intersection of Barrier Highway and Polville Road, with access on the eastern side of the highway. The following figure illustrates the access arrangement.

Figure 6-5: Aerial & Road Level (Looking North) Imagery of Access T2. Credit: Google Earth 2023

At this location, the Barrier Highway has a sealed width of approximately 9m, with 3.3m wide lanes, plus unsealed shoulders and a 110km/h speed limit. In the vicinity of the existing intersection, the highway also has continuity line marking permitting overtaking, which commences for 1.8km north and 90m south of the intersection. The highway also has continuous edge lines along the whole length. Polville Road is unsealed along its length, extending to the Barrier Highway edge of seal. There are trees on both site on the intersection on the eastern side of Barrier Highway, as well as trees extending along Polville Road.

Two-way traffic volume on Barrier Highway in this location is 850vpd, with 24.5% heavy vehicles. There is expected to be additional generated traffic of up to 310 two-way vpd (266 light vehicles, 38 heavy vehicles, 6 OSM vehicles) during the peak of the construction phase. This is a significant increase compared to its existing volumes, but can be accommodated by the current configuration. Table 6-1 below shows the known and assumed movement volumes considered for turn treatment assessment.

Table 6-2: Major road traffic volume (VPD / VPH) and Turn Volumes for Access Point T2.

Existing Vehicles Per Day (VPD)		Assumed Existing Vehicles Per Hour (VPH)		Estimated Construction Vehicles Per Hour (VPH)	Total Vehicles Per Hour (VPH)
850		170		62	232
		Assumed Turn Volumes Per Hour		**Estimated Construction Turn Volumes Per Hour**	**Total Turn Volumes Per Hour**
		9		31	40
Q_{T1}	**Q_{T2}**	**Q_R**	**Q_L**	**$Q_{M(R)} = Q_{T1} + Q_{T2} + Q_L$**	**$Q_{M(L)} = Q_{T2}$**
76	76	40	9	161	76

It is assumed that all construction light, heavy and OSM vehicles will approach the T2 access from the south.

Given the total vehicles and turn volumes per hour in the table above, based on the turn warrants outlined in Figure 6 1, it is recommended that the intersection is upgraded to incorporate a basic right turn (BAR) on the Barrier Highway. Should OSOM vehicles be required to travel via Route D3 instead of the preferred Route D1, it is recommended that a basic left turn (BAL) is also installed on the Barrier Highway.

Additional recommendations to improve safety at the access point are as follows:

- Provide 48m unbroken line on both approaches to the intersection to prevent overtaking, with a 10m break at the intersection, as per the DIT Pavement Marking Manual.
- Provide a 50m sealed apron along Polville Road.
- Where necessary, trim trees on Polville Road near Barrier Highway intersection to accommodate larger vehicles.

To access the site, at the intersection with Mount Bryan East Road and Old Belcunda Road vehicles can either turn left onto Mount Bryan East Road, or continue straight through the intersection and along Old Belcunda Road. For either route, curve widening or possibly realignment of the Polville Road approach will be required.

To accommodate heavy vehicle movement at the intersection with Mount Bryan East Road and Old Belcunda Road, the Polville Road approach should be realigned to facilitate left turns onto Mount Bryan East Road and through movements onto Old Belcunda Road.

Figure 6-6: Polville Road / White Hill Rd / Old Belcunda Rd realignment. Credit: Google Earth 2023

6.1.5 Access Point T3

This existing access point is at the intersection of Barrier Highway and White Hill Road, with access on the eastern side of the highway. The following figure illustrates the access arrangement.

Figure 6 2: Aerial & Road Level (Looking North) Imagery of Access T3. Credit: Google Earth 2023

At this location, the Barrier Highway has a sealed width of approximately 9m, with 3.3m wide lanes, plus unsealed shoulders and a 110km/h speed limit. The intersection is located on a reverse curve and overtaking is not permitted, but solid centre line marking to the north and south. The highway also has continuous edge lines along the whole length. White Hill Road is unsealed along its length, extending to the Barrier Highway edge of seal. Trees are located on the northern side of White Hill Road, near the intersection, but they are anticipated to have minimal impact on sightlines.

Two-way traffic volume on Barrier Highway in this location is 850vpd, with 24.5% heavy vehicles. There is expected to be additional generated traffic of up to 310 two-way vpd (266 light vehicles, 38 heavy vehicles, 6 OSM vehicles) during the peak of the construction phase. This is a significant increase compared to its existing volumes, but can be accommodated by the current configuration. Table 6-1 below shows the known and assumed movement volumes considered for turn treatment assessment.

Table 6-3: Major road traffic volume (VPD / VPH) and Turn Volumes for Access Point T3.

Existing Vehicles Per Day (VPD)		Assumed Existing Vehicles Per Hour (VPH)		Estimated Construction Vehicles Per Hour (VPH)	Total Vehicles Per Hour (VPH)
850		170		62	232
		Assumed Turn Volumes Per Hour		**Estimated Construction Turn Volumes Per Hour**	**Total Turn Volumes Per Hour**
		9		31	40
Q_{T1}	**Q_{T2}**	**Q_R**	**Q_L**	**$Q_{M(R)} = Q_{T1} + Q_{T2} + Q_L$**	**$Q_{M(L)} = Q_{T2}$**
76	76	40	9	161	76

It is assumed that all construction light, heavy and OSM vehicles will approach the T3 access from the south.

Given the total vehicles and turn volumes per hour in the table above, based on the turn warrants outlined in Figure 6 1, it is recommended that the intersection is upgraded to incorporate a basic right turn (BAR) on the Barrier Highway.

Should OSOM vehicles be required to travel via Route D3 instead of the preferred Route D1, it is recommended that a basic left turn (BAL) is also installed on the Barrier Highway. In addition, it is anticipated that significant curve widening or complete intersection realignment including tree removal would be required to support OSOM vehicle access from the north. The extent of any widening will be determined as part of the Traffic Management Plan.

Additional recommendations to improve safety at the access point are as follows:

- Provide a 50m sealed apron along White Hill Road.
- Where necessary, trim trees on White Hill Road near Barrier Highway intersection to accommodate larger vehicles.

It is noted that within the site, White Hill Road forms the northern boundary of Mokota Conservation Park, which may limit road widening or realignment options.

The Mawson Trail follows White Hill Road for approximately 675m from the intersection with Lines Road / Back Road to the site boundary and crosses the site from east to west along White Hill Road. Due to the likely higher volumes of walkers and bike riders on the Trail, additional safety management may be required to ensure the safety of all Trail users.

6.1.6 Access Point T4

This existing access point is at the intersection of Barrier Highway and Mount Bryan Road East, with access on the eastern side of the highway. The following figure illustrates the access arrangement.

Figure 6 2: Aerial & Road Level (Looking North) Imagery of Access T4. Credit: Google Earth 2023

At this location, the Barrier Highway has a sealed width of approximately 9.5m, with 3.3m wide lanes, plus unsealed shoulders and a 110km/h speed limit. In the vicinity of the existing intersection, the highway also has continuity line marking permitting overtaking, which commences for 870m north and 300m south (to the Mount Bryan township) of the intersection. The highway also has continuous edge lines along the whole length. Razorback Road has a 10m sealed apron extending from Barrier Highway. Little significant vegetation was observed on the side of the road.

Two-way traffic volume on Barrier Highway in this location is 850vpd, with 24.5% heavy vehicles. There is expected to be additional generated traffic of up to 310 two-way vpd (266 light vehicles, 38 heavy vehicles, 6 OSM vehicles) during the peak of the construction phase. This is a significant increase compared to its existing volumes, but can be accommodated by the current configuration. Table 6-1 below shows the known and assumed movement volumes considered for turn treatment assessment.

Table 6-4: Major road traffic volume (VPD / VPH) and Turn Volumes for Access Point T4.

Existing Vehicles Per Day (VPD)		Assumed Existing Vehicles Per Hour (VPH)		Estimated Construction Vehicles Per Hour (VPH)	Total Vehicles Per Hour (VPH)
850		170		62	232
		Assumed Turn Volumes Per Hour		**Estimated Construction Turn Volumes Per Hour**	**Total Turn Volumes Per Hour**
		9		31	40
Q_{T1}	Q_{T2}	Q_R	Q_L	$Q_{M(R)} = Q_{T1} + Q_{T2} + Q_L$	$Q_{M(L)} = Q_{T2}$
76	76	40	9	161	76

It is assumed that all construction light, heavy and OSM vehicles will approach the T4 access from the south.

Given the total vehicles and turn volumes per hour in the table above, based on the turn warrants outlined in Figure 6 1, it is recommended that the intersection is upgraded to incorporate a basic right turn (BAR) on the Barrier Highway.

Culvert and access widening, as well as possible road realignment may be required to accommodate restricted access and OSOM vehicle movement. The extent of any widening will be determined as part of the Traffic Management Plan.

Figure 6 2: Barrier Highway / White Hill Road realignment. Credit: Google Earth 2023

Should OSOM vehicles be required to travel via Route D3 instead of the preferred Route D1, it is recommended that a basic left turn (BAL) is also installed on the Barrier Highway. In addition, it is anticipated that significant curve widening or complete intersection realignment including tree removal would be required to support OSOM vehicle access from the north. The extent of any widening will be determined as part of the Traffic Management Plan.

Additional recommendations to improve safety at the access point are as follows:

- Provide 48m unbroken line on both approaches to the intersection to prevent overtaking, with a 10m break at the intersection, as per the DIT Pavement Marking Manual.
- Provide a 50m sealed apron along Mount Bryan Road East.

6.1.7 Access Point T5

This existing access point is at the intersection of Barrier Highway and Bowman Terrace / Gum Hill Road, with access on the eastern side of the highway. The access is immediately to the south of the Mount Bryan township. Due to the proximity to the township, Access T5 is recommended for use by general access (up to a 19m semi) vehicles only, with restricted access and OSOM vehicles using an alternative route. The following figure illustrates the access arrangement.

Figure 6 2: Aerial & Road Level (Looking North) Imagery of Access T5. Credit: Google Earth 2023

At this location, the Barrier Highway has a sealed width of approximately 10.5m, with 3.3m wide lanes, plus unsealed shoulders and a 60km/h speed limit. The intersection has solid centre line marking to the north and south, with overtaking not permitted. The highway also has continuous edge lines along the whole length. Bowman Terrace is sealed for 320m from Barrier Highway, as far as the intersection with Goode Terrace. Little significant vegetation was observed on the side of the road.

Two-way traffic volume on Barrier Highway in this location is 850vpd, with 24.5% heavy vehicles. There is expected to be additional generated traffic of up to 310 two-way vpd (266 light vehicles, 38 heavy vehicles, with all HVs assumed to be general access to provide a conservative analysis) during the peak of the construction phase. This is a significant increase compared to its existing volumes, but can be accommodated by the current configuration. Table 6-1 below shows the known and assumed movement volumes considered for turn treatment assessment.

Table 6-5: Major road traffic volume (VPD / VPH) and Turn Volumes for Access Point T5.

Existing Vehicles Per Day (VPD)		Assumed Existing Vehicles Per Hour (VPH)		Estimated Construction Vehicles Per Hour (VPH)	Total Vehicles Per Hour (VPH)
850		170		62	232
		Assumed Turn Volumes Per Hour		**Estimated Construction Turn Volumes Per Hour**	**Total Turn Volumes Per Hour**
		9		31	40
Q_{T1}	**Q_{T2}**	**Q_R**	**Q_L**	**$Q_{M(R)} = Q_{T1} + Q_{T2} + Q_L$**	**$Q_{M(L)} = Q_{T2}$**
76	76	40	9	161	76

It is assumed that all construction light, heavy vehicles will approach the T5 access from the south. OSOM vehicles will use an alternative access point.

Additional recommendations to improve safety at the access point are as follows:

- Where necessary, trim trees on Bowman Terrace to accommodate larger vehicles.

Given the location of the intersection within the Mount Bryan township, the current arrangement is considered sufficient to accommodate construction traffic. However, given the other access points are suitable for general construction traffic and OSOM vehicles, and are therefore more appropriate access points, this site access point is not recommended for use.

6.1.8 Access Point T6

This existing access point is at the intersection of Worlds End Highway and Powerline Road, with access on the eastern side of the highway. This access will provide access to the Bundey Batteries only. Access T6 is recommended for use by general access (up to a 19m semi) vehicles only. The following figure illustrates the access arrangement.

Figure 6 2: Aerial & Road Level (Looking North) Imagery of Access T6. Credit: Google Earth 2024

At this location, the Worlds End Highway has a sealed width of approximately 8m, with 3.5m wide lanes, plus unsealed shoulders and a 110km/h speed limit. The intersection has double one-way centreline marking to the north and south, with overtaking permitted for northbound vehicles. The highway also has continuous edge lines along the whole length.

Two-way traffic volume on Worlds End Highway in this location is 170vpd, with 22.5% heavy vehicles.

There is expected to be additional generated traffic of up to 40 two-way vpd (36 light vehicles, 4 heavy vehicles, with all HVs assumed to be general access to provide a conservative analysis) during the peak of the construction phase. as through and turning volumes are relatively low, it is considered that site vehicles can be accommodated by the current intersection configuration. A turn volume assessment has not been undertaken as the existing traffic and the traffic generated is relatively low.

It is assumed that all construction light, heavy vehicles will approach the T6 access from the south.

The current arrangement is considered sufficient to accommodate construction traffic and is recommended for use to access the Bundey Batteries.

6.1.9 Site Access Assessment Outcomes

Access to the Goyder North development is proposed via four access points (T1 – T4) located along Barrier Highway.

- Access points T1, T2 and T4 are considered suitable for all vehicle types, including OSOM vehicles.
- Access point T3 is considered suitable for all vehicle types, but with gazetted and OSOM vehicles approaching from the south only.
- Access point T5 is considered suitable for general access vehicles only, due to the proximity to Mount Bryan. However, it is not recommended as a site access point for the project given the other site access points are more suited.

Access Point T6, which provides access to the Bundey Batteries, is considered sufficient to accommodate construction traffic in its current arrangement.

The access points have been ranked based on the assessment, in order of preference of suitability as an access point, with consideration existing conditions and minimising requirements for upgrading.

1. **Access Point T1 Razorback Road –** Razorback Road provides a wide intersection footprint to allow OSOM vehicle movements, particular for vehicles from the North. There are also minimal constraints (e.g. environmental) from the Barrier Highway to the site.
2. **Access Point T2 Polville Road –** Polville Road provides a wide intersection footprint to allow OSOM vehicle movements. However, there is a stobie pole at the intersection which may require re-locating, and trees which would likely require trimming. Some intersection re-alignment may also be required where Polville Road meets White Hill Road. If it is determined that Stobie pole relocation is required, then it is recommended that Polville Road is replaced by an alternative route.
3. **Access Point T4 Mount Bryan East Road –** Mount Bryan East Road has no vegetation constraints and the road to the site is straight and in good condition. However, culvert and access widening might be required, and complete intersection re-alignment may be needed if vehicles are coming from the North.
4. **Access Point T3 White Hill Road –** White Hill Road will require significant curve widening or complete intersection realignment including tree removal to support OSOM vehicle access from the north. Upgrades would likely not be required for vehicle access from the south.

It is recommended to have at least two access points from the Barrier Highway for the whole duration of the construction phase as a back-up in the event one access becomes unusable. For example, due to natural weather events or vehicle breakdowns on the access road. Based on the above ranking, T1 is nominated as the preferred access point, with T2 as preferred back-up.

6.2 Designated Routes Assessment and Recommended Upgrades

A summary of the gazetted levels of the three routes (D1, D2 and D3) proposed in Section 3.4 are listed in Table 6-6 below.

Table 6-6: Maximum gazetted PBS Level along the highways and roads for routes D1, D2 and D3

	Northern Expressway	Horrocks Highway	Barrier Highway (S of Burra)	Copperhouse Road	Barrier Highway (N of Burra)
D1	3A	3A	3A	3A	3A
	Northern Expressway	**Thiele Highway**	**Worlds End Highway**	**Goyder Highway**	**Barrier Highway (N of Burra)**
D2	3A	2B	2A	3A	3A
	Northern Expressway	**Princes Highway**	**Wilkins Highway**	**Jamestown Bypass***	**Barrier Highway**
D3	3A	3A	3A	3A	3A

**Jamestown Bypass includes the following roads, Appila Road, Boundary Road, Mannanarie Road, Od5 Road.*

Due to the existing limitations mentioned in the existing conditions and the lower gazetted levels of roads along Route D2, it is recommended that Routes D1 and D3 are used as the route for over size and over mass vehicles.

All routes will be suitable for other traffic and transport movements during the project lifespan, provided that the vehicles meet the routes gazetted level.

As routes D1 and D3 will be used for the over size and over mass vehicles, it requires an investigation and assessment into the existing conditions to determine whether the route can accommodate those vehicles or whether any upgrades are recommended. The investigation and assessment focuses on the segments along the route where the over size and over mass vehicle movements may face geometry constraints and other potential impediments.

6.2.1 Vertical Clearances

6.2.1.1 Designated Routes D1, D2, D3a

Northern Connector & Northern Expressway

Along these routes there are several bridge structures as identified in Section 3.4. The minimum vertical clearance of these bridge structures is 5.3m. OSOM movements using these routes must not exceed this vertical clearance and therefore must have a height of lower than a combined 5.3m trailer and component height.

6.2.1.2 Designated Route D3b

Salisbury Highway & Port Wakefield Road

At the start of this route there is a bridge structure as identified in Section 3.4. The vertical clearance of this bridge structure is 7.2m.

Port Wakefield Overpass, Princes Highway / Copper Coast Highway intersection

Along this route is the intersection of the Princes Highway, which is located approximately 2km north of Port Wakefield. This intersection was upgraded under the 'Port Wakefield Overpass & Highway Duplication Project. This upgrade included a new two-lane overpass for traffic travelling southbound from the Copper Coast Highway to Port Wakefield, and for traffic travelling southbound along the Princes Highway to the Copper Coast Highway. The Princes Highway upgrade was completed in December 2021. With the new overpass built over the Princes Highway, the vehicles transporting wind turbine components will be required to travel underneath the overpass. The vertical clearance of the overpass is 7.5m.

OSOM movements using this route must not exceed this vertical clearance and therefore must have a height of lower than a combined 7.2m trailer and component height.

6.2.1.3 Vertical Clearance Summary

The OSOM movements of components must not exceed the vertical clearance heights for the respective routes above. That is, 5.3m for Designated Routes D1, D2, and D3a, and 7.2m for Designated Route D3b.

As listed in Section 4.2, most over-size components have a height of approximately 4-5m, with the largest component height listed at 6.0m.

It is again noted that these dimensions are considered the maximum expected dimensions to be used and therefore provide a conservative assessment.

The TMP for Goyder South showed a platform trailer height of approximately 1m. The maximum height of the wind turbine component used in this assessment is 6.0m for a tower section. This gives a 7.0m combined height, which is under the 7.2m vertical clearance. However, this gives a minimal clearance buffer.

Following confirmation of the component dimensions, the vertical clearance should be confirmed for the larger height components. While based on available information it is not anticipated that trailer and component heights will exceed the available vertical clearance of the assessed routes, in the event that the combined trailer and component height exceeds the currently specified maximum height, another route may need to be considered as part of a detailed traffic management plan.

6.2.2 Designated Route D1

Barrier Highway and Horrocks Highway Intersection

The intersection of the Horrocks Highway and Barrier Highway provides the link for vehicles travelling to the development area. Figure 6-7 below shows screenshot from Google Maps (2014) of the Intersection.

Figure 6-7: Barrier Highway and Horrocks Highway intersection, looking north along the Barrier Highway.

Both highways are relatively straight and flat, therefore there is a clear sight distance for vehicles driving in all directions. There is an existing approximate 150m dedicated right-turn lane for vehicles turning from Horrocks Highway onto the Barrier Highway. Travelling from the Barrier Highway onto Horrocks Highway, there is an approximate 250m left slip lane which merges onto the Horrocks Highway. Due to geometry constraints, there is no left-turn from the Horrocks Highway onto the Barrier Highway, and no right-turn from Barrier Highway onto the Horrocks Highway. The maximum gazetted vehicle size permitted through this intersection is a 36.5m Road Train (PBS Level 3A).

Noting the movement for over size vehicles to the proposed development occurs between Horrocks Highway south and Barrier Highway, the alignment of the intersection geometry is forgiving in the form of an obtuse angle, which should enable over-sized vehicles to undertaken this turn movement through the intersection under escort / traffic control without need for intersection upgrade works.

Upgrades to this intersection are not recommended due to the following:

- Current gazetted level – PBS Level 3A.
- The existing turn treatments and sight distances are sufficient to safely accommodate the construction and residential traffic during the project.
- The intersection geometry for the turn movement is forgiving, which should enable over-sized vehicles to undertaken this turn movement through the intersection under escort / traffic control without need for intersection upgrade works.

Copperhouse Road and Barrier Highway Intersection

The intersection of Copperhouse Road and Barrier Highway provides the link to the bypass of Burra. Figure 6-8 below shows pictures taken in May of 2019.

Figure 6-8: Copperhouse Road and Barrier Highway intersection, looking east along the Barrier Highway.

At this location, the Barrier Highway has a sealed width (including slip lane) of approximately 14m, with 3.7m wide lanes and sealed shoulders and a 110 km/h speed limit applies. Barrier Highway at this location also has double two-way barrier lines. Copperhouse Road has a sealed width of approximately 8m, with 3.5m wide lanes and sealed shoulders and a 110km/h speed limit applies. The road also has double two-way barrier lines. Both Barrier Highway and Copperhouse Road are straight and flat, therefore there is a clear sight distance for vehicles driving in either direction, which is more than adequate to meet the minimum requirement of 279m.

There are currently existing turning treatments at this intersection for all turns. There is 3.7m slip lane for the left-turn from Barrier Highway onto Copperhouse Road. There is an approximate 2m wide sealed shoulder for vehicles passing other vehicles which are performing a right-turn from Barrier Highway to Copperhouse Road. There is also a give-way line and a sealed shoulder with chevrons for the left-turn from Copperhouse Road onto Barrier Highway.

Upgrades to this intersection are not recommended as the existing turn treatments (upgraded in 2019) and sight distances are sufficient to safely accommodate the construction and passing by traffic during the project. The TMP for Goyder South did not identify any issues for the movement of OSOM vehicles at this location.

6.2.3 Designated Route D3

Princes Highway / Wilkins Highway

The intersection of the Princes Highway and Wilkins Highway provides the link for vehicles transporting wind turbine components to the site. Figure 6-9 below shows the Intersection.

Figure 6-9: Princes Highway and Wilkins Highway intersection, looking south along the Princes Highway.

At this location, the Princes Highway has a sealed width of approximately 15m, with 4m wide lanes and sealed shoulders and a 110km/h speed limit applies. The highway at this location also has chevron marking and double two-way barrier lines. The Wilkins Highway has a sealed width of approximately 10m, with 3.7m wide lanes and sealed shoulders and a 110km/h speed limit. The Wilkins Highway also has a single barrier line. The highways are relatively straight and flat, with sight distances more than adequate to meet the minimum requirement of 279m. There are currently channelised turn treatments for all movements at the intersection. As noted previously, the movements at this intersection form part of the OSM Routes (4.6m Wide up to 93.5t Low Loader and 6 Axle Crane Network) and PBS Route (Level 3A).

The intersection geometry is forgiving in that it is flat, wide and relatively barren of vegetation. The TMP for Goyder South did not identify any issues for the movement of OSOM vehicles at this location.

Wilkins Highway (Gladstone)

The Wilkins Highway provides one of the main links for vehicles transporting wind turbine components to the site. The location shown in Figure 6-10 below is a section of the Wilkins Highway which passes through Gladstone with a roundabout and significant curves on the outer edge of Gladstone.

Figure 6-10: Roundabout and bends in the road along the Wilkins Highway on the outer edge of Gladstone.

It is likely that an over-sized vehicle may require to traverse the annulus (outer edge) of the roundabout, which is flat and close to the road level. It is also likely that an over-sized vehicle may require the full width of the roadway to navigate the bends. Swept path analysis undertaken as part of the TMP for Goyder South concluded that OSOM vehicles can travel through this section of the Wilkins Highway without any modifications, but did note that tree trimming may be required to facilitate the over-size movements.

Wilkins Highway (Caltowie)

The Wilkins Highway provides one of the main links for vehicles transporting wind turbine components to the site. The location shown in Figure 6-11 below is a section of the Wilkins Highway in Caltowie, that intersects with Laura-Caltowie Road.

Figure 6-11: Turn on the Wilkins Highway in Caltowie, looking west along the Wilkins Highway

At this location, the Wilkins Highway has a sealed width of approximately 10m, with 3.7m wide lanes and sealed shoulders and a 60m/h speed limit applies. The highways are straight and flat, with sight distances more than adequate to meet the minimum requirement of 279m. There is a channelised left-turn from the Wilkins Highway (East) to the Wilkins Highway (South-West). As noted previously, this route forms part of the OSM Routes (4.6m Wide up to 93.5t Low Loader and 4 Axle Crane Network) and PBS Route (Level 3A).

The intersection geometry is forgiving in that it is flat, wide and relatively barren of vegetation, which should enable the OSOM vehicles to take a wide berth under escort to safely travel through the intersection. The movement may require the full width of the roadway to navigate this turn. The TMP for Goyder South did not identify any issues for the movement of OSOM vehicles at this location.

Jamestown Bypass

The Jamestown Bypass (Figure 6-12) is a designated heavy vehicle bypass of Jamestown. It will be used for vehicles transporting wind turbine components to the site, connecting to the Wilkins Highway on both sides of the bypass.

Figure 6-12: Jamestown Bypass

Street view capture (captured between September 2018 and November 2020, sourced from *Mapillary*) and aerial imagery (captured in March 2017, sourced from *Location SA* Viewer) are shown in Table 6-7 below for each of the five intersections.

Table 6-7: Jamestown Bypass Intersection street-view and aerial imagery

Intersection	Street View	Aerial
1 – Wilkins Highway and Appila Road Intersection	 Looking west along the Wilkins Highway	
2 – Appila Road and Boundary Road Intersection	 Looking north along Appila Road	
3 – Boundary Road and Mannanarie Road Intersection	 Looking north along Mannanarie Road	

4 – Mannanarie Road and Od5 Road Intersection	 Looking south along Mannanarie Road	
5 – Od5 Road and Wilkins Highway Intersection	 Looking west along Wilkins Highway	

Speed limits along the bypass range from 60km/h to 100km/h depending on the road. All roads of the bypass have are sealed. As noted previously, this bypass forms part of the OSM Routes (4.6m Wide up to 93.5t Low Loader and 4 Axle Crane Network) and PBS Route (Level 3A).

Swept path analysis undertaken as part of the TMP for Goyder South concluded that OSOM vehicles can negotiate the Jamestown Bypass without any modifications, but did note that tree trimming may be required to facilitate the over-size movements.

It is noted that the continuation of the Wilkins Highway through Jamestown is relatively straight, except for where it intersects R M Williams Way. The route through this section of the highway, rather than the bypass, has not been assessed for the following reasons:

- The Jamestown Bypass is a designated Heavy Vehicle Bypass, with a higher gazetted level (PBS Level 3A) compared to the section of the highway through Jamestown (PBS Level 2A).
- The bypass is a preferable route due to the safety concerns associated with transporting the wind turbine components.
- The bypass is also a preferable route due to the amenity impact the OSM movements will have on Jamestown.

7. Traffic Impact Assessment and Recommended Upgrades

7.1 Site Accessibility

The assessment of the existing road conditions in the Goyder North development area has identified three routes that provide access to the development area. These routes are:

- Designated Route 1 (D1): Northern Connector – Northern Expressway – Sturt Highway – Horrocks Highway – Barrier Highway – Copperhouse Road (Burra bypass) – Goyder Highway – Barrier Highway
- Designated Route 2 (D2): Northern Connector – Northern Expressway – Sturt Highway – Horrocks Highway – Thiele Highway – East Terrace (bypass of Kapunda) – Thiele Highway – Three Chain Road (bypass of Eudunda) – Worlds End Highway – Goyder Highway – Barrier Highway
- Designated Route 3a (D3a): Northern Connector – Princes Highway – Wilkins Highway – Jamestown Bypass – Wilkins Highway – Barrier Highway
- Designated Route 3b (D3b): Salisbury Highway – Port Wakefield Road – Princes Highway – Wilkins Highway – Jamestown Bypass – Wilkins Highway – Barrier Highway

There are road geometry and road condition issues Route D2 which pose limitations to the transport of the oversize wind turbine components. For this reason, the following recommendations have been made for the routes:

- Route D1: Proposed to be used for the transport of OSOM vehicles, up to the vertical clearance limits identified, as well as currently gazetted vehicles.
- Route D2: Proposed to be suitable for use solely by currently gazetted vehicles.
- Route D3a: Proposed to be used for the transport of OSOM vehicles, up to the vertical clearance limits identified, as well as currently gazetted vehicles.
- Route D3b: Proposed to be used for the transport of OSOM vehicles, up to the vertical clearance limits identified, as well as currently gazetted vehicles.

Route D1 is the preferred route, with Route D3 to serve as an alternative route in the event that Route D1 cannot be used by any or all of the development vehicle types.

7.2 Transportation Impacts

The assessment of the impacts the increased traffic movements will have on the road network identified that the principal issues will be during the construction phase. This is due to the delivery of OSOM equipment, and the high number of construction vehicle movements. The traffic generated during the operational and maintenance phase will be minimal compared to the existing traffic movement volumes on the road network.

To ensure the transportation impacts on the road network, adjacent towns and local residents are minimised, it is recommended that a specific Traffic Management Plan (TMP) is developed to coordinate between the transport contractor programs. A TMP should be developed in consultation with DIT and local councils to ensure all road safety and traffic issues are addressed and the impacts to the local communities and road users are minimised. The TMP should include:

- Specified delivery periods, routes and access points to the development area for all equipment and materials supplied.
- Designated warning signage, appropriate controls and procedures to address potential traffic impacts and to ensure vehicles use the designated routes.
- Controls to inform road users and local communities of the changed traffic conditions.

7.3 Intersection Improvements

It is recommended that at least two of the following four access point upgrades are undertaken to accommodate construction traffic and to facilitate restricted access and OSOM vehicle movement. Two access points are required to have a back-up in the event one access becomes unusable. For example, due to natural weather events or vehicle breakdowns on the access road. Based on the below ranking, T1 is nominated as the preferred access point, with T2 as preferred back-up.

The access points are listed below in order from highest to lowest ranked access point.

Access Point T1 Razorback Road

- Full basic right turn (BAR) treatment on the Barrier Highway.
- 48m unbroken line on both Barrier Highway approaches, with a 10m break at the intersection.
- 50m sealed apron along Razorback Road.
- If OSOM vehicles are required to travel via Route D3: basic left turn (BAL) treatment on the Barrier Highway.
- Widening accommodate OSOM vehicle movements to be determined as part of the Traffic Management Plan.

Access Point T2 Polville Road

- Full basic right turn (BAR) treatment on the Barrier Highway.
- 48m unbroken line on both Barrier Highway approaches, with a 10m break at the intersection.
- 50m sealed apron along Polville Road.
- Tree trimming on Polville Road near Barrier Highway intersection to accommodate larger vehicles.
- If OSOM vehicles are required to travel via Route D3: basic left turn (BAL) treatment on the Barrier Highway.
- Widening accommodate OSOM vehicle movements to be determined as part of the Traffic Management Plan.

Access Point T4 Mount Bryan Road East

- Full basic right turn (BAR) treatment on the Barrier Highway.
- Culvert and access widening on Mount Bryan Road East, as well as possible road realignment to accommodate OSOM vehicle movement.
- 48m unbroken line on both Barrier Highway approaches, with a 10m break at the intersection.
- 50m sealed apron along Mount Bryan Road East.
- If OSOM vehicles are required to travel via Route D3: basic left turn (BAL) treatment on the Barrier Highway, plus curve widening or complete intersection realignment including tree removal.
- Widening accommodate OSOM vehicle movements to be determined as part of the Traffic Management Plan.

Access Point T3 White Hill Road

- Full basic right turn (BAR) treatment on the Barrier Highway.
- 50m sealed apron along White Hill Road.
- Tree trimming on White Hill Road near Barrier Highway intersection to accommodate larger vehicles.
- If OSOM vehicles are required to travel via Route D3: basic left turn (BAL) treatment on the Barrier Highway, plus curve widening or complete intersection realignment including tree removal.
- Widening accommodate OSOM vehicle movements to be determined as part of the Traffic Management Plan.

The following upgrade is required if Access Point T2 is to be used as an OSOM access.

Polville Road / Mount Bryan East Road / Old Belcunda Road intersection

- Realign Polville Road approach to the intersection to facilitate left turns onto Mount Bryan East Road and through movements onto Old Belcunda Road.

8. Conclusions

The traffic and transport issues arising from the proposed Goyder North development will impact the local community surrounding the proposed site and the through traffic along the surrounding highways. This impact will be primarily during the construction phase where there will be a large number of vehicle movements within a short period of time compared to the operational phase.

Through adopting the specified site access routes, implementing the required and recommended upgrades discussed in Section 6 and implementing the management and mitigation measures discussed in Section 7, the traffic impacts associated with the additional construction vehicle movements should be minimised and the current level of road safety should not be compromised.

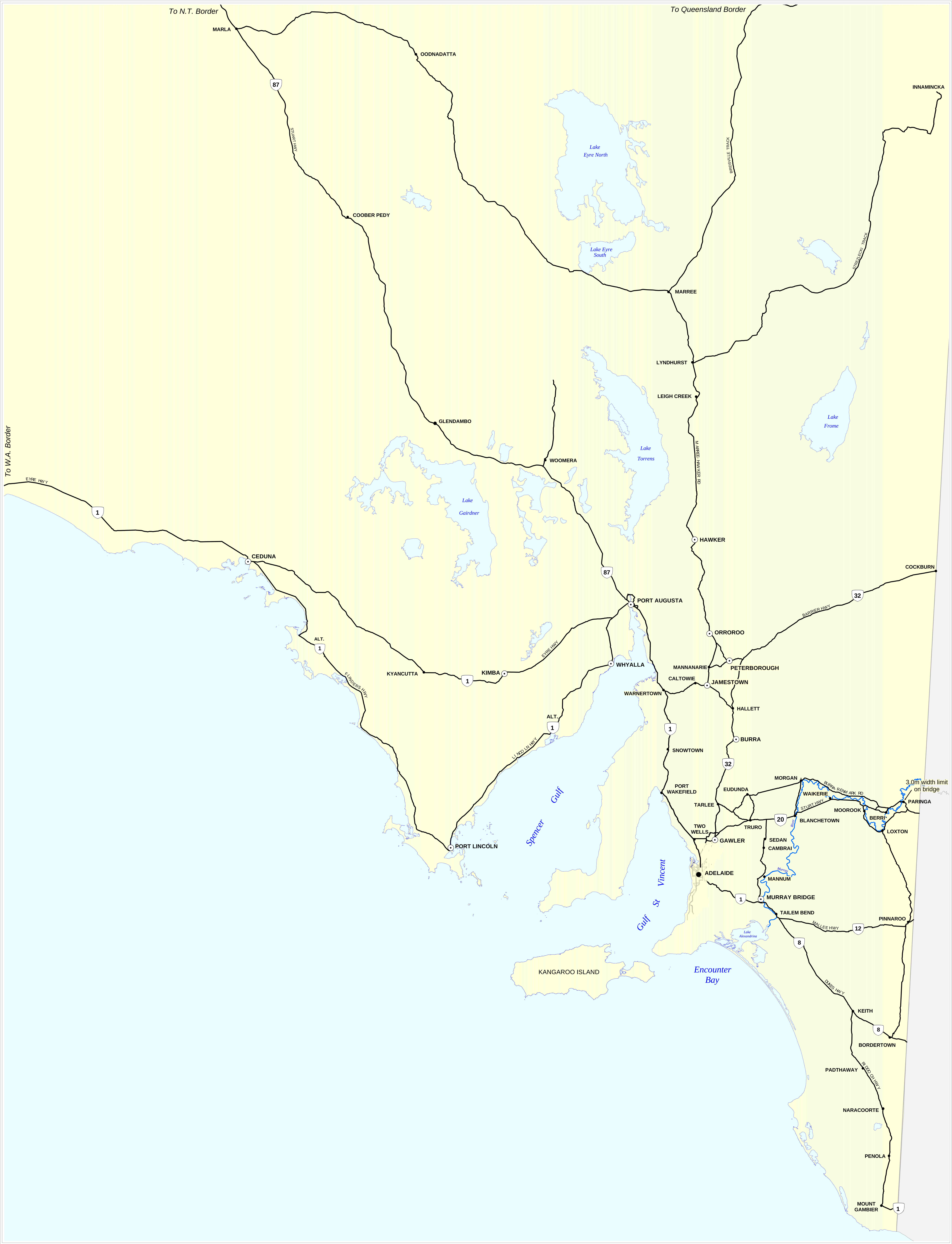
Traffic impact can be minimised by providing adequate notification to the local community, restricting OSM vehicle deliveries to off-peak times where practical, and employment of appropriate traffic control.

A detailed Traffic Management Plan (TMP) will need to be prepared in consultation with DIT and Council prior to construction to ensure that the overall impact and disturbance to infrastructure and other road users is minimal.

Based on the assessment undertaken for the proposed Goyder North project, the following conclusions are reached:

- Route D1, via Horrocks Highway and Barrier Highway, is the preferred route for all construction traffic, including restricted access and OSOM vehicles, up to the vertical clearance limits. In the event of Route D1 being unavailable or not suitable for OSOM vehicles, Route D3 is the recommended alternative. Route D2 is recommended for use by vehicles up to the current gazetted limits only.
- When final component dimensions have been confirmed, conformance with available bridge clearance on the assessed routes will need to be verified.
- It is proposed to use at least two of the assessed four existing site access points via rural access roads to access the site from the State controlled road, with intersection upgrades proposed where necessary to accommodate vehicle movements. T1 has been nominated as the preferred site access point, with T2 as the preferred back-up.
- The access points (T1 – T4) are considered suitable for use by all construction vehicle types, including restricted access and OSOM vehicles.
- The access points were ranked regarding suitability as an access and the scale of upgrades required to be used as an access. The rankings were, from highest to lowest, T1, T2, T4, T3.
- Recommendations for turning treatment upgrades at intersections have been provided to improve the efficiency and safety of traffic movement, due to the large number of turning vehicle movements in the construction phase.
- Access Point T6, which provides access to the Bundey Batteries, is considered sufficient to accommodate construction traffic in its current arrangement.
- There will be a substantial increase in heavy vehicle traffic during the construction stages of the project, however existing traffic volumes surrounding the project area are relatively low. There is a risk of surrounding drivers unexpectedly encountering slow-moving vehicles. Signs warning drivers to expect slow moving traffic should be considered as part of the TMP to manage this risk.
- Due to the greatly reduced traffic generation during the operational phase of the project, no significant operational traffic impacts have been identified in addition to construction stage impacts.
- The lifespan of the technology associated with the project is approximately 30 years. Towards the end of this lifespan a decision will be made either for decommissioning or renewal. In either instance another assessment of traffic impacts will be required (and in the case of renewal, as part of a full DA).
- Permits will need to be obtained from NHVR and DIT for all vehicles transporting equipment and materials to the site which are outside the mass and size limits of current gazetted highways and roads specified in the document.

Appendix A. DIT Designated Principal Routes for Overdimensional Loads



For Overdimensional Load Routes within the Metropolitan Area see Adelaide maps.

Produced by Transport Information Management Section October 2003

PRINCIPAL ROUTES FOR OVERDIMENSIONAL LOADS

TRANSPORT SA
For details of Designated Routes at Towns indicated by ⊙ see separate towns map

Government of South Australia

TRANSPORT SA

Appendix B. Goyder South Route Assessment

www.aresgroup.com.au

www.aresgroup.com.au

Goyder South

Transport Management Plan

Prepared: December 2021
Client: GE Renewables

Silverton WF

Silverton WF is located 600 klms from the Port of Entry and had several challenges, including gradients in excess of 25 degrees.

Goyder South

Transport Management Plan

"

The Goyder region is home to some of the best wind and solar resources in the country."

– Goyder Renewables Zone website

Table of Contents

Introduction

The Goyder South Hybrid Energy Facility is a proposed renewable energy development located in South Australia. The Project has received development approval and will be built in stages, with Stage 1 to include 38 wind turbine generators (WTGs).

The Project is located in the Goyder Regional Council LGA – approximately 20km south of the town of Burra and 30km northwest of Robertstown. The nearest Port of Import for turbine components is Adelaide.

Ares have been tasked by **GE Renewables** with writing a Transport Management Plan (TMP) for the oversized WTG components from the Port of Import to site. The purpose of the TMP is to detail the route taken, any constraints or restrictions, proposed timing of deliveries and resources and equipment required.

The contents of this TMP are a proposal only, and subject to approval from the relevant stakeholders and authorities prior to deliveries commencing.


SIZE

01

Overview

Biala WF

Two ARES prime movers transporting a Base Tower Section for the Biala Wind Farm.

Project Overview

Goyder South Stage 1 will consist of 38 WTGs, with blade sections up to 65m long and tower sections 4.3m in diameter and 30m long. Almost 400 oversized loads need delivery from the Port of Adelaide to the site.

Port of Import

The proposed Port of Import (POI) for the Project is Adelaide. The nearest to the wind farm by distance, the port has seen numerous wind farm projects over the last few years, including Silverton and Port Augusta.

Adelaide has excellent break bulk cargo offloading capacity through their common user berths, Berths 18-20 and Berth 29. Storage options at or near the berths are plentiful as shown below. From storage there is good access to the Port River Expressway and then onto the new M2 North-South Motorway.

Port Adelaide berths and storage areas

Site

The Wind Farm is located in the Goyder Regional Council, with the main access point anticipated to be via Porter Lagoon Rd from the west off the Barrier Hwy. The eastern access route via Worlds End Hwy is not to be used for Stage 1 construction.

Designs for the site entrances have not yet been finalized but will need to cater for the swept paths of the longest components, i.e. the blade root sections.

Cargo

The proposed wind turbine generator for the Project is a GE 5.5-158 at 121m hub height. The main oversized components consist of the following:

- Nacelle
- Drivetrain
- Hub
- Blades (3 per turbine, separate root + tip sections)
- Tower Sections (5 per turbine)

The following tables summarize the cargo and overall quantities, weights and dimensions for the Project. This does not include smaller components and shipping containers which can be transported without permits.

Cargo Dimensions

Component	Qty	Length (m)	Width (m)	Height (m)	Weight (t)
Nacelle	38	12.8	4.8	4.2	89.0
Drivetrain	38	7.4	4.0	3.2	79.0
Hub	38	3.5	4.0	3.8	50.0
Blade Root	114	65.4	4.2	3.4	23.3
Tower Base	38	12.6	4.3	4.3	70.2
Tower Mid C	38	19.9	4.3	4.3	73.0
Tower Mid B	38	26.6	4.3	4.3	74.8
Tower Mid A	38	30.0	4.3	4.3	64.7
Tower Top	38	29.7	4.3	4.3	61.6

Pilot and Police Volumes

The below table outlines the volumes of Pilot and Police required for each individual component. They are initial estimates and subject to final approval by the road authorities and SA Police, and do not take into account potential convoying opportunities.

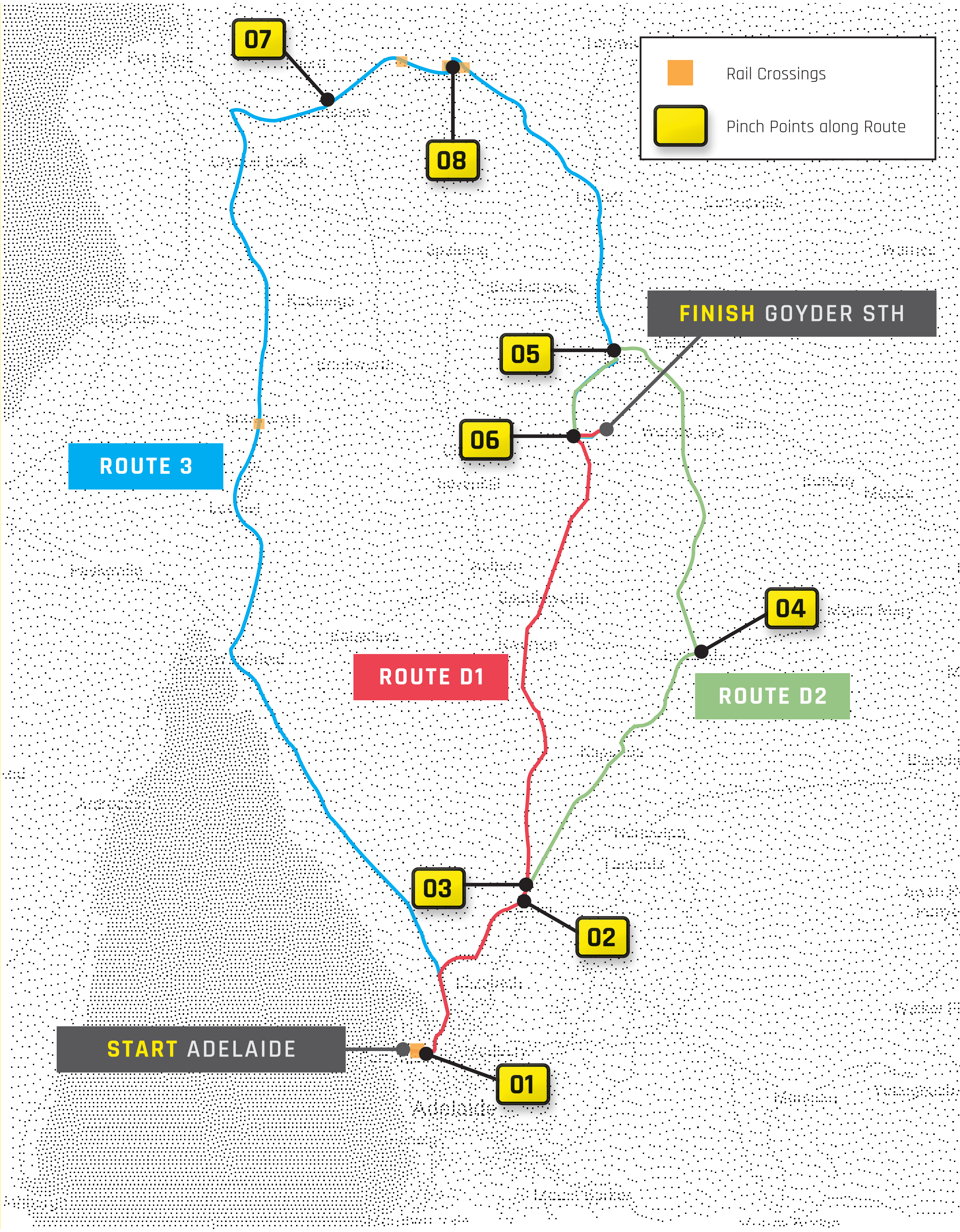
Component	Pilot Vehicles	Police Vehicles
Nacelle	2	0
Drivetrain	2	0
Hub	1	0
Blade	2	2
Tower Base	2	0
Tower Mid C	2	0
Tower Mid B	2	1
Tower Mid A	2	2
Tower Top	2	2

02

Route

Murra Warra WF

Ares transported 6.0m diameter Senvion tower sections for the Murra Warra Stage 1 Wind Farm on our specially designed bookend trailers.



Rail Crossings
Pinch Points along Route
FINISH GOYDER STH
START ADELAIDE
ROUTE 3
ROUTE D1
ROUTE D2
01
02
03
04
05
06
07
08
Adelaide

Route Options

ARES have assessed a total of three routes for the project.

- **Route D1** - Preferred Route for all components
- **Route D2** - Preferred Alternative during Horrocks Hwy roadworks restrictions
- **Route 3** - Alternative route via Jamestown using a state OD route

All three routes are viable for transport of the Goyder South turbine components, with Route D1 preferred due to being the most direct route, and being a Designated Route under the Development Approval (DA).

There are scheduled roadworks on Horrocks Hwy which may prevent its use for OSOM transport for part of the project, hence the assessment of two alternate routes. Route D2 is the preferred alternative due to the shorter travel distance, allowing for a one-day return trip, and also being a Designated Route under the DA.

The Port Wakefield duplication project is currently ongoing and scheduled to finish in 2022. Liaison with DIT is required to confirm if the project will be completed before Goyder transport commences - affects Route 3.

ROUTE D1

	START - Port of Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Parade
1.0 KM	Port River Expressway
4.4 KM	North South Mwy (M2)
42.7 KM	National Hwy (A20)
44.0 KM	Horrocks Hwy
84.4 KM	Barrier Hwy
134.1 KM	Porter Lagoon Rd
139.7 KM	**FINISH - Goyder South**

ROUTE D2

	START - Port of Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Parade
1.0 KM	Port River Expressway
4.4 KM	North South Mwy (M2)
42.7 KM	National Hwy (A20)
44.0 KM	Horrocks Hwy
44.9 KM	Thiele Hwy
72.6 KM	East Tce
76.3 KM	Thiele Hwy
101.3 KM	3 Chains Rd
104.1 KM	Worlds End Hwy
123.4 KM	Bower Rd/East Rd
124.7 KM	Worlds End Hwy
153.7 KM	Goyder Hwy
170.3 KM	West St/Copperhouse St
174.3 KM	Barrier Hwy
191.0 KM	Porter Lagoon Rd
196.6 KM	**FINISH - Goyder South**

ROUTE 3

	START - Port of Adelaide
0.0 KM	Ocean Steamers Rd
0.1 KM	Eastern Parade
1.0 KM	Port River Expressway
4.4 KM	North South Mwy (M2)
19.3 KM	National Hwy (A1)
200.4 KM	Wilkins Hwy
247.7 KM	Clyde St/Appila Rd
248.8 KM	Boundary Rd
249.9 KM	RM Williams Way
250.4 KM	OD5 Rd
252.9 KM	Wilkins Hwy
288.3 KM	Government Silos Rd
290.0 KM	Barrier Hwy
318.5 KM	West St/Copperhouse St
322.4 KM	Barrier Hwy
339.1 KM	Porter Lagoon Rd
344.7 KM	**FINISH - Goyder South**

Pinch Point

01

LEFT TURN

Eastern Pde & Port River Expy

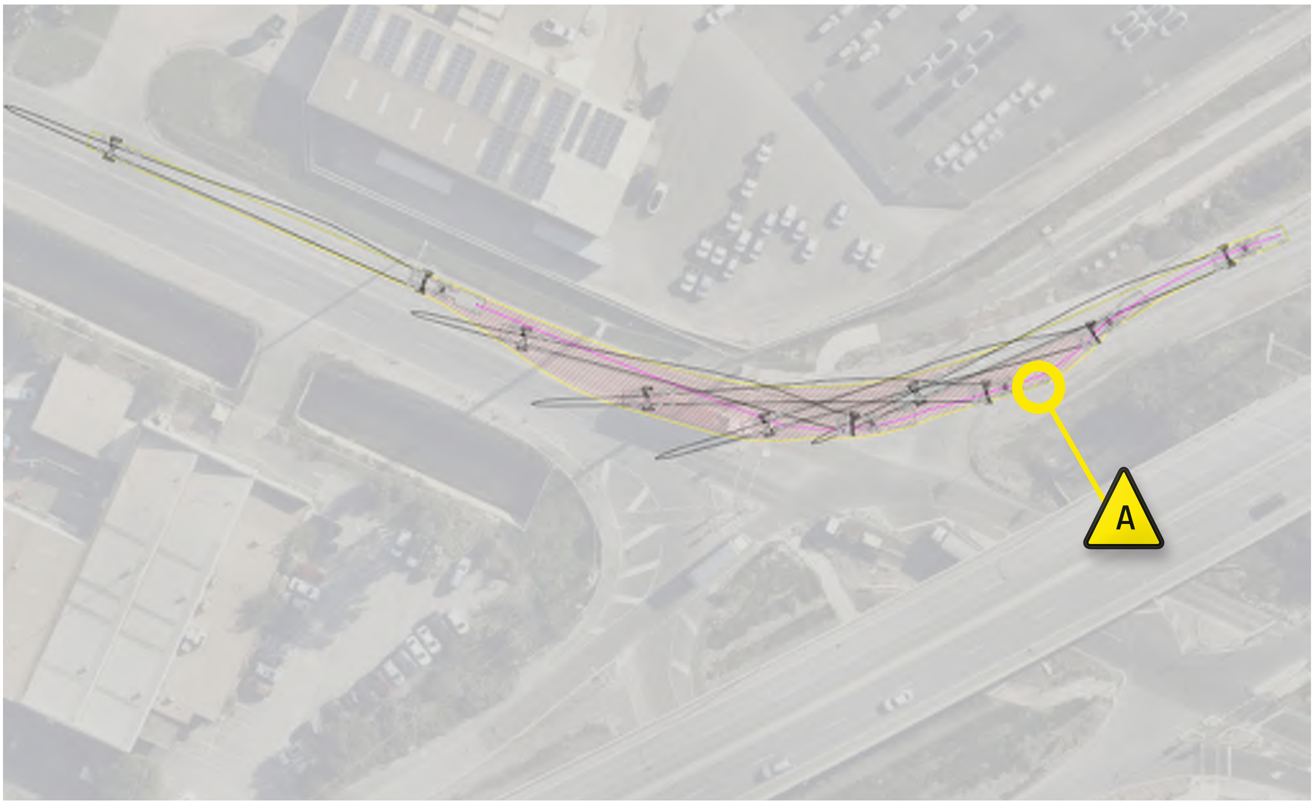
ROUTE D1 ROUTE D2 ROUTE 3

A

Trailer to use hardstand on outside of corner (no modifications required)

This corner was taken by Ares for similar blades for the Silverton project with no issues. The blade trailer will need to track off the asphalt on the outside of the corner in order to avoid the traffic lights on Eastern Parade. This area is generally suitable, with the option to add hardstand material to it if required for added stability.

View of left hand turn onto Port River Expressway



DRAWING NOTES:

ALL DIMENSIONS ARE IN mm UNLESS NOTED OTHERWISE (UNO) ALL WEIGHTS ARE IN t (METRIC TONNES) UNO ALL DETAILS ARE PROVISIONAL AND SUBJECT TO CONFIRMATION LASHINGS CALCULATIONS AS PER RESTRAINT GUIDELINES

CUSTOMER:	GE Renewables	SIZE:
PROJECT:	Goyder South	SCALE NTS
DRAWING TITLE:	SWEPT PATH DRAWING	SHEET NO:
DRAWING NAME:	TMP	REV

DRAWN BY:
DRAWN DATE:
CHECKED BY:

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

02

LEFT TURN

Sturt Hwy & Horrocks Hwy

ROUTE D1 ROUTE D2

A

Trailer to traverse median strip (minor modifications may be required)

This corner can be taken with care without having to remove any of the light poles. The blade trailer will have to cross the centre median twice, kerbs may need to be made trafficable. Hardstand can be added if required for extra stability.

Police escorts will be on hand to manage any contratraffic as the blade crosses over and back to the correct side of the road.

View of left hand turn onto Horrocks Hwy

DRAWING NOTES:

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PROJECT:	Goyder South	SCALE NTS
DRAWING TITLE:	SWEPT PATH DRAWING	SHEET NO:
DRAWING NAME:	TMP	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

03

LEFT TURN

Horrocks Hwy & Thiele Hwy

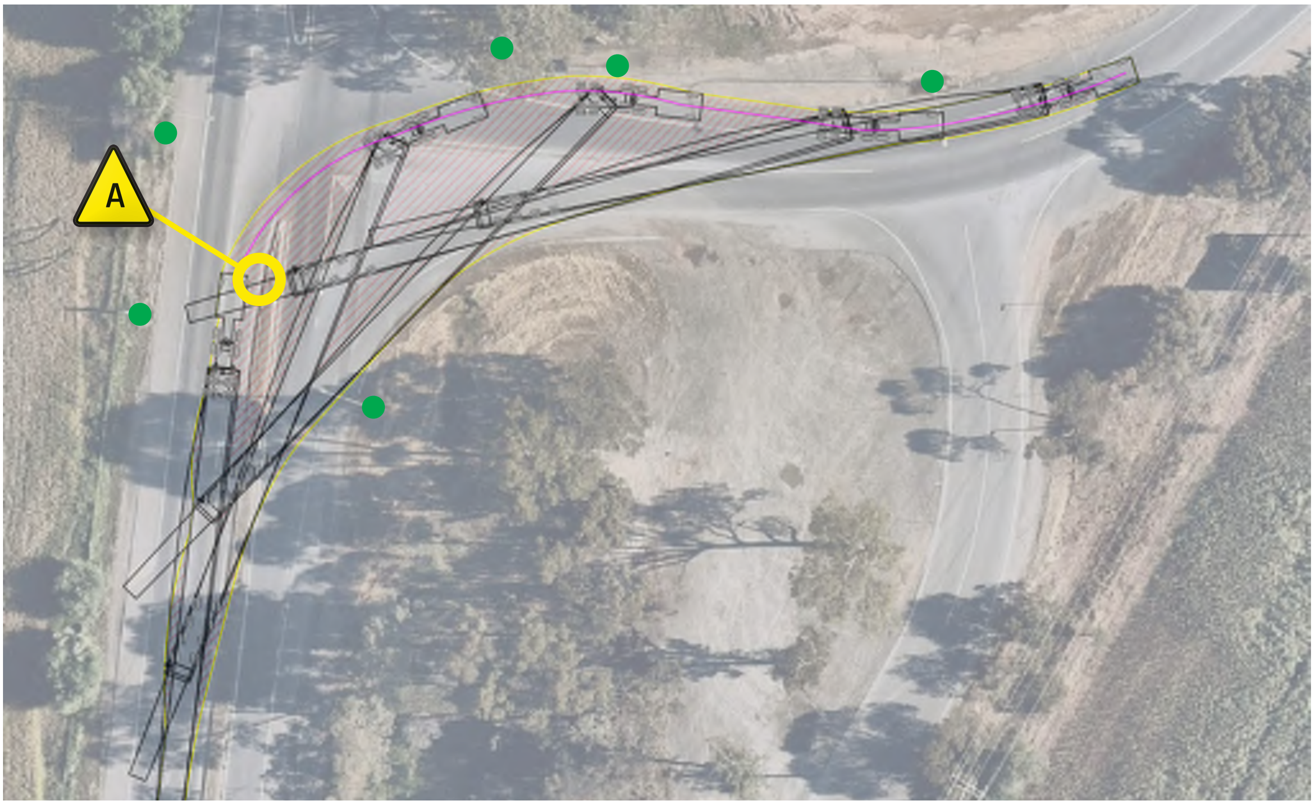
ROUTE D2

Trailer to traverse median strip (minor modifications may be required)

The turn onto Thiele Hwy is generally suitable for the Goyder components. Longer loads may need to mount the median strip to make the corner. The median strip may need to be made trafficable, no light poles require removal.

Police escorts will hold traffic on both sides of Horrocks Hwy while the loads negotiate the turn.

View of right hand turn onto Thiele Hwy



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ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

04

LEFT TURN

Thiele Hwy & Three Chains Rd

ROUTE D2

The full bypass of Eudunda was completed in late 2017 with the extension of Three Chains Rd to the Thiele Hwy. The new intersection was designed for heavy vehicle traffic and has good clearance for the blades.

Police escorts will hold oncoming traffic on both Thiele Hwy and Three Chains Rd, allowing the blade trailer to take the corner from the incorrect side of Thiele Hwy onto the incorrect side of Three Chains Rd.

View of Three Chains Rd/Thiele Hwy intersection (looking south from Three Chains Rd). Loads will approach from right of picture.

DRAWING NOTES:

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ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

05

LEFT TURN

Goyder Hwy & West St

ROUTE D2

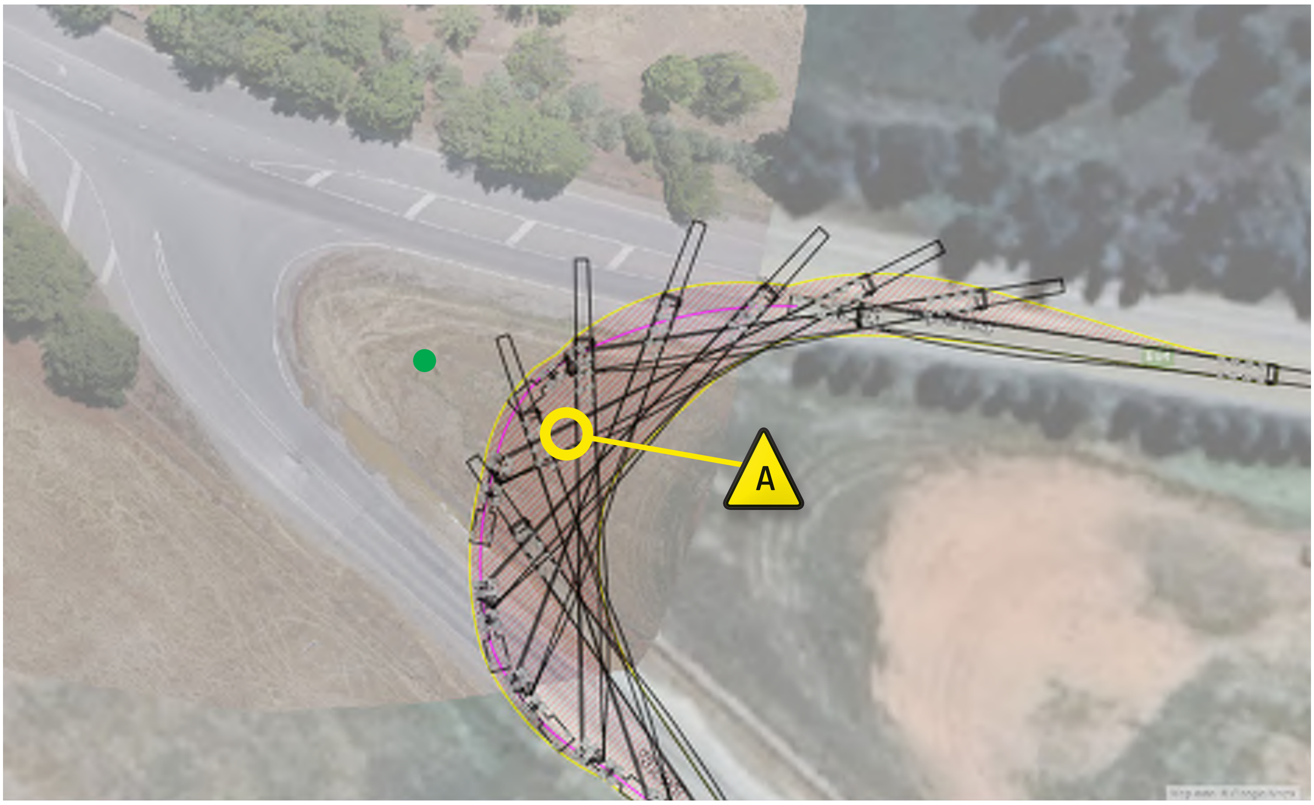
Temporary road required through private land

This left hand turn is too acute for blades and will require permission to build and use a temporary road through private land on the inside of the corner, as shown in the swept path opposite.

Police escorts will be on hand to manage any contratraffic on Goyder Hwy as the blade completes the turn.

For loads apart from blades, or for loads coming from the west via Route 3, this turn does not pose any problems.

Aerial view of left hand turn onto West St (Burra Heavy Vehicle bypass)



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PROJECT:	Goyder South	SCALE NTS	
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ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

06

RIGHT TURN

Barrier Hwy
& Porter Lagoon Rd

ROUTE D1

A

Hardstand required - may already be catered for by planned road upgrade

Modifications will be required to the corner to allow the safe passage of oversized loads, in particular the blade trailers. Fill material will need to be placed as shown opposite.

These modifications would be in addition to any upgrades to this intersection required by the Development Approval conditions, which are not shown here and are to be done by others.

OSOM loads turning left into Porter Lagoon Rd from the north-west (i.e. Routes D2 and 3) should have no issues negotiating this intersection.

Aerial view of right hand turn into Porter Lagoon Rd

DRAWING NOTES:

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DRAWING NAME:	TMP	REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

07

S BEND

Wilkins Hwy, Gladstone

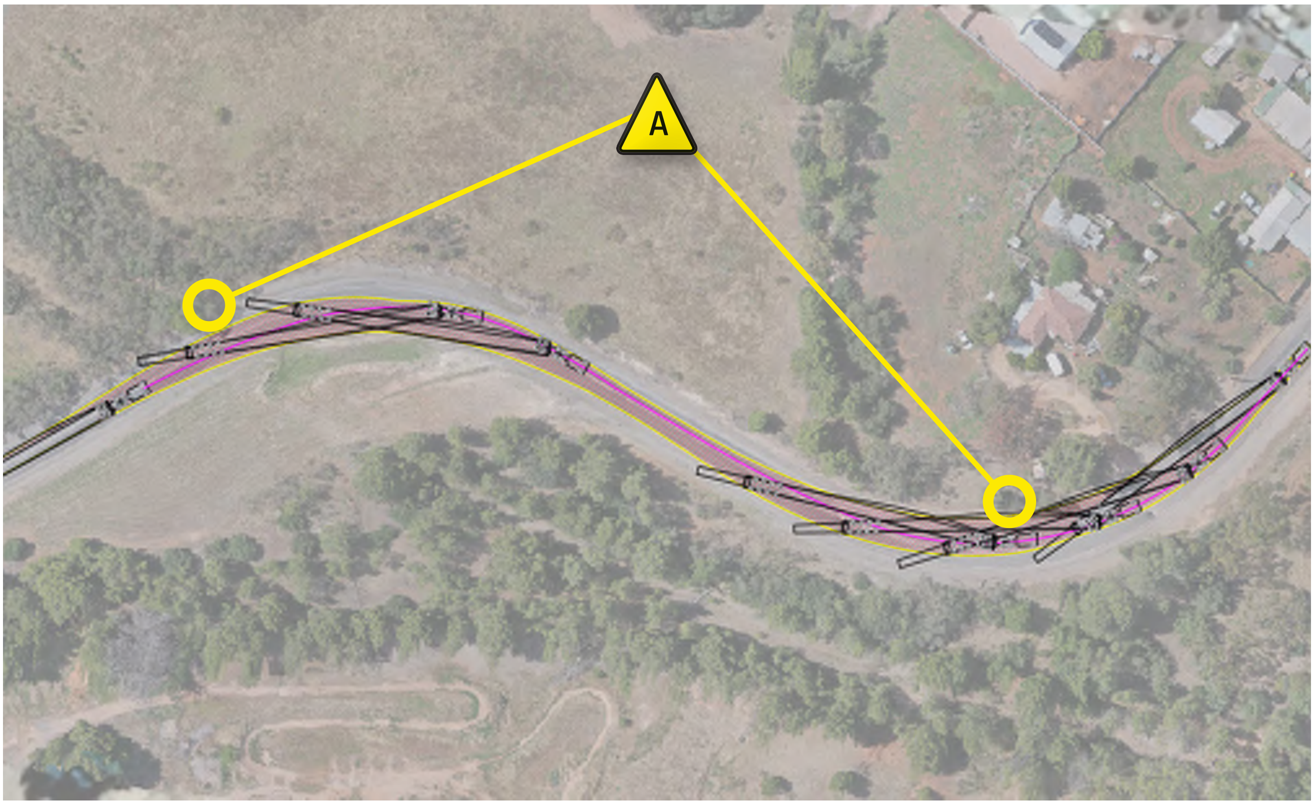
ROUTE 3

A

Area possibly requiring tree trimming.

The compound S-bend in Gladstone can be taken with no modifications, but will require traffic to be held at both ends while the blade trailer is traversing this section of road. Some tree trimming may be required to accommodate the blade swept path.

Aerial view of S-bend on Wilkins Hwy at Gladstone.



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DRAWING NAME:	TMP	REV

DRAWN BY:
DRAWN DATE:
CHECKED BY:

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

08

DETOUR

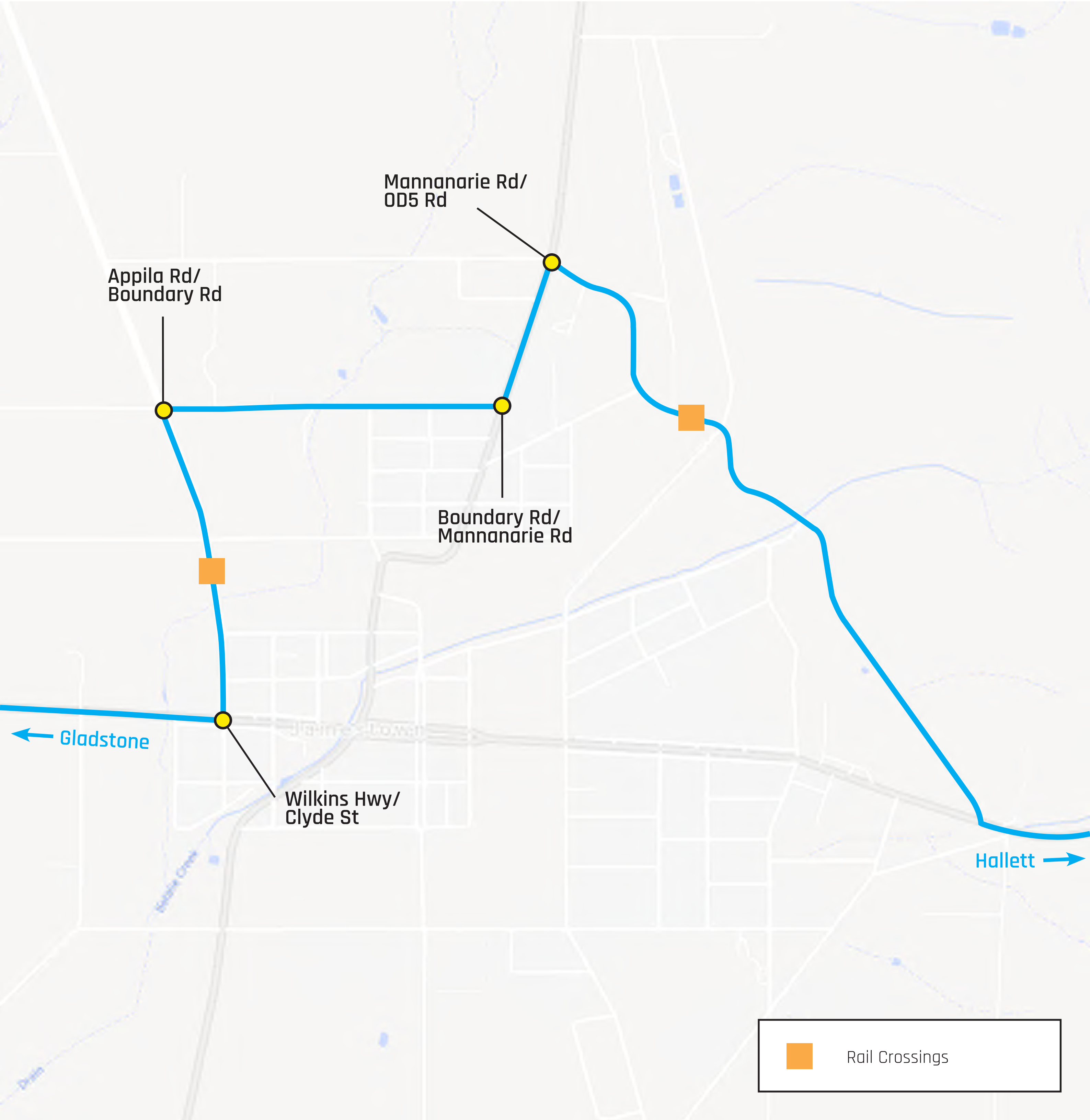
OD5 Bypass, Jamestown

ROUTE 3

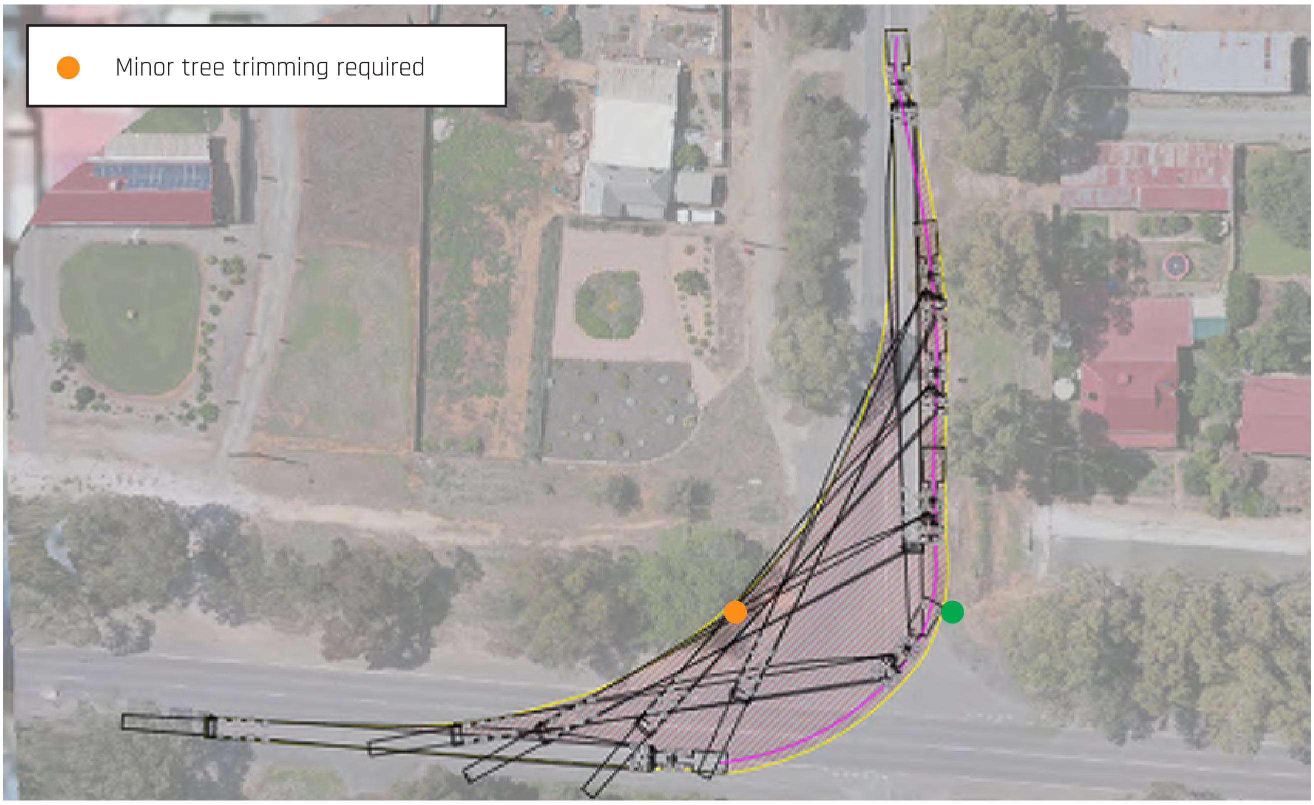
The Jamestown bypass via OD5 Rd is designed for heavy vehicle traffic up to B-Double road train size. It consists of four (4) right angled turns, all of which will pose no major problems for any of the components for Goyder South, including the blades. The following pages provide analysis of the intersections in question.

- LHT - Wilkins Hwy/Clyde St
- RHT - Appila Rd/Boundary Rd
- LHT - Boundary Rd/Mannanarie Rd
- RHT - Mannanarie Rd/OD5 Rd

Overview - Jamestown Bypass



Wilkins Hwy/Clyde St - Left Hand Turn



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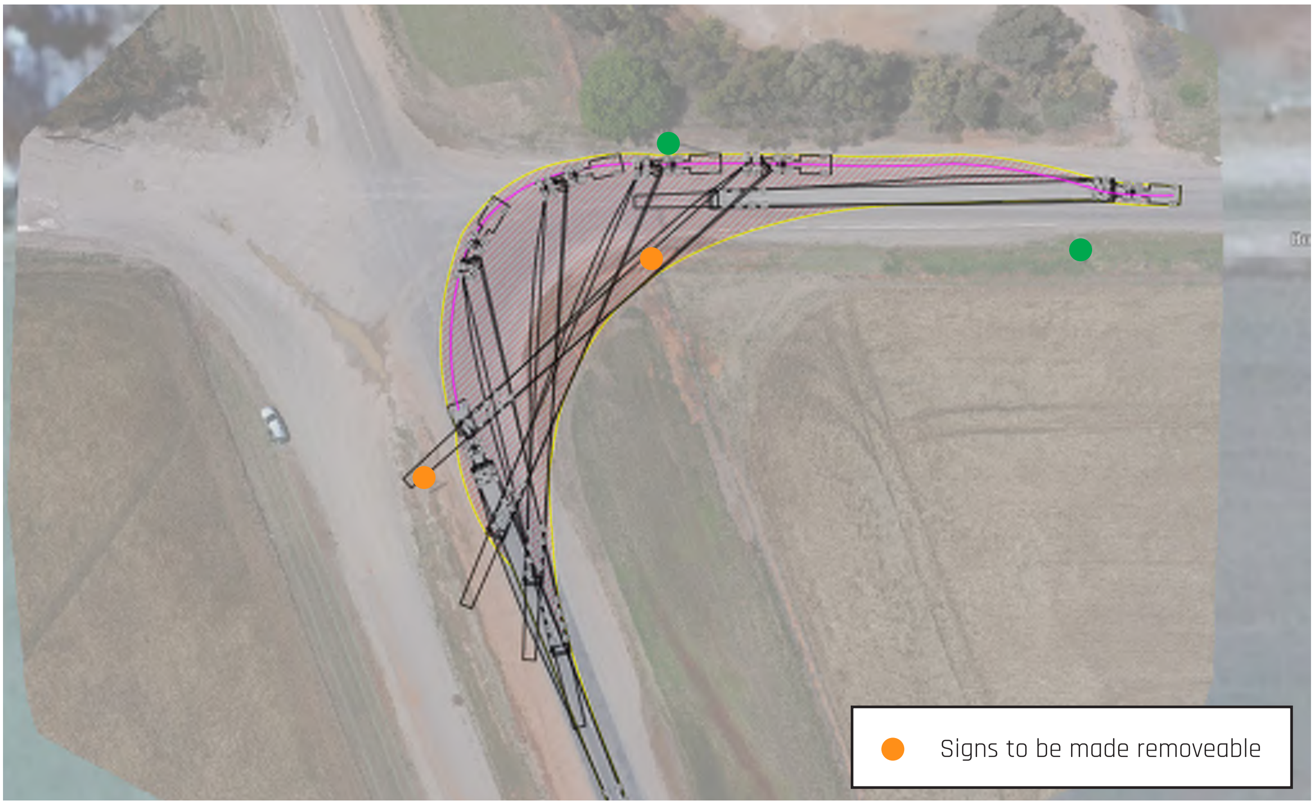
		DRAWING NAME:	TMP	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Appila Rd/Boundary Rd - Right Hand Turn



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		DRAWING NAME:	TMP

SIZE:
SCALE NTS
SHEET NO:
REV

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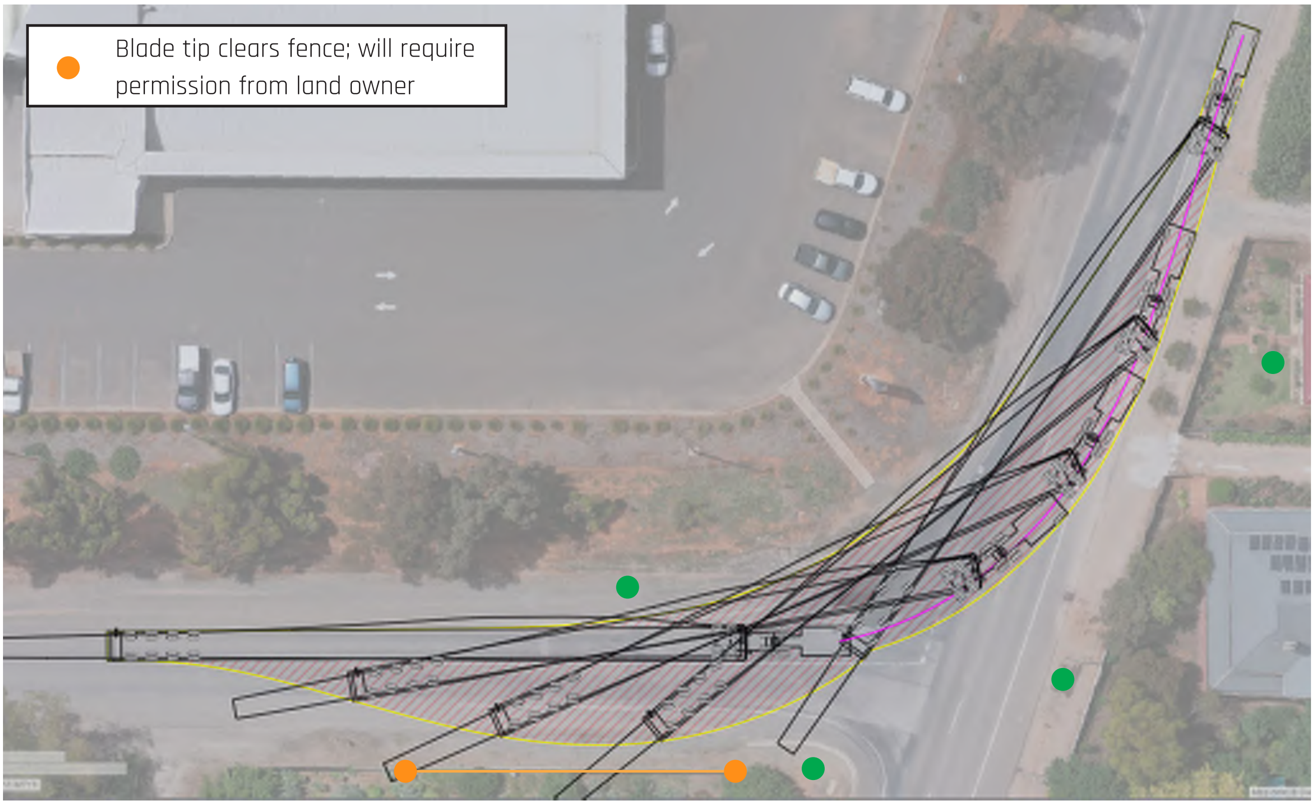
Boundary Rd/Mannanarie Rd - Left Hand Turn



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PROJECT:	Goyder South	SCALE	NTS
DRAWING TITLE:	SWEPT PATH DRAWING	SHEET NO:	
DRAWING NAME:	TMP	REV	

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DRAWN DATE:
CHECKED BY:

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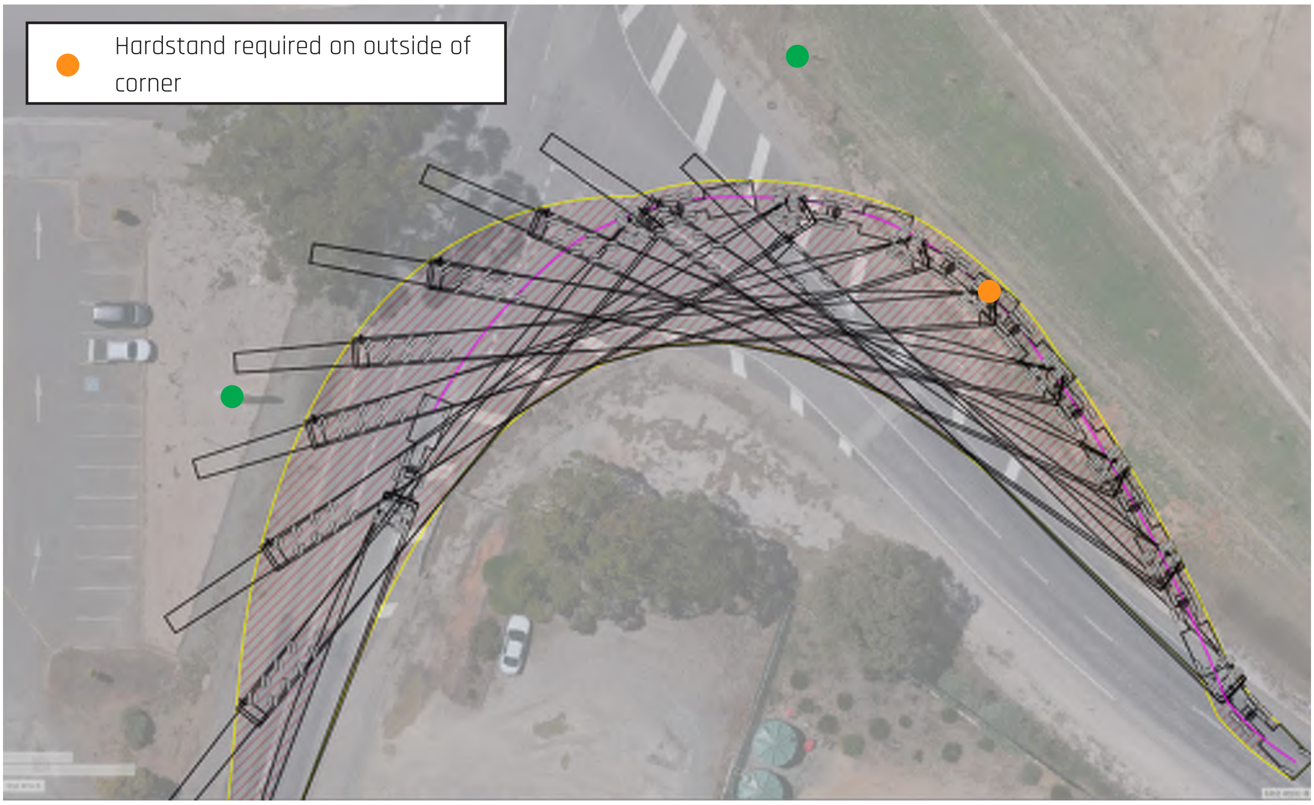
Mannanarie Rd/OD5 Rd - Right Hand Turn



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	DRAWING NAME:	TMP	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

03

Delivery Schedule

Murra Warra WF

A blade trailer loaded with a 70m Senvion blade skilfully negotiates the township of Nhill for the Murra Warra Stage 1 Wind Farm.

Deliveries Overview

The Goyder South Stage 1 project is scheduled to commence construction in 2022, with wind turbine component deliveries commencing around **Q2 2023**. Please note, these dates are subject to change and should be treated as indicative at this stage.

The proposed construction run rate is around 2 complete turbines per week. We anticipate total duration of OSOM transport to be approximately 6 months.

During the peak of construction activity, there will be a total of **22 oversized deliveries per week** to site, spread over six days (Mon-Sat). Curfews in the Adelaide Metro area limit travel times, however we would apply for an exemption for the blades to clear the metropolitan area during the early morning due to their size and potential disruption to other road users.

The following pages provide indicative schedules for deliveries from Port Adelaide to the wind farm site for each of the three routes assessed, showing rough timings for planning purposes. Please note, actual timings may vary depending on permit conditions and operational requirements.

Blades - Route D1

START: PORT OF ADELAIDE

04.00hrs*	Depart Flinders Port Berth 18-20
05.00hrs	Reach edge of Adelaide Metro
	<rest break>
06.00hrs	Resume journey at sunrise
06.45hrs	Riverton
07.30hrs	Porter Lagoon
08.00hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	150 km
Travel Time:	4 hrs

* Requires dispensation to travel within Adelaide Metro area at night, outside of normal curfew hours. This has been granted in the past, e.g. Silverton Wind Farm.

Schedule - WTG Components

Blades will depart Port Adelaide and travel through the metro area in the early morning, then complete the remainder of the trip in daylight hours.

Other Components - Rte. D1

START: PORT OF ADELAIDE

09.00hrs	Depart Flinders Port Berth 18-20
10.00hrs	Gawler
10.45hrs	Riverton
11.30hrs	Porter Lagoon
12.00hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	150 km
Travel Time:	3 hrs

Blades - Route D2

START: PORT OF ADELAIDE

04.00hrs*	Depart Flinders Port Berth 18-20
05.00hrs	Reach edge of Adelaide Metro
	<rest break>
06.00hrs	Resume journey at sunrise
07.00hrs	Eudunda
08.30hrs	Burra
09.30hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	200 km
Travel Time:	5.5 hrs

*Curfew dispensation required per Route D1.

Other Components - Rte. D2

START: PORT OF ADELAIDE

09.00hrs	Depart Flinders Port Berth 18-20
10.00hrs	Gawler
11.00hrs	Eudunda
12.30hrs	Burra
13.30hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	200 km
Travel Time:	4.5 hrs

Blades - Route 3

START: PORT OF ADELAIDE

04.00hrs*	Depart Flinders Port Berth 18-20
05.00hrs	Reach edge of Adelaide Metro
	<rest break>
06.00hrs	Resume journey at sunrise
07.00hrs	Port Wakefield
08.30hrs	Wilkins Hwy
09.45hrs	Jamestown
11.00hrs	Burra
12.00hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	350 km
Travel Time:	8 hrs

* Requires dispensation to travel within Adelaide Metro area at night, outside of normal curfew hours. This has been granted in the past, e.g. Silverton Wind Farm.

Other Components - Rte. 3

START: PORT OF ADELAIDE

09.00hrs	Depart Flinders Port Berth 18-20
10.30hrs	Port Wakefield
12.00hrs	Wilkins Hwy
13.15hrs	Jamestown
14.30hrs	Burra
15.30hrs	Arrive site entrance

FINISH: GOYDER SOUTH

Total Distance:	350 km
Travel Time:	465 hrs

Weekly Schedule

The following table shows a proposed weekly delivery schedule meeting the requirements of two complete wind turbines per week. This is indicative only and subject to change.

Component	Mon	Tue	Wed	Thu	Fri	Sat
Nacelle		●			●	
Drivetrain		●			●	
Hub			●			●
Blade 1	●			●		
Blade 2		●			●	
Blade 3			●			●
Tower Base	●			●		
Tower Mid C			●			●
Tower Mid B		●			●	
Tower Mid A	●			●		
Tower Top	●			●		

Recommendations

Based on the analysis undertake in this report, ARES recommends the following delivery regime for the Goyder South Stage 1 project.

Normal Road Conditions

- All components to take Route D1.

During Horrocks Hwy Roadworks (currently estimated between Dec 2021 and Jun 2023)

- Blades to take Route 3 via Jamestown, or alternatively take Route D2 with modifications done to intersection at Burra (Goyder Hwy/West St).
- All other components to take Route D2 via Eudunda.

We recommend seeking clarification from SA Department of Infrastructure and Transport (DIT) regarding the width restriction on the Horrocks Hwy and whether it is possible to transport blades through there during the roadworks, as the blade trailers travel at 2.5m wide.

For Route 3, ARES note that the Port Wakefield duplication project is currently in progress with restrictions and roadworks through Port Wakefield. We recommend obtaining confirmation from DIT that this project will be completed before the start of deliveries for Goyder South.

All blade deliveries from Port Adelaide should be done under curfew exemption to clear the Adelaide metro area during the early morning hours and minimize any disruptions to metro traffic.

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Appendix C. Crash Data

At the locations where there are more than one crash, the statistics do not distinguish between what type of crash caused what injury. Therefore, these locations are numbered in the left hand column and the location listed at the bottom of the tables.

Horrocks Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Horrocks Highway	Rear End	1		7	8
	Side Swipe	2			2
	Right Angle	9		1	10
	Head On	1		3	4
	Hit Pedestrian / Parked Vehicle / Animal / Object	1		2	3
	Roll Over	2		1	3
	Right Turn	1			1
	Left Road				
	Other			1	1
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes, except for the following locations:

1) Intersection of Gawler north ramp from Adelaide and Horrocks Highway
2) Intersection of Horrocks Highway and Thiele Highway
3) Intersection of Horrocks Highway and Templers Road
4) Intersection of Horrocks Highway and Owen Road

Barrier Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Barrier Highway	Rear End	1			1
	Side Swipe				
	Right Angle	4			4
	Head On	1			1
	Hit Pedestrian / Parked Vehicle / Animal / Object	3	1	5	9
	Roll Over	2		2	4
	Right Turn				
	Left Road				
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes, except for the following locations:

1) Intersection of Barrier Highway and Winders Road

Goyder Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Goyder Highway	Rear End				
	Side Swipe				
	Right Angle	1		1	2
	Head On				
	Hit Pedestrian / Parked Vehicle / Animal / Object				
	Roll Over				
	Right Turn				
	Left Road				
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes, except for the following locations:

1) Intersection of Goyder Highway and The Crescent

Worlds End Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Worlds End Highway	Rear End			1	1
	Side Swipe				
	Right Angle				
	Head On				
	Hit Pedestrian / Parked Vehicle / Animal / Object		1	1	2
	Roll Over				
	Right Turn				
	Left Road				
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes.

Thiele Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Thiele Highway	Rear End	6			6
	Side Swipe	4			4
	Right Angle	4	1	4	9
	Head On	3		2	5
	Hit Pedestrian / Parked Vehicle / Animal / Object	2		3	5
	Roll Over	2			2
	Right Turn	3			3
	Left Road	2			2
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes, except for the following locations:

1) Intersection of Thiele Highway and Clare Road and Mildred Street
2) Intersection of Thiele Highway and Perry Road
3) Intersection of Thiele Highway and Leske Road
4) Intersection of Thiele Highway and Hanson Street
5) Intersection of Thiele Highway and Gray Street
6) Intersection of Thiele Highway and Roseworthy Road
7) Intersection of Thiele Highway and Flett Road

Princes Highway

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Thiele Highway	Rear End	15	2	4	21
	Side Swipe	2	1	3	6
	Right Angle	23	4	5	32
	Head On	5	3	2	10
	Hit Pedestrian / Parked Vehicle / Animal / Object	28	3	11	42
	Roll Over	11	1	8	20
	Right Turn	5	1	2	8
	Left Road	1		1	2
	Other	2			2
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes, except for the following locations:

1) Intersection of Princes Highway and Old Port Wakefield Road
2) Intersection of Princes Highway and Ryan Road
3) Intersection of Princes Highway and McEvoy Road
4) Intersection of Princes Highway and Angle Vale Road
5) Intersection of Princes Highway and Brooks Road
6) Intersection of Princes Highway and Mallala Road
7) Intersection of Princes Highway and Copper Coast Highway (pre-Port Wakefield overpass)
8) Intersection of Princes Highway and Goyder Highway

Copperhouse Road

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
Copperhouse Road	Rear End				
	Side Swipe				
	Right Angle				
	Head On				
	Hit Pedestrian / Parked Vehicle / Animal / Object				
	Roll Over			1	1
	Right Turn				
	Left Road				
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes.

East Terrace

Highway / Road	Crash Type	Injury Crashes	Fatal Crashes	Serious Injury Crashes	Total Crashes
East Terrace	Rear End				
	Side Swipe				
	Right Angle				
	Head On				
	Hit Pedestrian / Parked Vehicle / Animal / Object				
	Roll Over	1			1
	Right Turn				
	Left Road				
	Other				
	Rear end and left road				
	Rear end, right angle, roll over, right turn				

All road crash locations were single crashes.

Three Chain Road

There are no recorded crashes along Three Chain Road within this data range.

Cattle Station Road, Razorback Road, Mount Bryan East Road, Polville Road and Bowman Terrace

There are no recorded crashes within this data range for these site access roads.

Preliminary Environmental Site Assessment

Goyder North

Goyder Renewables Zone

South Australia

Prepared for: Neoen Australia Pty Ltd

Date: 7 July 2023

Reference: JC1345

Version: JC1339_ESA_GN/02

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TABLES

AGON DOCUMENT CONTROL

Report Title	Project Reference
Preliminary Environmental Site Assessment Goyder North Goyder Renewables Zone South Australia	JC1345_ESA_GN

Written	Approved
Sophie Hambour Senior Environmental Scientist **Hudson Trigg** Environmental Scientist	**David Probert** Technical Principal - Environment

Rev No	Status	Date	Author	Reviewer
01	Draft	23/06/2023	SH	DP
02	Issue	07/07/20023	SH/HT	DP

Rev No	Copies	Recipient
01	1 electronic	Neoen Australia Pty Ltd; Thomas Daly
02	1 electronic	Neoen Australia Pty Ltd; Thomas Daly

1.0 INTRODUCTION

1.1 Background

The Goyder Renewables Zone is a hybrid renewable energy project proposed for the area around Burra, in the Goyder region of South Australia. The Goyder Renewables Zone includes two separate projects inclusive of the Goyder North (north of Burra), and Goyder South (south of Burra) Stage 1 and Stage 2.

Agon Environmental Pty Ltd (Agon) was engaged by Neoen Australia Pty Ltd (Neoen) to undertake a Preliminary Environmental Site Assessment (ESA) of the Goyder North project area ("the project area"). The boundary of the project area is shown in Figure 1, Appendix A.

Agon understands the Goyder North Project Area is currently in the planning stages and will consist entirely of wind power. This ESA was undertaken to support Neoen in the project development process and provide sufficient information to assess the potential for site contamination risks associated with the project and the provision of recommendations to manage and/ or mitigate the risks of any identified areas of potential or actual contamination.

1.2 Objective

The objectives of this assessment were to:

- Identify potentially contaminating activities (PCAs) which may have occurred or are occurring in the project area.
- Undertake an initial risk assessment of the existing and proposed activities within the project area to identify and prioritise those activities that are considered likely to have caused or potentially cause site contamination within the project area.
- Undertake an in-person inspection of the region to obtain information on baseline conditions of key areas and collection of limited soil samples representative of the key areas.
- Provide recommendations to manage and/ or mitigate the risks of any identified contamination.

1.3 Scope of Works

The scope of work for this assessment comprised:

- Desktop review of the project area, including zoning, geology, hydrogeology, topography and drainage, environmental licences and authorisations, land tenure, regional history and a review of any nearby environmental investigations (if available).
- Identify the relevant constraints and conflicts that may affect the proposed development utilising the information obtained during the site appraisal. Data gained during this phase will inform the civil design and streamline the process of determining the final alignments to avoid potential conflicts.
- A general in-person inspection of the region to identify key features associated with the project area and, where possible, of the proposed locations of project infrastructure (including turbines and ancillary infrastructure).
- Collection of limited soil samples and analysis of soil samples for potential contaminants of concern to provide a preliminary assessment of soil conditions in selected areas where site contamination impacts could potentially impact the project.

- An initial risk assessment of the existing and proposed activities within the project area identifying and prioritising those activities that are considered likely to have caused or potentially cause site contamination within the project area.
- Compilation of this information presented in this report providing recommendations to manage and/or mitigate the risks of any identified site contamination impacts.

1.4 Legislative Framework

This assessment has been undertaken in general accordance with the guidance provided within the following documents:

- Schedule B2 of the National Environment Protection Council (1999) National Environment Protection (*Assessment of Site Contamination*) Measure, as amended in 2013 ("the ASC NEPM").
- SA EPA (November 2018) Guidelines for the assessment and remediation of site contamination, amended 2019 ("the GAR").

2.0 SITE DETAILS

2.1 Site Identification and Land Use

The project area is located to the north east of the township of Burra, in the Goyder region of South Australia. The boundary covers numerous land parcels over an area within the localities of Burra, Mount Bryan East and Mongolata, situated between the townships of Burra (south east), Baldina (south west), Mongolata (east), Mount Bryan (west), Hallett (north west) and Mount Bryan East (north). The Goyder North project boundary is shown in Figure A1, Appendix A.

The project area is a transitional zone between cropping and pastoral country and the general landform of the area is defined by numerous ridgelines that run north-south through the site of the development. The land within the project area comprises paddock utilised for dryland cropping with much of the land not being easily accessible and utilised for light pastoral grazing.

2.2 Site Zoning

The project area is situated within the Regional Council of Goyder. Under the Planning and Design Code the area is predominantly zoned "Rural" and lies within a large expanse of Rural Zoned land. The Primary Desired Outcomes (DOs) of the Rural zone are:

> *DO 1 A zone supporting the economic prosperity of South Australia primarily through the production, processing, storage and distribution of primary produce, forestry and the generation of energy from renewable sources.*
>
> *DO 2 A zone supporting diversification of existing businesses that promote value-adding such as industry, storage and warehousing activities, the sale and consumption of primary produce, tourist development and accommodation.*

The Mokota Conservation Park lies within the project area and is zoned "Conservation". The Primary Desired Outcome of the Conservation Zone is:

> *DO 1 The conservation and enhancement of the natural environment and natural ecological processes for their ability to reduce the effects of climate change, for their historic, scientific, landscape, habitat, biodiversity, carbon storage and cultural values and provision of opportunities for the public to experience these through low-impact recreational and tourism development.*

The project area is predominantly bound by Rural Zoned land with the Caroona Creek Conservation Zone to the north east and the Township Zones of Hallett and Burra.

2.3 Proposed Project Elements and Components

The Goyder Renewables Zone comprises a number of proposed temporary and permanent project elements and components and include (but not limited to):

- Permanent Infrastructure:
  - Wind Turbine Generators, Solar Panels, Batteries and Grid Connections, Substations, Overhead Transmission Lines (OHL), Meteorological Masts, Access Tracks and Underground Cabling.
- Temporary Infrastructure:
  - Construction Compounds (wind and solar), Concrete Batching Plants and Laydown Areas.

Agon understands the Goyder North Project Area is currently in the planning stages and will consist entirely of wind power (inclusive of Wind Turbine Generators, Substations, Overhead Transmission Lines, Laydown

Areas). The proposed location of the associated infrastructure to date (Wind Turbine Generators, Substations, Overhead Transmission Lines) as provided by Neoen is shown in Figure 2, Appendix A.

2.4 Topography and Geology

The project area predominantly lies within the Wandalla Land System (WAN) and a review of the Department for Environment and Water (DEW) report details the WAN encompasses the moderately steep to steep range of hills north of Burra, and its associated outwash fans. The hills are generally steep (20 - 75% slopes) and very strongly dissected. In the north the topography is more subdued with undulating to rolling rises and low hills with slopes of 3-20%.

Drainage from the ranges is mostly to the west and east of the WAN with sediments in the west deposited by streams from the hills have formed gently inclined fans with slopes up to 10% and sediments from the hills in the west form the Stone Chimney Creek Land System. Sediment accumulation also occurs within the hills, in narrow eroded drainage depressions.

Soils are anticipated to be shallow to moderately deep over weathering rock and include sandy loams to loams directly overlying rock, or a carbonate layer capping the rock, and red clayey subsoils. On lower slopes, soils are anticipated to be deeper, usually with hard sandy loam to loam surfaces over red clay subsoils.

A review of geological information, as presented in the South Australian Resources Information Geoserver (SARIG, 2023), indicates that natural regional geology underlying the site and in the vicinity of the site is likely to include the following Geological Units:

- Appila Tillite (Nya): tillite; quartzite; siltstone. Massive, grey.
- Cox Sandstone Member (Nirc): sandstone, coarse-grained; sandstone medium to fine-grained, with siltstone.
- Fortress Hill Formation (Nef): Siltstone, gritty; dolomitic lenses, and cobbles.
- Pepuarta Tillite (Nep): Siltstone and sandy siltstone, sparse granule to boulder erratics, pale grey or greyish green, massive or bedded, often calcareous. Minor lenses and interbeds of massive and laminated calcareous sandy siltstone and calcareous sandstone.
- Quaternary and Holocene alluvial/fluvial sediments (Qa/ Qha).
- Saddleworth Formation (Nds): mudstone, siltstone, shale, partly carbonaceous.
- Tapley Hill Formation (Q/Nnt): siltstone, grey to black, dolomitic and pyritic grading upwards to calcareous, thinly laminated, locally cross-bedded; dolomite, grey, flaggy to massive; limestone conglomerate, intraformational; greywacke.
- Tarcowie Siltstone (Nir): siltstone, sandy, flaser bedded.
- Woolshed Flat Shale (Ndw): shale, black; dolomitic siltstone; dolomite; grey laminated siltstone.
- Waukaringa Silstone (Nik): Siltstone, blue-grey, thin bands of limestone and calcareous siltstone
- Wildildie Sandstone Member (Nikw): Sandstone, grey, massive, fine to medium-grained, rarely coarse-grained, with flaser bedding, calcareous.
- Wilyerpa Formation (Nyw): siltstone, green. Lower third is fine grained, includes glacial dropstones; middle unit is medium to coarse sandstone; upper unit is siltstone with minor sandstone. Minor diamictite, sandy and pebbly dolomite.

2.5 Acid Sulphate Soils

A review of the Atlas of Australian Acid Sulfate Soils within the Australian Soil Resource Information System (ASRIS) indicates the project area is in an area of C4: Extremely low probability of occurrence (1-5% chance of occurrence with occurrences in small, localised areas).

2.6 Environmental Values of Water Resources

2.6.1 Hydrogeology

A review of available groundwater data was undertaken using the WaterConnect website (DEW, 2023) to obtain information on registered uses of groundwater bores and determine beneficial groundwater environmental values (EVs).

Groundwater information indicates there 63 registered groundwater wells within the project area including 47 Water Wells, 14 Mineral Wells and 2 Water Point Wells. Of the registered Water Wells, the following extractive uses were identified, including:

- Domestic use was registered in two wells operational wells (unit 6630-1008 and 6630-1405). These wells recorded salinity values of 2,253 and 2,852 mg/L Total Dissolved Solids (TDS). The Standing Water Level (SWLs) within one well was reported at 40.28 metres below ground level (mBGL).
- Irrigation use was registered in two wells, one of which was registered as operational. These wells recorded a salinity of 1,085 and 495 mg/L TDS with one well recording a SWL of 12.95 mBGL.
- Stock use was registered in 24 wells, 20 of which were registered as operational. These wells recorded a salinity between 801 and 3,708 mg/L TDS with SWLs between 6.1 and 45.11 mBGL.

The remaining wells in the project area, are registered for Spring (1) use (Water Point Well) with the remaining wells (34) registered without a purpose.

SWLs measured in all wells range from 4.57 m to 67.67 mBGL. Water occurrence within the local area is dependent on topography within the area. Salinities values recorded in wells within the search range between 495 mg/L to 5,327 mg/L, indicating variable water quality in the area, noting the environmental value for underground waters for drinking water for human consumption is < 1,200 mg/L (WQEPP).

2.6.2 Hydrology

The Burra Creek catchment arises in undulating terrain surrounding Mt Bryan (west of the project area), north of Burra, and is aligned north south from its upper catchment to Burra Gorge. The Burra Creek flows in a southerly direction through Burra towards Worlds End (south of the project area) before changing direction to the east and flowing across pastoral lands to its discharge point at the River Murray near Morgan.

The broad ecological character of the Burra Creek Catchment, including its associated tributaries, is that of a semi-arid ephemeral stream ecosystem (DWLBC 2008). The flat topography and very low rainfall of the lower catchment produces little runoff and surface flows from the catchment to the main stem of the Burra Creek are rare as the lower reaches are essentially flood out plains and lack defined drainage (DWLBC 2008).

There are numerous first, second and third order streams across the Burra Creek Catchment, including numerous within the project area. Other surface bodies of water include numerous dams and ephemeral natural drainage lines scattered across the agricultural properties.

2.6.3 Determination of Applicable Environmental Values

Based on a review of local hydrogeology within the project area and the extent of the proposed construction within the project area it is considered that the likelihood of potential impacts to environmental values of groundwater resulting from project activities is low.

The following environmental values considered to be applicable to the project area (in order of sensitivity) include:

- Fresh Aquatic Systems.
- Recreational and aesthetics.
- Primary Industries

The likelihood of impacts to each environmental value has been determined in Table 1.

It is anticipated that any potential impact to identified surface water receptors should be able to be sufficiently managed through the implementation of standard environmental measures as part of a project wide management plan.

Table 1: Preliminary Regional Beneficial Use Assessment

Environmental Value (EV)	Likelihood of Impact to EV	
	Current	**Potential**
Fresh Aquatic ecosystem	**Likely**	**Likely**
	Numerous water courses throughout the project area.	
Marine Aquatic ecosystem	**Unlikely**	**Unlikely**
	No marine ecosystems present on or near the site.	
Recreation and aesthetics	**Likely**	**Likely**
	Numerous water courses throughout the project area.	
Drinking water for human consumption	**Unlikely/Possible**	**Unlikely/Possible**
	Two domestic wells were identified within the project area. Considered unlikely due to use of rainwater.	
Primary Industries— Irrigation and general water uses	**Unlikely/Possible**	**Unlikely/Possible**
	Two irrigation wells were identified within the project area. Use of water for irrigation is therefore considered possible.	
Primary Industries— Livestock drinking water	**Likely**	**Likely**
	Twenty-four stock wells were identified within the project area.	
Primary industries— Aquaculture and human consumption of aquatic foods	**Unlikely**	**Unlikely**
	No aquaculture use bores nor activities within off-site areas 2 km from the site.	

3.0 HISTORICAL INFORMATION

3.1 Review of Historical Information

The project area is situated across a number of private properties primarily used for dryland cropping and grazing and includes numerous land parcels and therefore various landowners.

The project area is recognised as being within the traditional lands of the Ngadjuri Nation and a small portion (associated with the NSW interconnector) may extend to lands of the First Peoples of the Murray Mallee.

A review of historical information identifies a history of mining, agricultural and grazing within the region (DEW 2021c). Mining activity in the region commenced in the mid 1840’s and extended into the late 1870’s and included the Burra Copper Mine (approximately 1 km west of the Burra township). The Burra Copper Mine operated from 1845 until its closure in 1877 and, in 1850, was the largest metal mine in Australia before operating in a second production phase in 1970 to 1981 (DAWE 2021).

During the 1900’s, the region shifted to agricultural and pastoral activities including the use of the land for cereal cropping and sheep and cattle grazing. The region remains predominantly land used for agricultural and pastoral industries and paddocks are utilised for dryland cropping and livestock.

3.2 Mining Operations and Mineral Deposits

A review of the records of Mines and Mineral Deposits using the information presented in the South Australian Resources Information Geoserver (SARIG) indicates there are historic records within the project area and are summarised in Table 2, and shown in Figure 3, Appendix A.

It is not anticipated that any historic mining operations will significantly affect the construction of project infrastructure as these locations are highly localised and sparsely dispersed across the project area. It is therefore anticipated that any old mines, excavations or spoil areas can be avoided by appropriate micro-siting of project infrastructure. Given the age of mining activities in the area, there may be undocumented remnant mines or shafts in the area.

A review of the spatial layout of the mine records indicates the records are predominantly positioned within the vicinity of the ridgeline that runs along the eastern/central eastern boundary of the project area.

Table 2: Mining Operations and Mineral Deposits

Name ID	Coordinates	Commodity	Description	Status
Newikie	310320.73 E 6290201.52 N	Siltstone	Council roadside pit of ~5,000m2 x 1-3m deep on weathered, grey-green siltstone of the Appila Tillite.	Seasonal
Mount Edith	319846.8 E 6288000.84 N	Gold	Single shaft developed on a quartz lode in host metasediment of the Waukaringa Siltstone.	Abandoned
Retriever	319851.99 E 6286959.27 N	Gold	Quartz-iron oxide lode in host shale of the Waukaringa Siltstone. 45.7 tonnes was treated for 193gm gold at 4g/tAu.	Abandoned
Golden Speck	319905.71 E 6286396.51 N	Gold	2 quartz reefs in host metasediment of the Waukaringa Siltstone. A number of shafts, and 2 lines of shallow pits along separate stratabound quartz lodes were sunk. 3.8 tonnes ore yielded 104.2gm gold at 27.7g/tAu.	Abandoned
Orinda	319104.32 E 6286616.1 N	Gold	Prospecting consisted of an adit to 4.8m, and costeans and pits developed on a quartz lode in host metasediment of the Waukaringa Siltstone. An assay from the quartz reef gave 1.4% Cu, 4.5 g/t Au.	Abandoned
Donovan and Wills	318923.2 E 6286155.87 N	Gold	Shallow prospecting pits on gold and copper mineralised quartz veins in host slate of the Tarcowie Siltstone.	Not Worked
Rosewalls	318826.98 E 6285474.69 N	Gold	Quartz reef near the Golden Guinea mine. Host rock was metasediment of the Fortress Hill Formation.	Abandoned
Oates	318870.51 E 6285244.55 N	Gold	Tenement granted on the Mongolata Goldfield presumably on quartz lode on host Fortress Hill Formation.	Not Worked
Feltus Find	319487.77 E 6285601.38 N	Gold	Shallow workings on a small quartz vein in host metasediment of the Waukaringa Siltstone. An assay of the lode was taken giving a grade of 9.3 gm/t Au. In the late 2000s Phoenix Copper completed a single diamond hole ~200m south of the main workings for a best interval of 1m at 0.04g/tAu from 157m in sandstone. Follow up shallow RAB holes were drilled to test these anomalies at depth. 6 holes were completed for no significant intersections.	Abandoned
Golden Guinea	319906.23 E 6285500.4 N	Gold	Ferruginous quartz lode in host metasediment of the Wildildie Sandstone Member. Workings included a shaft to 15m following a vein 5-10cm wide carrying low gold values. Production records exist for 50.8 tonne ore yielding 402gm bullion gold at 8g/t Au. 200m to N is a line of pits for ~30m distance, and following a quartz lode trending NNE.	Abandoned
Golden Eagle	319815.72 E 6285101.56 N	Gold	Ferruginous quartz lodes in host metasediment of the Tarcowie Siltstone. Workings included several excavations along the northern bank of a creek, with a main shaft to 7.6m, and an underlie following a 5cm wide vein. Recorded production was 15.2 tonne ore for 107gm gold at 6.8g/t Au. Phoenix Copper complete a single diamond hole in the late 2000s located ~600m SSW from the main workings and along the trend of the lode.	Abandoned
Reids	320204.27 E 6284288.81 N	Gold	Shallow prospecting pits on quartz lode in host metasediment of the Tarcowie Siltstone for no gold. Most pits are located on the eastern hillslopes, and are widely spaced along a rough line of lode trending NS over a distance of ~800m to the large creek adjacent to the Golden Eagle workings.	Not Worked

3.3 SA EPA Public Register Review

3.3.1 Environmental Authorisations and Licences

A search of the SA EPA Environmental Authorisations and Licences index indicates the SA EPA does not hold any details of records within the project area.

There were numerous Licences recorded in the area of Burra. These Licences were issued to properties outside of the project area and are not anticipated to impact the upon the project area.

3.3.2 Site Contamination Index

A search of the SA EPA's Site Contamination Index was undertaken to identify any site contamination notifications or reports held by the EPA in the public register, under the Environment Protection Act 1993, pertaining to the site. There were no notifications for the project area.

Numerous details notifications listed within the Regional Council of Goyder situated outside of the project area. These properties are not anticipated to impact upon the project area.

3.4 Environmental Protection Orders and Clean up Orders

A search of the SA EPA Environment protection orders (EPO) and clean up orders (CUO) was undertaken to identify if the EPA holds written statutory orders that require a person or company to undertake actions to remedy a risk or prevent further environmental harm, under the Environment Protection Act 1993, pertaining to the project area. There were no Orders pertaining to the project area.

4.0 POTENTIAL SOURCES OF CONTAMINATION

Based on identified historical and current land uses on and near the site, potential sources of contamination, Potentially Contaminating Activities and Potential Contaminants of Concern are described in Table 3.

The qualitative risk ratings (low, medium or high) have been made based on whether site contamination is known, possible or unlikely from the relevant activity; and the potential human health/environmental implications.

Table 3: Potentially Contaminating Activity and Potential Contaminants of Concern (PCOC)

Potential Contamination Sources	Potentially Impacted Area	PCOC	Preliminary Assessment of Likelihood & Potential Risk to Human Health and the Environment
Historical and Current Agricultural and Pastoral Activities	Organochlorine (OCP) Organophosphorus Pesticides (OPP) Metals (Arsenic, Copper)	Areas historically and currently utilised for agricultural and pastoral activities including dry land cropped and livestock. Use of pesticides and herbicides associated with historical and current land uses may have resulted in pesticide or herbicide residues in site soils.	If present, pesticide concentrations within shallow site soils are expected to be at residual (minor levels), the likelihood of pesticide impacted soils to be present in considered LOW. It is considered that any significant site contamination impacts associated with the historical application of pesticides/ herbicides pose a **LOW RISK** to users of the site and to the environment under the proposed commercial/ industrial land use setting.
Historical Mines and Mineral Deposit Sites	Explosives Heavy Metals	Areas historically utilised as mines and mineral deposits (dis-used mine shafts).	The likelihood of residual impacts to site soils associated with the historical mining operations is considered to be LOW. It is considered that any significant site contamination impacts associated with the historical mining operations pose a **LOW RISK** to users of the site and to the environment under the proposed commercial/ industrial land use setting.
Historical Mining and Unexploded Ordnances (UXOs)	Explosives Heavy Metals	Potential for historical UXOs to remain in areas historically utilised as mines and mineral deposits.	The likelihood of any explosives was considered to be linked with the location and probability of historical mining. A review of historical information did not identify any military activity in the area and the likelihood of military UXOs in the area is considered to be very low.

If mine workings or evidence of historical excavations are detected during construction, these should be assessed on a case-by-case basis with regard to the infrastructure proposed for each location. Considerations should include proximity to known former mine workings, the potential for encountering unmapped dis-used mine shafts, other indications of mining activity (including spoil heaps, remnant infrastructure) and the potential for buried waste (including UXOs).

Similarly, where informal landfills associated with agricultural land use are identified across the project area and are likely be intercepted during construction, these will be assessed under the respective unexpected finds protocols and avoided by appropriate micro-siting of project infrastructure or realignment of linear infrastructure.

5.0 SITE WORKS

5.1 Site Inspection

An inspection of the project area was undertaken on 19 June 2023 by an Agon Environmental Scientist. The areas targeted during the inspection included:

- Proposed turbine locations.
- Proposed Overhead Transmission Lines (OHL).
- Areas with large footprints (Proposed Substation Areas).
- Former mine/ mineral deposit sites.
- General inspection of the accessible project area.

At the time of the inspection the following observations were made regarding the main features and uses of land within the project area:

- Paddocks used for livestock (sheep and cattle).
- Paddocks used for dry land cropping.
- Ridgelines and undulating hills.

The location of historical mines and mineral deposit sites that were accessible during the inspection were characterised by depressions in the ground (appeared to look like a dam). There were no large areas of infilling (miscellaneous waste, informal landfills associated with agricultural use) noted during the inspection.

Photos taken during the inspection are provided in Appendix B.

5.2 Soil Sampling Plan and Rationale

During the inspection shallow soil samples were collected to provide a preliminary assessment of soil conditions in selected areas where site contamination impacts could potentially impact the project, including:

- Representative sampling in areas where infrastructure is proposed (e.g., proposed turbine sites, linear infrastructure such as feeder line junctions and alignments).
- Areas with large footprints (e.g., possible substation locations).
- Former mine/ mineral deposit sites.

The rationale for the soil sampling locations is described in Table 4 and the soil sample plan is provided in Figure 4, Appendix A.

5.3 Laboratory Analysis

Soil samples were analysed for a range of contaminants of potential concern (COPCs) including:

- Heavy metals.
- Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene (BTEXN), Polycyclic aromatic hydrocarbons (PAHs).
- Organochlorine pesticides (OCPs).
- Explosives.

All soil primary sample analysis was undertaken by Eurofins MGT (Eurofins). Eurofins are accredited by the National Association of Testing Authorities (NATA) for all requested analyses.

Table 4: Sampling Locations and Rationale

Sample ID	Coordinate		Target Infrastructure/ Location	Rationale
	Easting	Northing		
N-SS01	310360.81	6290236.11	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS02	310382.34	6290177.22	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS03	310347.3	6290137.44	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS04	310297.66	6290190.88	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS05	310312.55	6290226.64	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS06	313509.49	6289669.21	WF Substation	Significant Footprint
N-SS07	313510.99	6289688.8	WF Substation	Significant Footprint
N-SS08	313491.96	6289688.64	WF Substation	Significant Footprint
N-SS09	313493.87	6289665.57	WF Substation	Significant Footprint
N-SS10	314614.89	6288426.2	Turbine Location	Representative Sampling
N-SS11	314593.88	6288430.22	Turbine Location	Representative Sampling
N-SS12	314591.64	6281652.2	WF Substation	Significant Footprint
N-SS13	314632.56	6281652.6	WF Substation	Significant Footprint
N-SS14	314607.63	6281641.74	WF Substation	Significant Footprint
N-SS15	314591.82	6281637.27	WF Substation	Significant Footprint
N-SS16	314604.97	6281635.45	Turbine Location	Representative Sampling
N-SS17	313843.02	6284093.03	Turbine Location	Representative Sampling
N-SS18	313848.66	6284097.59	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS19	318668.39	6285767.17	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS20	318642.84	6285771.99	Mine/Mineral Deposit Site	Potential Impact from Former Land Use
N-SS21	318677.76	6285738.01	Mine/Mineral Deposit Site	Potential Impact from Former Land Use

5.4 Soil Assessment Criteria

The primary guideline for the assessment of site contamination in Australia is the National Environmental Protection (Assessment of Site Contamination) Measure, National Environmental Protection Council 1999 (Amended 2013), ("the NEPM"). The NEPM promotes the use of investigation, screening and management levels to form the basis of a Tier 1 risk assessment. These criteria provide an initial indication of the contamination status of site soils within the context of land use.

Although the proposed development is suitable to be categorised as commercial / industrial land use, Agon has conservatively adopted NEPM criteria pertaining to a residential land use with access to garden soils as conservative criteria. Soil chemical data were compared to the following criteria:

- NEPM Health Investigation Levels (HILs) - The HILs are investigation levels for the protection of human health from direct contact with soil.
  - HIL A (residential with garden/accessible soil) have been adopted as initial screening criteria and is considered conservative to assess the risk to future site users.
- NEPM Health-based Screening Levels (HSLs) – The HSLs are applicable for specific petroleum compounds and depend on the depth below surface, specific land use and soil type.
  - HSL-A/B (residential; assuming sand lithology based on a conservative approach) have also been adopted as initial screening levels for the assessment of vapour intrusion, to assess the risk to future site users.
- Ecological Investigation Levels (EILs) EILs are for the protection of terrestrial ecosystems and have been derived for common contaminants in soil based on a species sensitivity distribution. For the purposes of this investigation, generic EILs have been assumed based on conservative soil parameters for "Aged" contamination for Areas of Ecological Significance.
- Ecological Screening Levels (ESLs) The ESLs outline criteria for TRPH, BTEX and benzo(a)pyrene in soil for assessing risk for areas of Ecological Significance

5.5 Soil Analytical Results

Soil analytical results are presented in Appendix C. Chain of custody documentation and laboratory certificates are presented in Appendix D.

Evaluation of the soil analytical data indicates all soil analytical results were below the conservatively adopted health-based and ecological-based criteria identified in Section 5.4.

Chemical concentrations above the laboratory limit of reporting (LOR) were limited to a range of heavy metals. All hydrocarbon, pesticide and explosive results reported below the laboratory LOR.

6.0 SUMMARY AND CONCLUSIONS

6.1 Summary

The Goyder Renewables Zone is a hybrid renewable energy project proposed for the area around Burra, in the Goyder region of South Australia and includes two separate projects inclusive of the Goyder North and Goyder South (Stage 1 and Stage 2). The Goyder Renewables Zone comprises a number of proposed temporary and permanent project elements.

This ESA was undertaken to support Neoen in the project development process of the Goyder North project area to provide sufficient information to assess the potential for site contamination risks associated with the project and the provision of recommendations to manage and/ or mitigate the risks of any identified contamination.

The review of historical information identified that the area of Burra (including the project area) has an extensive history of mining and exploration activities dating back to the 1840's, as well as agricultural and pastoral industries. Various records of historic mines and mineral deposits were identified within the project area and were predominantly associated with the former mining of gold and have since been abandoned. A review of the spatial layout of the mine records indicates the records are predominantly positioned within the vicinity of the ridgeline that runs along the eastern/central eastern boundary of the project area. Given the age of mining activities in the area, there may be undocumented remnant mines or shafts in the area.

A general in-person inspection of the project area was undertaken to identify key features associated with the project area and, where possible, of the proposed locations of project infrastructure (including proposed turbine locations, overhead transmission lines, substation areas), the location of historic mine sites and a general inspection of the accessible project area. At the time of the inspection the main features and uses of land inspected within the project area included paddocks used for livestock (sheep and cattle), paddocks used for dry land cropping, ridgelines and undulating hills.

Based on a review of the information obtained during the project area appraisal, the following potential sources of contamination associated with historical and current land uses were identified in the project area:

- **Historical and Current Agricultural and Pastoral Activities**: Areas historically and currently utilised for agricultural and pastoral activities including dry land cropped and livestock. Use of pesticides and herbicides associated with historical and current land uses may have resulted in pesticide or herbicide residues in site soils.
- **Historical Mines and Mineral Deposit Sites**: Areas historically utilised as mines and mineral deposits (disused mine shafts).
- **Historical Mining and Unexploded Ordnances (UXOs):** Potential for historical UXOs to remain in areas historically utilised as mines and mineral deposits.

During the inspection of the project area to obtain information on baseline conditions of key areas, Agon collected limited soil samples representative of the key areas. Selected soil samples were analysed for potential contaminants of concern to provide a preliminary assessment of soil conditions in selected areas where site contamination impacts could potentially impact the project. All analytical results were below the adopted health-based and ecological-based criteria and are not considered to present a significant health or environmental risk.

6.2 Conclusions

Agon considers contamination associated with the above for mentioned PCAs across the project area poses a potential low risk to future users of the site and to the environment.

The qualitative risk ratings associated with the PCAs were determined based on whether site contamination is known, possible or unlikely from the relevant activity; and the potential human health/environmental implications. It is considered that any significant site contamination impacts associated with these activities pose a low risk to users of the site and to the environment under the proposed commercial/ industrial land use setting (construction and operation of a wind farm).

If mine workings or evidence of other historical excavations or land filling activities are detected during construction, these should be assessed on a case-by-case basis with regard to the infrastructure proposed for each location. Considerations should include the potential for encountering or proximity to:

- Known former mine workings.
- Unmapped dis-used mine shafts.
- Other indications of mining activity (including spoil heaps, remnant infrastructure).
- The potential for buried waste (including UXOs).
- Informal landfills associated with agricultural land use across the project area.

If any of the above are identified and are likely to be intercepted during construction, these will be assessed under the respective unexpected finds protocols and avoided by appropriate micro-siting of project infrastructure or realignment of linear infrastructure.

The likelihood of potential impacts to environmental values of groundwater during the construction and operation of the project is considered to be low. There are numerous surface water receptors identified within the project area; it is anticipated that any potential impact to identified receptors will be sufficiently managed through the implementation of standard environmental measures as part of a project wide management plan.

It is considered that any site contamination impacts associated with current or historic land uses within the project area are not likely to pose a significant risk to the construction or operation of the project.

6.3 Recommendations

The construction and operation of the project is likely to require ongoing consideration of potential site contamination issues and risks. To that end, it is recommended that allowance for the following elements are included in project planning:

- Waste Classification
  - If excavation requiring offsite disposal of excavation spoil is anticipated, spoil materials must be classified in accordance with the SA EPA's WDF Standard.
- Management Plans – measures will need to be developed and implemented to manage and mitigate the potential for environmental impact during site construction and operation, including:
  - Storage and use of fuel, lubricants and other chemicals.
  - Management and use of vehicles, equipment and machinery.
  - Management of stormwater, including prevention of erosion and sedimentation and the management of runoff, particularly near watercourses).
  - Importation of soil/ gravel materials (e.g., for levelling sites, construction of hardstands, etc).
  - Unexpected Finds Protocol, including contingencies for micro-siting of infrastructure if materials suspected to be contaminated are encountered, or evidence of former mining or landfilling activities is observed.

7.0 REFERENCES

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SA EPA – South Australian Environment Protection Authority (2023) Site Contamination Index, located at https://www.epa.sa.gov.au/public_register/site_contamination_index.

SA GOV – Government of South Australia (2023) Location SA Map Viewer, located at: http://location.sa.gov.au/viewer/.

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NHMRC - Natural Health and Medical Research Council (2021) National Water Quality Management Strategy, Australian Drinking Water Guidelines 6 2011. Version 3.6 March 2021.

SA Health (2023) Salinity and Drinking Water, located at https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/public+health/water+quality/salinity+and+drinking+water.

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APPENDIX A: FIGURES

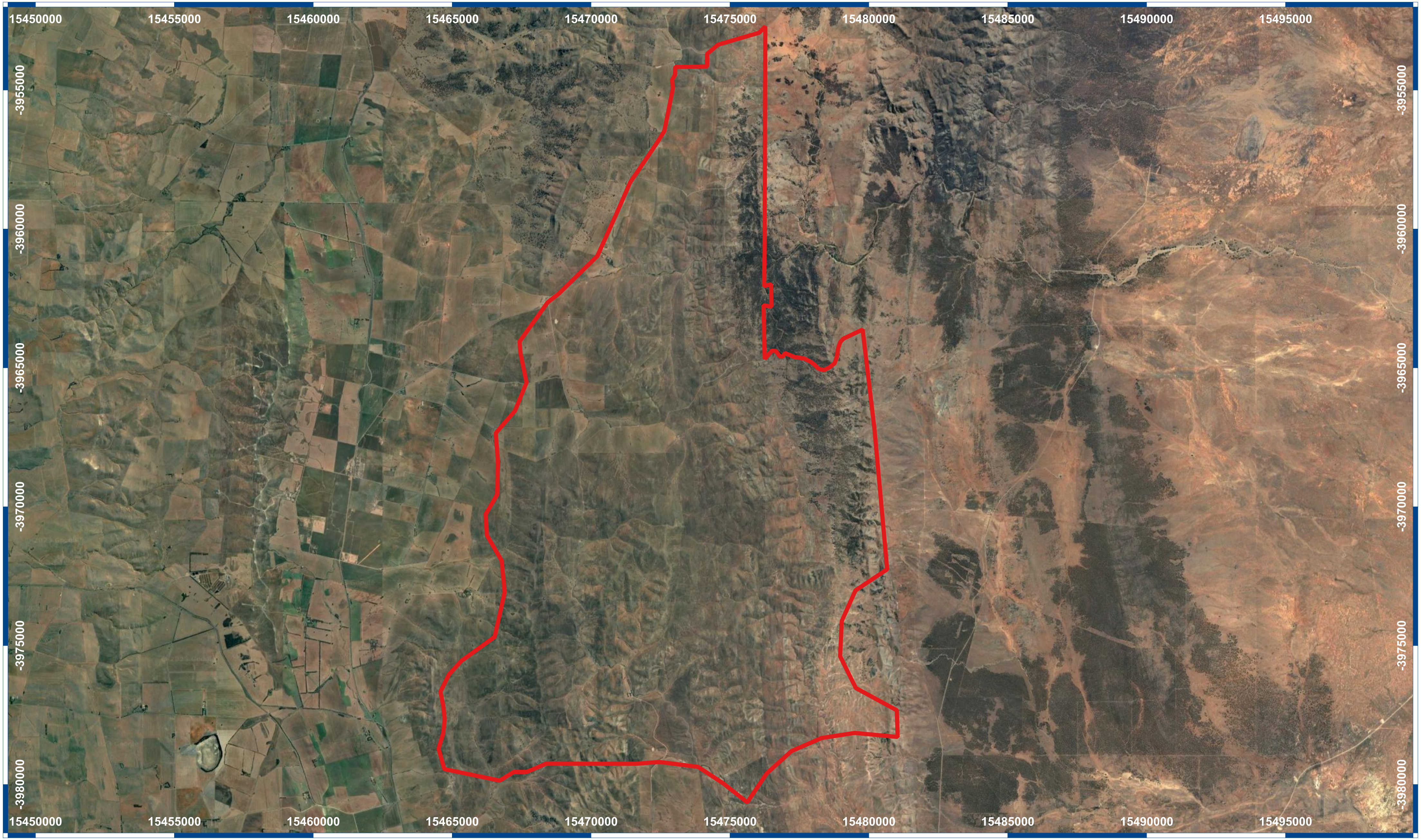

Figure 1. Goyder North Project Boundary

Goyder Renewable Zone
Goyder North, Burra, South Australia
Prepared for: Neoen Australia Pty Ltd

Legend

Goyder North Project Boundary

agon ENVIRONMENTAL

Agon Environmental Pty Ltd
3/224 Glen Osmond Rd,
Adelaide, SA 5063
agonenviro.com.au

0 2.5 5 km

N

Projection: Transverse Mercator
Horizontal Datum: GDA94 1994
Grid: GDA 1994 MGA Zone 55
Aerial Image: SAPPA 2023

REVISION: 1
Date: 22/06/2023
Reference: JC1345
Prepared by DM

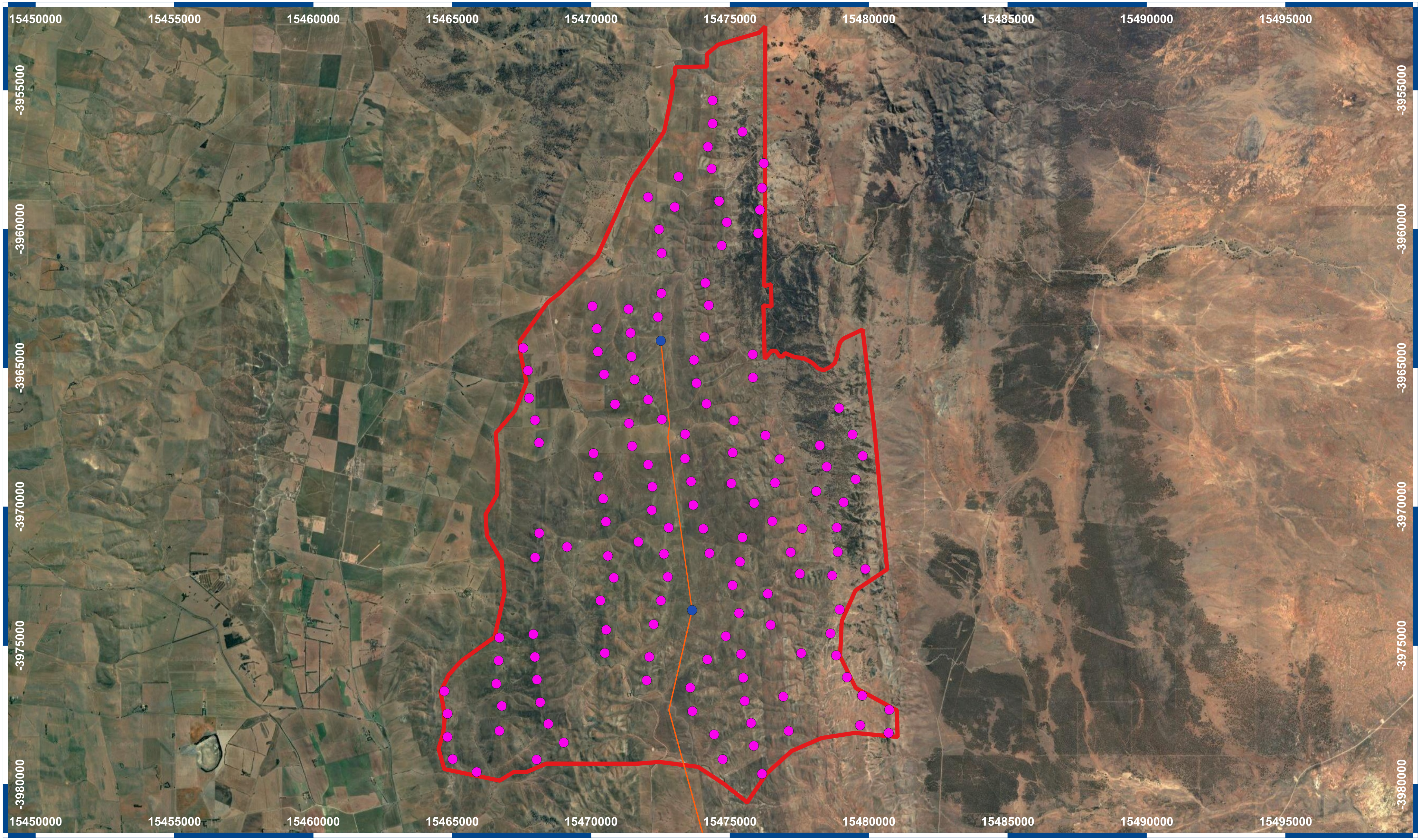

Figure 2. Proposed Project Layout

Goyder Renewable Zone
Goyder North, Burra, South Australia
Prepared for: Neoen Australia Pty Ltd

Legend

- Wind Turbine Generators (WTG) Proposed Layout (Neoen 20230525)
- Proposed Substation (Neoen 20230525)
- Overhead Transmission Line (OHL) Option (Neoen 20230525)
- Goyder North Project Boundary

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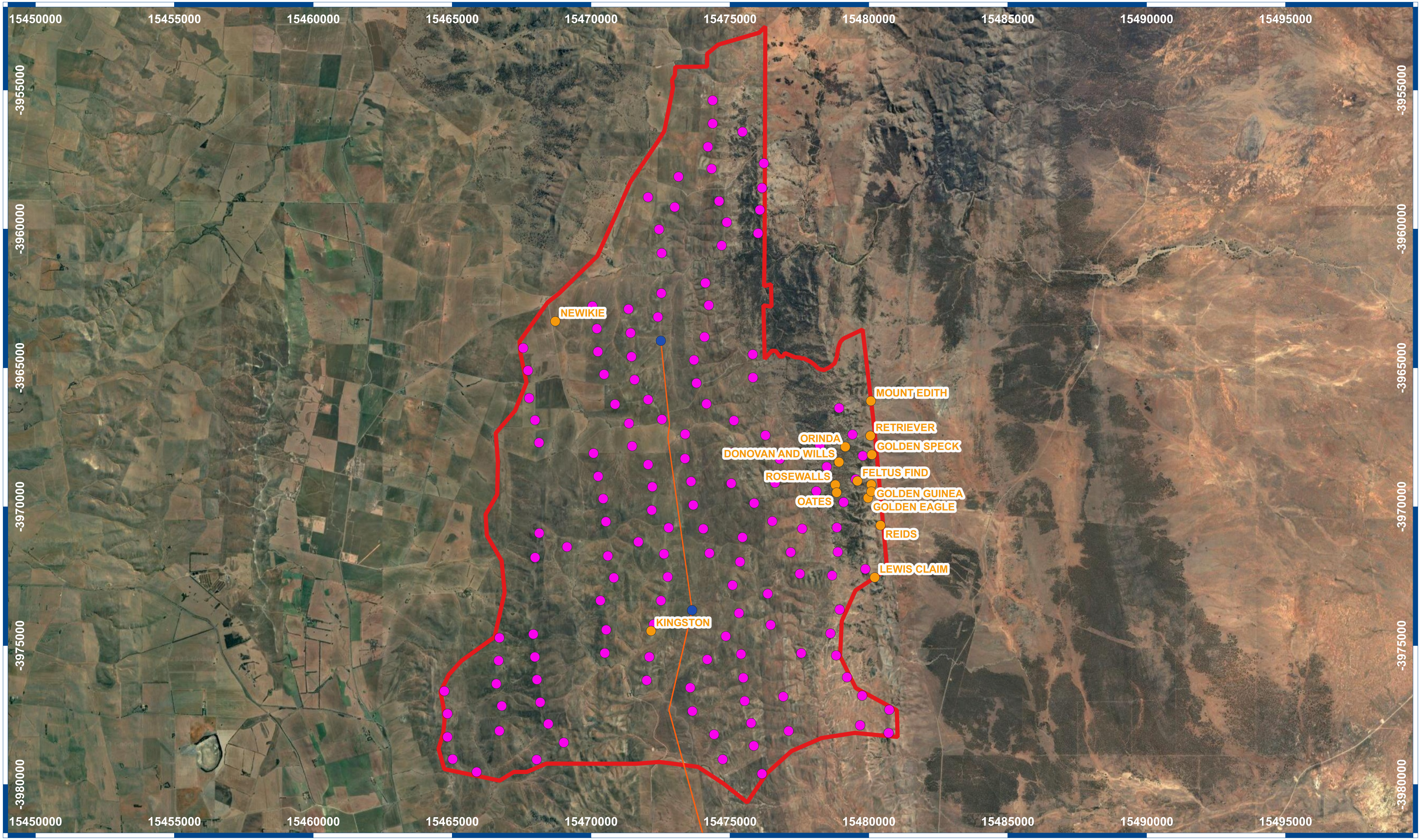

Figure 3. Mines and Mineral Deposit Sites

Goyder Renewable Zone
Goyder North, Burra, South Australia
Prepared for: Neoen Australia Pty Ltd

Legend

- Mines and Mineral deposits sites
- Wind Turbine Generators (WTG) Proposed Layout (Neoen 20230525)
- Proposed Substation (Neoen 20230525)
- Overhead Transmission Line (OHL) Option (Neoen 20230525)
- Goyder North Project Boundary

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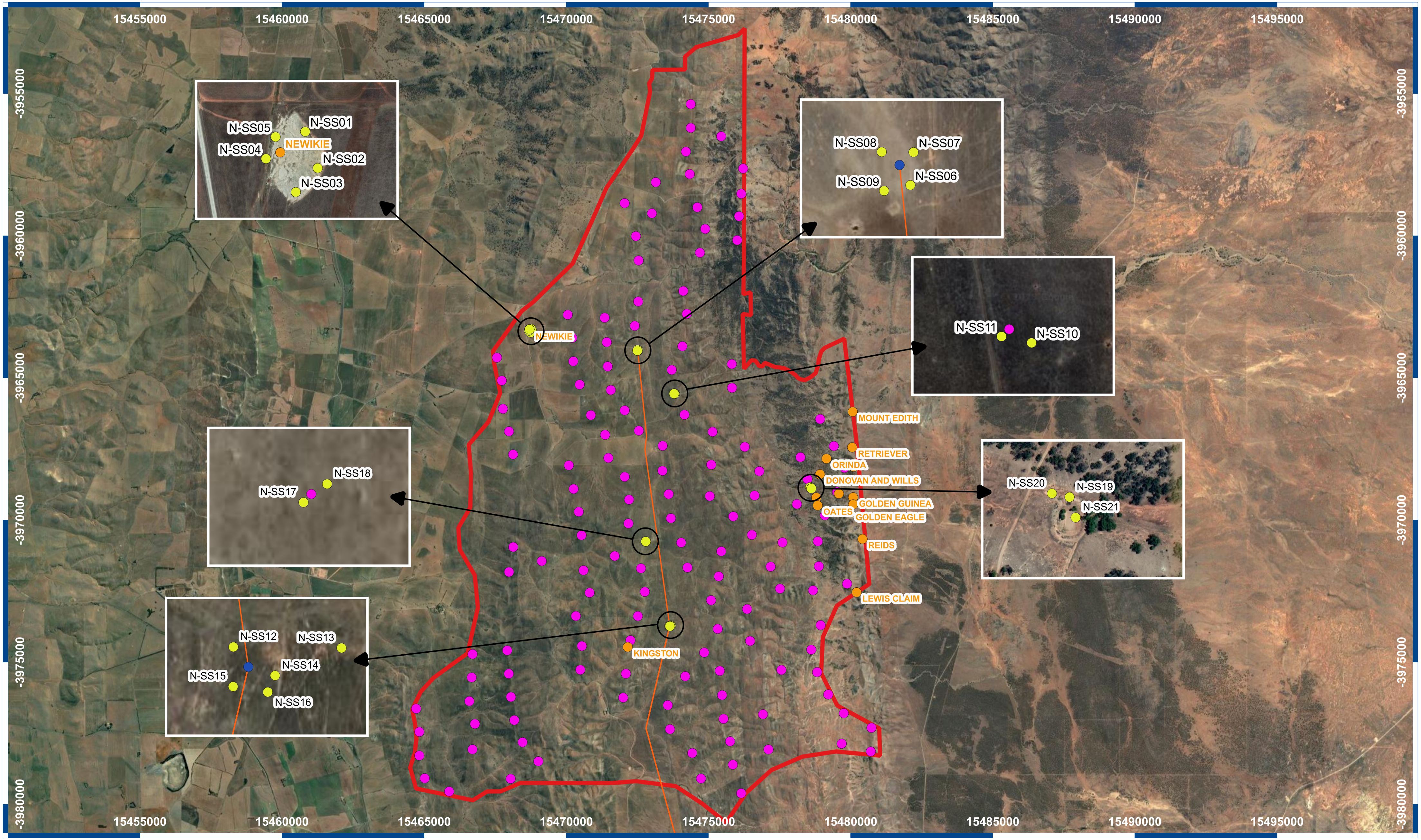

Figure 4. Soil Sample Location Plan

Goyder Renewable Zone
Goyder North, Burra, South Australia
Prepared for: Neoen Australia Pty Ltd

Legend

- Agon Soil Sample Location
- Mines and Mineral deposits sites
- Wind Turbine Generators (WTG) Proposed Layout (Neoen 20230525)
- Proposed Substation (Neoen 20230525)
- Overhead Transmission Line (OHL) Option (Neoen 20230525)
- Goyder North Project Boundary

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0 2.5 5 km

N

Projection: Transverse Mercator
Horizontal Datum: GDA94 1994
Grid: GDA 1994 MGA Zone 55
Aerial Image: SAPPA 2023

REVISION: 1
Date: 22/06/2023
Reference: JC1345
Prepared by DM

APPENDIX B: SITE PHOTOGRAPHS

Photograph 1: Sampling locations for N-SS01 to N-SS05

Photograph 2: Sampling locations for N-SS01 to N-SS05

Photograph 3: Sampling locations for N-SS06 to N-SS09

Photograph 4: Sampling locations for N-SS06 to N-SS09

Photograph 5: Sampling locations for N-SS10 to N-SS11

Photograph 6: Sampling locations for N-SS10 to N-SS11

Photograph 7: Sampling locations for N-SS12 to N-SS15

Photograph 8: Sampling locations for N-SS12 to N-SS15

Photograph 9: Sampling locations for N-SS16 to N-SS17

Photograph 10: Sampling locations for N-SS16 to N-SS17

Photograph 11: Sample location for N-SS18

Photograph 12: Sample location for N-SS19

Photograph 13: Sample location for N-SS20

Photograph 14: Sample location for N-SS21

APPENDIX C: TABULATED RESULTS

	Metals																
	Arsenic	Barium	Beryllium	Boron	Cadmium	Cobalt	Copper	Chromium (III+VI)	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Tin	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	2	10	2	10	0.4	5	5	5	5	5	0.1	5	5	2	2	10	5
NEPM 2013HILs Res A Soil	100		60	4,500	20	100	6,000		300	3,800	40		400	200			7,400
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand																	
>=0m, <1m																	
>=1m, <2m																	
>=2m, <4m																	
>=4m																	
NEPM 2013 Generic EIL - Areas of Ecological Significance	40						70	80	470				45				190
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil																	
>=0m, <2m																	

	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene TEQ calc (Zero)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Half)	Benzo(a) pyrene	Benzo(b+j)fluoranthene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
NEPM 2013HILs Res A Soil					3	3	3		
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand									
>=0m, <1m									
>=1m, <2m									
>=2m, <4m									
>=4m									
NEPM 2013 Generic EIL - Areas of Ecological Significance									
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil								1.4	
>=0m, <2m								1.4	

Lab Number	Lab Name	Field ID	Date	Arsenic	Barium	Beryllium	Boron	Cadmium	Cobalt	Copper	Chromium (III+VI)	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Tin	Zinc
1001497	**Eurofins**	**N-SS01**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS03**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS04**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS05**	**19 Jun 2023**	6.9	57	<2	<10	<0.4	15	16	40	18	400	<0.1	<5	21	<2	<2	<10	38
1001497	**Eurofins**	**N-SS06**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS07**	**19 Jun 2023**	12	75	<2	<10	<0.4	14	34	33	24	260	<0.1	<5	33	<2	<2	<10	53
1001497	**Eurofins**	**N-SS08**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS09**	**19 Jun 2023**	6.0	70	<2	<10	<0.4	15	15	29	17	260	<0.1	<5	23	<2	<2	<10	45
1001497	**Eurofins**	**N-SS10**	**19 Jun 2023**	5.9	100	<2	<10	<0.4	15	16	30	14	310	<0.1	<5	20	<2	<2	<10	54
1001497	**Eurofins**	**N-SS11**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS12**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS13**	**19 Jun 2023**	9.0	130	<2	<10	<0.4	17	25	33	18	840	<0.1	<5	33	<2	<2	<10	62
1001497	**Eurofins**	**N-SS14**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS15**	**19 Jun 2023**	8.6	130	<2	<10	<0.4	22	28	39	37	710	<0.1	<5	41	<2	<2	<10	77
1001497	**Eurofins**	**N-SS16**	**19 Jun 2023**	8.3	79	<2	<10	<0.4	15	29	37	27	360	<0.1	<5	32	<2	<2	<10	58
1001497	**Eurofins**	**N-SS17**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS18**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS19**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS20**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS21**	**19 Jun 2023**	8.2	140	<2	<10	<0.4	19	26	39	23	700	<0.1	<5	33	<2	<2	<10	71

Lab Number	Lab Name	Field ID	Date	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene TEQ calc (Zero)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Half)	Benzo(a) pyrene	Benzo(b+j)fluoranthene
1001497	**Eurofins**	**N-SS01**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS03**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS04**	**19 Jun 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5
1001497	**Eurofins**	**N-SS05**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS06**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS07**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS08**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS09**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS10**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS11**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS12**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS13**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS14**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS15**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS16**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS17**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS18**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS19**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS20**	**19 Jun 2023**	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5
1001497	**Eurofins**	**N-SS21**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-

				PAH											BTEX						TRH								
				Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (o)	Xylene (m & p)	Xylene Total	C6-C10	C6-C10 (F1 minus BTEX)	C10-C16	C10-C16 (F2 minus Naphthalene)	C16-C34	C34-C40	C10-C40 (Sum of total)	C6-C9	C10-C14
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.2	0.3	20	20	50	50	100	100	100	20	20
NEPM 2013HILs Res A Soil														300															
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand											3																		
>=0m, <1m											3				0.5	55	160			40		45		110					
>=1m, <2m															0.5		220			60		70		240					
>=2m, <4m															0.5		310			95		110		440					
>=4m															0.5		540			170		200							
NEPM 2013 Generic EIL - Areas of Ecological Significance											10																		
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil															8	1.5	10			10		125		25					
>=0m, <2m															8	1.5	10			10		125		25					
Lab Number	**Lab Name**	**Field ID**	**Date**																										
1001497	Eurofins	N-SS01	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS03	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS04	19 Jun 2023	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<20	<20	<50	<50	<100	<100	<100	<20	<20
1001497	Eurofins	N-SS05	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS06	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS07	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<20	<20	<50	<50	<100	<100	<100	<20	<20
1001497	Eurofins	N-SS08	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS09	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS10	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS11	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS12	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS13	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<20	<20	<50	<50	<100	<100	<100	<20	<20
1001497	Eurofins	N-SS14	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS15	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS16	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS17	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS18	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<20	<20	<50	<50	<100	<100	<100	<20	<20
1001497	Eurofins	N-SS19	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS20	19 Jun 2023	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<20	<20	<50	<50	<100	<100	<100	<20	<20
1001497	Eurofins	N-SS21	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

				TPH			Organochlorine Pesticides																						
				C15-C28	C29-C36	+C10-C36 (Sum of total)	Aldrin	Dieldrin	Aldrin + Dieldrin	DDD	DDT	4,4-DDE	DDT+DDE+DDD	Endosulfan I	Endosulfan II	Endrin	Endrin ketone	Endrin aldehyde	Endosulfan sulphate	chlordane	Hexachlorobenzene	Heptachlor	Heptachlor epoxide	a-BHC	b-BHC	d-BHC	g-BHC (Lindane)	Methoxychlor	Toxaphene
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				50	50	50	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
NEPM 2013HILs Res A Soil									6				240			10				50	10	6						300	20
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand																													
>=0m, <1m																													
>=1m, <2m																													
>=2m, <4m																													
>=4m																													
NEPM 2013 Generic EIL - Areas of Ecological Significance											3																		
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil																													
>=0m, <2m																													
Lab Number	**Lab Name**	**Field ID**	**Date**																										
1001497	**Eurofins**	**N-SS01**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS03**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS04**	**19 Jun 2023**	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS05**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS06**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS07**	**19 Jun 2023**	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS08**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS09**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS10**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS11**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS12**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS13**	**19 Jun 2023**	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS14**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS15**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS16**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS17**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS18**	**19 Jun 2023**	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS19**	**19 Jun 2023**	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
1001497	**Eurofins**	**N-SS20**	**19 Jun 2023**	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS21**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

						Organophosphorous Pesticides																						
				Organochlorine pesticides EPAVic	Other organochlorine pesticides EPAVic	Azinophos methyl	Bolstar (Sulprofos)	Chlorfenvinphos	Chlorpyrifos-methyl	Coumaphos	Demeton-O	Demeton-S	Diazinon	Dichlorvos	Dimethoate	Disulfoton	Merphos	EPN	Methyl parathion	Ethion	Ethoprop	Mevinphos (Phosdrin)	Fenitrothion	Fensulfothion	Monocrotophos	Fenthion	Malathion	Naled (Dibrom)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.1	0.2	0.2	0.2	0.2	2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2	0.2	0.2	0.2
NEPM 2013HILs Res A Soil																												
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand																												
>=0m, <1m																												
>=1m, <2m																												
>=2m, <4m																												
>=4m																												
NEPM 2013 Generic EIL - Areas of Ecological Significance																												
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil																												
>=0m, <2m																												
Lab Number	**Lab Name**	**Field ID**	**Date**																									
1001497	**Eurofins**	**N-SS01**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS03**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS04**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS05**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS06**	**19 Jun 2023**	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2
1001497	**Eurofins**	**N-SS07**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS08**	**19 Jun 2023**	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2
1001497	**Eurofins**	**N-SS09**	**19 Jun 2023**	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS10**	**19 Jun 2023**	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2
1001497	**Eurofins**	**N-SS11**	**19 Jun 2023**	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS12**	**19 Jun 2023**	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2
1001497	**Eurofins**	**N-SS13**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS14**	**19 Jun 2023**	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS15**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS16**	**19 Jun 2023**	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2
1001497	**Eurofins**	**N-SS17**	**19 Jun 2023**	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS18**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS19**	**19 Jun 2023**	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS20**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1001497	**Eurofins**	**N-SS21**	**19 Jun 2023**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

												NA	Inorganics	Explosives										Pesticides	
				Omethoate	Phorate	Pyrazophos	Ronnel	Terbufos	Tetrachlorvinphos	Tokuthion	Trichloronate	Chlorpyrifos	Naphthalene (VOC)	Moisture Content (dried @ 103°C)	1,3,5-Trinitrobenzene	2,4-& 2,6-Dinitrotoluene	2,4,6-Trinitrotoluene (TNT)	2-Nitrotoluene	4-Nitrotoluene	m-Nitrotoluene	Nitroglycerine	RDX	Nitrobenzene	1,3-Dinitrobenzene	Parathion	Pirimiphos-methyl
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	1	1	1	1	0.5	0.5	0.5	5	0.5	0.5	0.5	0.2	0.2
NEPM 2013HILs Res A Soil												160														
NEPM 2013 Res A/B Soil HSL for Vapour Intrusion, Sand																										
>=0m, <1m																										
>=1m, <2m																										
>=2m, <4m																										
>=4m																										
NEPM 2013 Generic EIL - Areas of Ecological Significance																										
NEPM 2013 ESLs for Areas of Ecological Significance, Coarse Soil																										
>=0m, <2m																										
Lab Number	**Lab Name**	**Field ID**	**Date**																							
1001497	Eurofins	N-SS01	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	14	<1	<1	<1	<0.5	<0.5	<0.5	<5	<0.5	<0.5	<0.5	-	-
1001497	Eurofins	N-SS03	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	<5	-	-	-	-	-
1001497	Eurofins	N-SS04	19 Jun 2023	-	-	-	-	-	-	-	-	-	<0.5	13	<1	<1	<1	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	-
1001497	Eurofins	N-SS05	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS06	19 Jun 2023	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	13	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
1001497	Eurofins	N-SS07	19 Jun 2023	-	-	-	-	-	-	-	-	-	<0.5	11	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS08	19 Jun 2023	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	10	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
1001497	Eurofins	N-SS09	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS10	19 Jun 2023	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	17	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
1001497	Eurofins	N-SS11	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS12	19 Jun 2023	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	26	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
1001497	Eurofins	N-SS13	19 Jun 2023	-	-	-	-	-	-	-	-	-	<0.5	20	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS14	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS15	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS16	19 Jun 2023	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	16	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
1001497	Eurofins	N-SS17	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	-
1001497	Eurofins	N-SS18	19 Jun 2023	-	-	-	-	-	-	-	-	-	<0.5	11	<1	<1	<1	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	-
1001497	Eurofins	N-SS19	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	<5	-	-	-	-	-
1001497	Eurofins	N-SS20	19 Jun 2023	-	-	-	-	-	-	-	-	-	<0.5	11	<1	<1	<1	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	-
1001497	Eurofins	N-SS21	19 Jun 2023	-	-	-	-	-	-	-	-	-	-	23	<1	<1	<1	<0.5	<0.5	<0.5	<5	<0.5	<0.5	<0.5	-	-

APPENDIX D: LABORATORY DOCUMENTATION

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Environment Testing

Certificate of Analysis

Agon Environmental Pty Ltd
3/224 Glen Osmond Road
Fullarton
SA 5063

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Sophie Hambour**

Report	**1001497-S**
Project name	Goyder North
Project ID	JC1345
Received Date	Jun 22, 2023

Client Sample ID			**N-SS01**	**N-SS03**	**N-SS04**	**N-SS05**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M23-Jn0051772**	**M23-Jn0051773**	**M23-Jn0051774**	**M23-Jn0051775**
Date Sampled			**Jun 19, 2023**	**Jun 19, 2023**	**Jun 19, 2023**	**Jun 19, 2023**
Test/Reference	LOR	Unit				
Nitroglycerine (NG)	5	mg/kg	< 5	< 5	-	-
Explosives						
1.3-Dinitrobenzene (1.3-DNB)	0.5	mg/kg	< 0.5	-	< 0.5	-
1.3.5-Trinitrobenzene (1.3.5-TNB)	1	mg/kg	< 1	-	< 1	-
2-Nitrotoluene (2-NT)	0.5	mg/kg	< 0.5	-	< 0.5	-
2.4- & 2.6-Dinitrotoluene	1	mg/kg	< 1	-	< 1	-
3-Nitrotoluene (3-NT)	0.5	mg/kg	< 0.5	-	< 0.5	-
4-Nitrotoluene (4-NT)	0.5	mg/kg	< 0.5	-	< 0.5	-
Hexahydro-1.3.5-trinitro-1.3.5-triazine (RDX)	0.5	mg/kg	< 0.5	-	< 0.5	-
Nitrobenzene (NB)	0.5	mg/kg	< 0.5	-	< 0.5	-
TNT	1	mg/kg	< 1	-	< 1	-
Sample Properties						
% Moisture	1	%	14	18	13	22
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	-	-	< 20	-
TRH C10-C14	20	mg/kg	-	-	< 20	-
TRH C15-C28	50	mg/kg	-	-	< 50	-
TRH C29-C36	50	mg/kg	-	-	< 50	-
TRH C10-C36 (Total)	50	mg/kg	-	-	< 50	-
TRH C6-C10	20	mg/kg	-	-	< 20	-
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	-	-	< 20	-
TRH >C10-C16	50	mg/kg	-	-	< 50	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	-	-	< 50	-
TRH >C16-C34	100	mg/kg	-	-	< 100	-
TRH >C34-C40	100	mg/kg	-	-	< 100	-
TRH >C10-C40 (total)*	100	mg/kg	-	-	< 100	-
BTEX						
Benzene	0.1	mg/kg	-	-	< 0.1	-
Toluene	0.1	mg/kg	-	-	< 0.1	-
Ethylbenzene	0.1	mg/kg	-	-	< 0.1	-
m&p-Xylenes	0.2	mg/kg	-	-	< 0.2	-
o-Xylene	0.1	mg/kg	-	-	< 0.1	-
Xylenes - Total*	0.3	mg/kg	-	-	< 0.3	-
4-Bromofluorobenzene (surr.)	1	%	-	-	82	-

Client Sample ID			N-SS01	N-SS03	N-SS04	N-SS05
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051772	M23-Jn0051773	M23-Jn0051774	M23-Jn0051775
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	-	< 0.5	-
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	-	-	0.6	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	-	-	1.2	-
Acenaphthene	0.5	mg/kg	-	-	< 0.5	-
Acenaphthylene	0.5	mg/kg	-	-	< 0.5	-
Anthracene	0.5	mg/kg	-	-	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	-	-	< 0.5	-
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	-	-	< 0.5	-
Benzo(g.h.i)perylene	0.5	mg/kg	-	-	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Chrysene	0.5	mg/kg	-	-	< 0.5	-
Dibenz(a.h)anthracene	0.5	mg/kg	-	-	< 0.5	-
Fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Fluorene	0.5	mg/kg	-	-	< 0.5	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	-	-	< 0.5	-
Naphthalene	0.5	mg/kg	-	-	< 0.5	-
Phenanthrene	0.5	mg/kg	-	-	< 0.5	-
Pyrene	0.5	mg/kg	-	-	< 0.5	-
Total PAH*	0.5	mg/kg	-	-	< 0.5	-
2-Fluorobiphenyl (surr.)	1	%	-	-	80	-
p-Terphenyl-d14 (surr.)	1	%	-	-	81	-
Heavy Metals						
Arsenic	2	mg/kg	-	-	-	6.9
Barium	10	mg/kg	-	-	-	57
Beryllium	2	mg/kg	-	-	-	< 2
Boron	10	mg/kg	-	-	-	< 10
Cadmium	0.4	mg/kg	-	-	-	< 0.4
Chromium	5	mg/kg	-	-	-	40
Cobalt	5	mg/kg	-	-	-	15
Copper	5	mg/kg	-	-	-	16
Lead	5	mg/kg	-	-	-	18
Manganese	5	mg/kg	-	-	-	400
Mercury	0.1	mg/kg	-	-	-	< 0.1
Molybdenum	5	mg/kg	-	-	-	< 5
Nickel	5	mg/kg	-	-	-	21
Selenium	2	mg/kg	-	-	-	< 2
Silver	2	mg/kg	-	-	-	< 2
Tin	10	mg/kg	-	-	-	< 10
Zinc	5	mg/kg	-	-	-	38

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Environment Testing

Client Sample ID			N-SS06	N-SS07	N-SS08	N-SS09
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051776	M23-Jn0051777	M23-Jn0051778	M23-Jn0051779
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Sample Properties						
% Moisture	1	%	13	11	10	11
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	-	< 20	-	-
TRH C10-C14	20	mg/kg	-	< 20	-	-
TRH C15-C28	50	mg/kg	-	< 50	-	-
TRH C29-C36	50	mg/kg	-	< 50	-	-
TRH C10-C36 (Total)	50	mg/kg	-	< 50	-	-
TRH C6-C10	20	mg/kg	-	< 20	-	-
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	-	< 20	-	-
TRH >C10-C16	50	mg/kg	-	< 50	-	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	-	< 50	-	-
TRH >C16-C34	100	mg/kg	-	< 100	-	-
TRH >C34-C40	100	mg/kg	-	< 100	-	-
TRH >C10-C40 (total)*	100	mg/kg	-	< 100	-	-
BTEX						
Benzene	0.1	mg/kg	-	< 0.1	-	-
Toluene	0.1	mg/kg	-	< 0.1	-	-
Ethylbenzene	0.1	mg/kg	-	< 0.1	-	-
m&p-Xylenes	0.2	mg/kg	-	< 0.2	-	-
o-Xylene	0.1	mg/kg	-	< 0.1	-	-
Xylenes - Total*	0.3	mg/kg	-	< 0.3	-	-
4-Bromofluorobenzene (surr.)	1	%	-	62	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	< 0.5	-	-
Heavy Metals						
Arsenic	2	mg/kg	-	12	-	6.0
Barium	10	mg/kg	-	75	-	70
Beryllium	2	mg/kg	-	< 2	-	< 2
Boron	10	mg/kg	-	< 10	-	< 10
Cadmium	0.4	mg/kg	-	< 0.4	-	< 0.4
Chromium	5	mg/kg	-	33	-	29
Cobalt	5	mg/kg	-	14	-	15
Copper	5	mg/kg	-	34	-	15
Lead	5	mg/kg	-	24	-	17
Manganese	5	mg/kg	-	260	-	260
Mercury	0.1	mg/kg	-	< 0.1	-	< 0.1
Molybdenum	5	mg/kg	-	< 5	-	< 5
Nickel	5	mg/kg	-	33	-	23
Selenium	2	mg/kg	-	< 2	-	< 2
Silver	2	mg/kg	-	< 2	-	< 2
Tin	10	mg/kg	-	< 10	-	< 10
Zinc	5	mg/kg	-	53	-	45
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05

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Environment Testing

Client Sample ID			N-SS06	N-SS07	N-SS08	N-SS09
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051776	M23-Jn0051777	M23-Jn0051778	M23-Jn0051779
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	70	-	94	124
Tetrachloro-m-xylene (surr.)	1	%	61	-	121	122
Organophosphorus Pesticides						
Azinphos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Bolstar	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorfenvinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorpyrifos	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorpyrifos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Coumaphos	2	mg/kg	< 2	-	< 2	-
Demeton-S	0.2	mg/kg	< 0.2	-	< 0.2	-
Demeton-O	0.2	mg/kg	< 0.2	-	< 0.2	-
Diazinon	0.2	mg/kg	< 0.2	-	< 0.2	-
Dichlorvos	0.2	mg/kg	< 0.2	-	< 0.2	-
Dimethoate	0.2	mg/kg	< 0.2	-	< 0.2	-
Disulfoton	0.2	mg/kg	< 0.2	-	< 0.2	-
EPN	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethion	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethoprop	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethyl parathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fenitrothion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fensulfothion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fenthion	0.2	mg/kg	< 0.2	-	< 0.2	-
Malathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Merphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Methyl parathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Mevinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Monocrotophos	2	mg/kg	< 2	-	< 2	-
Naled	0.2	mg/kg	< 0.2	-	< 0.2	-
Omethoate	2	mg/kg	< 2	-	< 2	-

Client Sample ID			N-SS06	N-SS07	N-SS08	N-SS09
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051776	M23-Jn0051777	M23-Jn0051778	M23-Jn0051779
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Organophosphorus Pesticides						
Phorate	0.2	mg/kg	< 0.2	-	< 0.2	-
Pirimiphos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Pyrazophos	0.2	mg/kg	< 0.2	-	< 0.2	-
Ronnel	0.2	mg/kg	< 0.2	-	< 0.2	-
Terbufos	0.2	mg/kg	< 0.2	-	< 0.2	-
Tetrachlorvinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Tokuthion	0.2	mg/kg	< 0.2	-	< 0.2	-
Trichloronate	0.2	mg/kg	< 0.2	-	< 0.2	-
Triphenylphosphate (surr.)	1	%	64	-	69	-

Client Sample ID			N-SS10	N-SS11	N-SS12	N-SS13
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051780	M23-Jn0051781	M23-Jn0051782	M23-Jn0051783
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Sample Properties						
% Moisture	1	%	17	18	26	20
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	-	-	-	< 20
TRH C10-C14	20	mg/kg	-	-	-	< 20
TRH C15-C28	50	mg/kg	-	-	-	< 50
TRH C29-C36	50	mg/kg	-	-	-	< 50
TRH C10-C36 (Total)	50	mg/kg	-	-	-	< 50
TRH C6-C10	20	mg/kg	-	-	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	-	-	-	< 20
TRH >C10-C16	50	mg/kg	-	-	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	-	-	-	< 50
TRH >C16-C34	100	mg/kg	-	-	-	< 100
TRH >C34-C40	100	mg/kg	-	-	-	< 100
TRH >C10-C40 (total)*	100	mg/kg	-	-	-	< 100
BTEX						
Benzene	0.1	mg/kg	-	-	-	< 0.1
Toluene	0.1	mg/kg	-	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	-	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	-	-	-	< 0.2
o-Xylene	0.1	mg/kg	-	-	-	< 0.1
Xylenes - Total*	0.3	mg/kg	-	-	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	-	-	-	95
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	-	-	< 0.5
Heavy Metals						
Arsenic	2	mg/kg	5.9	-	-	9.0
Barium	10	mg/kg	100	-	-	130
Beryllium	2	mg/kg	< 2	-	-	< 2
Boron	10	mg/kg	< 10	-	-	< 10
Cadmium	0.4	mg/kg	< 0.4	-	-	< 0.4
Chromium	5	mg/kg	30	-	-	33

Client Sample ID			N-SS10	N-SS11	N-SS12	N-SS13
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051780	M23-Jn0051781	M23-Jn0051782	M23-Jn0051783
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Cobalt	5	mg/kg	15	-	-	17
Copper	5	mg/kg	16	-	-	25
Lead	5	mg/kg	14	-	-	18
Manganese	5	mg/kg	310	-	-	840
Mercury	0.1	mg/kg	< 0.1	-	-	< 0.1
Molybdenum	5	mg/kg	< 5	-	-	< 5
Nickel	5	mg/kg	20	-	-	33
Selenium	2	mg/kg	< 2	-	-	< 2
Silver	2	mg/kg	< 2	-	-	< 2
Tin	10	mg/kg	< 10	-	-	< 10
Zinc	5	mg/kg	54	-	-	62
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	< 0.1	< 0.1	-
4.4'-DDD	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
4.4'-DDE	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
4.4'-DDT	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
a-HCH	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Aldrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
b-HCH	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
d-HCH	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Dieldrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endosulfan I	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endosulfan II	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endrin aldehyde	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Endrin ketone	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
g-HCH (Lindane)	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Heptachlor	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Methoxychlor	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Toxaphene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	< 0.05	< 0.05	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	-
Dibutylchlorendate (surr.)	1	%	117	120	84	-
Tetrachloro-m-xylene (surr.)	1	%	121	121	122	-
Organophosphorus Pesticides						
Azinphos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Bolstar	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorfenvinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorpyrifos	0.2	mg/kg	< 0.2	-	< 0.2	-
Chlorpyrifos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Coumaphos	2	mg/kg	< 2	-	< 2	-
Demeton-S	0.2	mg/kg	< 0.2	-	< 0.2	-
Demeton-O	0.2	mg/kg	< 0.2	-	< 0.2	-
Diazinon	0.2	mg/kg	< 0.2	-	< 0.2	-

Client Sample ID			N-SS10	N-SS11	N-SS12	N-SS13
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051780	M23-Jn0051781	M23-Jn0051782	M23-Jn0051783
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Organophosphorus Pesticides						
Dichlorvos	0.2	mg/kg	< 0.2	-	< 0.2	-
Dimethoate	0.2	mg/kg	< 0.2	-	< 0.2	-
Disulfoton	0.2	mg/kg	< 0.2	-	< 0.2	-
EPN	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethion	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethoprop	0.2	mg/kg	< 0.2	-	< 0.2	-
Ethyl parathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fenitrothion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fensulfothion	0.2	mg/kg	< 0.2	-	< 0.2	-
Fenthion	0.2	mg/kg	< 0.2	-	< 0.2	-
Malathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Merphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Methyl parathion	0.2	mg/kg	< 0.2	-	< 0.2	-
Mevinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Monocrotophos	2	mg/kg	< 2	-	< 2	-
Naled	0.2	mg/kg	< 0.2	-	< 0.2	-
Omethoate	2	mg/kg	< 2	-	< 2	-
Phorate	0.2	mg/kg	< 0.2	-	< 0.2	-
Pirimiphos-methyl	0.2	mg/kg	< 0.2	-	< 0.2	-
Pyrazophos	0.2	mg/kg	< 0.2	-	< 0.2	-
Ronnel	0.2	mg/kg	< 0.2	-	< 0.2	-
Terbufos	0.2	mg/kg	< 0.2	-	< 0.2	-
Tetrachlorvinphos	0.2	mg/kg	< 0.2	-	< 0.2	-
Tokuthion	0.2	mg/kg	< 0.2	-	< 0.2	-
Trichloronate	0.2	mg/kg	< 0.2	-	< 0.2	-
Triphenylphosphate (surr.)	1	%	75	-	106	-

Client Sample ID			N-SS14	N-SS15	N-SS16	N-SS17
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051784	M23-Jn0051785	M23-Jn0051786	M23-Jn0051787
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Sample Properties						
% Moisture	1	%	17	20	16	14
Heavy Metals						
Arsenic	2	mg/kg	-	8.6	8.3	-
Barium	10	mg/kg	-	130	79	-
Beryllium	2	mg/kg	-	< 2	< 2	-
Boron	10	mg/kg	-	< 10	< 10	-
Cadmium	0.4	mg/kg	-	< 0.4	< 0.4	-
Chromium	5	mg/kg	-	39	37	-
Cobalt	5	mg/kg	-	22	15	-
Copper	5	mg/kg	-	28	29	-
Lead	5	mg/kg	-	37	27	-
Manganese	5	mg/kg	-	710	360	-
Mercury	0.1	mg/kg	-	< 0.1	< 0.1	-
Molybdenum	5	mg/kg	-	< 5	< 5	-

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Client Sample ID			N-SS14	N-SS15	N-SS16	N-SS17
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051784	M23-Jn0051785	M23-Jn0051786	M23-Jn0051787
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Nickel	5	mg/kg	-	41	32	-
Selenium	2	mg/kg	-	< 2	< 2	-
Silver	2	mg/kg	-	< 2	< 2	-
Tin	10	mg/kg	-	< 10	< 10	-
Zinc	5	mg/kg	-	77	58	-
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	74	-	103	62
Tetrachloro-m-xylene (surr.)	1	%	113	-	125	110
Organophosphorus Pesticides						
Azinphos-methyl	0.2	mg/kg	-	-	< 0.2	-
Bolstar	0.2	mg/kg	-	-	< 0.2	-
Chlorfenvinphos	0.2	mg/kg	-	-	< 0.2	-
Chlorpyrifos	0.2	mg/kg	-	-	< 0.2	-
Chlorpyrifos-methyl	0.2	mg/kg	-	-	< 0.2	-
Coumaphos	2	mg/kg	-	-	< 2	-
Demeton-S	0.2	mg/kg	-	-	< 0.2	-
Demeton-O	0.2	mg/kg	-	-	< 0.2	-
Diazinon	0.2	mg/kg	-	-	< 0.2	-
Dichlorvos	0.2	mg/kg	-	-	< 0.2	-
Dimethoate	0.2	mg/kg	-	-	< 0.2	-
Disulfoton	0.2	mg/kg	-	-	< 0.2	-
EPN	0.2	mg/kg	-	-	< 0.2	-
Ethion	0.2	mg/kg	-	-	< 0.2	-
Ethoprop	0.2	mg/kg	-	-	< 0.2	-

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Environment Testing

Client Sample ID			N-SS14	N-SS15	N-SS16	N-SS17
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051784	M23-Jn0051785	M23-Jn0051786	M23-Jn0051787
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Organophosphorus Pesticides						
Ethyl parathion	0.2	mg/kg	-	-	< 0.2	-
Fenitrothion	0.2	mg/kg	-	-	< 0.2	-
Fensulfothion	0.2	mg/kg	-	-	< 0.2	-
Fenthion	0.2	mg/kg	-	-	< 0.2	-
Malathion	0.2	mg/kg	-	-	< 0.2	-
Merphos	0.2	mg/kg	-	-	< 0.2	-
Methyl parathion	0.2	mg/kg	-	-	< 0.2	-
Mevinphos	0.2	mg/kg	-	-	< 0.2	-
Monocrotophos	2	mg/kg	-	-	< 2	-
Naled	0.2	mg/kg	-	-	< 0.2	-
Omethoate	2	mg/kg	-	-	< 2	-
Phorate	0.2	mg/kg	-	-	< 0.2	-
Pirimiphos-methyl	0.2	mg/kg	-	-	< 0.2	-
Pyrazophos	0.2	mg/kg	-	-	< 0.2	-
Ronnel	0.2	mg/kg	-	-	< 0.2	-
Terbufos	0.2	mg/kg	-	-	< 0.2	-
Tetrachlorvinphos	0.2	mg/kg	-	-	< 0.2	-
Tokuthion	0.2	mg/kg	-	-	< 0.2	-
Trichloronate	0.2	mg/kg	-	-	< 0.2	-
Triphenylphosphate (surr.)	1	%	-	-	121	-

Client Sample ID			N-SS18	N-SS19	N-SS20	N-SS21
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051788	M23-Jn0051789	M23-Jn0051790	M23-Jn0051791
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Nitroglycerine (NG)	5	mg/kg	-	< 5	-	< 5
Explosives						
1.3-Dinitrobenzene (1.3-DNB)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
1.3.5-Trinitrobenzene (1.3.5-TNB)	1	mg/kg	< 1	-	< 1	< 1
2-Nitrotoluene (2-NT)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
2.4- & 2.6-Dinitrotoluene	1	mg/kg	< 1	-	< 1	< 1
3-Nitrotoluene (3-NT)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
4-Nitrotoluene (4-NT)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Hexahydro-1.3.5-trinitro-1.3.5-triazine (RDX)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Nitrobenzene (NB)	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
TNT	1	mg/kg	< 1	-	< 1	< 1
Sample Properties						
% Moisture	1	%	11	10	11	23
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	< 20	-	< 20	-
TRH C10-C14	20	mg/kg	< 20	-	< 20	-
TRH C15-C28	50	mg/kg	< 50	-	< 50	-
TRH C29-C36	50	mg/kg	< 50	-	< 50	-
TRH C10-C36 (Total)	50	mg/kg	< 50	-	< 50	-
TRH C6-C10	20	mg/kg	< 20	-	< 20	-

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Environment Testing

Client Sample ID			N-SS18	N-SS19	N-SS20	N-SS21
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051788	M23-Jn0051789	M23-Jn0051790	M23-Jn0051791
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons						
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	< 20	-
TRH >C10-C16	50	mg/kg	< 50	-	< 50	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-	< 50	-
TRH >C16-C34	100	mg/kg	< 100	-	< 100	-
TRH >C34-C40	100	mg/kg	< 100	-	< 100	-
TRH >C10-C40 (total)*	100	mg/kg	< 100	-	< 100	-
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	< 0.1	-
Toluene	0.1	mg/kg	< 0.1	-	< 0.1	-
Ethylbenzene	0.1	mg/kg	< 0.1	-	< 0.1	-
m&p-Xylenes	0.2	mg/kg	< 0.2	-	< 0.2	-
o-Xylene	0.1	mg/kg	< 0.1	-	< 0.1	-
Xylenes - Total*	0.3	mg/kg	< 0.3	-	< 0.3	-
4-Bromofluorobenzene (surr.)	1	%	64	-	82	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	< 0.5	-
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	-	-	0.6	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	-	-	1.2	-
Acenaphthene	0.5	mg/kg	-	-	< 0.5	-
Acenaphthylene	0.5	mg/kg	-	-	< 0.5	-
Anthracene	0.5	mg/kg	-	-	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	-	-	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	-	-	< 0.5	-
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	-	-	< 0.5	-
Benzo(g.h.i)perylene	0.5	mg/kg	-	-	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Chrysene	0.5	mg/kg	-	-	< 0.5	-
Dibenz(a.h)anthracene	0.5	mg/kg	-	-	< 0.5	-
Fluoranthene	0.5	mg/kg	-	-	< 0.5	-
Fluorene	0.5	mg/kg	-	-	< 0.5	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	-	-	< 0.5	-
Naphthalene	0.5	mg/kg	-	-	< 0.5	-
Phenanthrene	0.5	mg/kg	-	-	< 0.5	-
Pyrene	0.5	mg/kg	-	-	< 0.5	-
Total PAH*	0.5	mg/kg	-	-	< 0.5	-
2-Fluorobiphenyl (surr.)	1	%	-	-	109	-
p-Terphenyl-d14 (surr.)	1	%	-	-	97	-
Heavy Metals						
Arsenic	2	mg/kg	-	-	-	8.2
Barium	10	mg/kg	-	-	-	140
Beryllium	2	mg/kg	-	-	-	< 2
Boron	10	mg/kg	-	-	-	< 10
Cadmium	0.4	mg/kg	-	-	-	< 0.4
Chromium	5	mg/kg	-	-	-	39
Cobalt	5	mg/kg	-	-	-	19
Copper	5	mg/kg	-	-	-	26

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Environment Testing

Client Sample ID			N-SS18	N-SS19	N-SS20	N-SS21
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M23-Jn0051788	M23-Jn0051789	M23-Jn0051790	M23-Jn0051791
Date Sampled			Jun 19, 2023	Jun 19, 2023	Jun 19, 2023	Jun 19, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	-	-	-	23
Manganese	5	mg/kg	-	-	-	700
Mercury	0.1	mg/kg	-	-	-	< 0.1
Molybdenum	5	mg/kg	-	-	-	< 5
Nickel	5	mg/kg	-	-	-	33
Selenium	2	mg/kg	-	-	-	< 2
Silver	2	mg/kg	-	-	-	< 2
Tin	10	mg/kg	-	-	-	< 10
Zinc	5	mg/kg	-	-	-	71
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	-	-
4.4'-DDD	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDE	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDT	0.05	mg/kg	-	< 0.05	-	-
a-HCH	0.05	mg/kg	-	< 0.05	-	-
Aldrin	0.05	mg/kg	-	< 0.05	-	-
b-HCH	0.05	mg/kg	-	< 0.05	-	-
d-HCH	0.05	mg/kg	-	< 0.05	-	-
Dieldrin	0.05	mg/kg	-	< 0.05	-	-
Endosulfan I	0.05	mg/kg	-	< 0.05	-	-
Endosulfan II	0.05	mg/kg	-	< 0.05	-	-
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	-	-
Endrin	0.05	mg/kg	-	< 0.05	-	-
Endrin aldehyde	0.05	mg/kg	-	< 0.05	-	-
Endrin ketone	0.05	mg/kg	-	< 0.05	-	-
g-HCH (Lindane)	0.05	mg/kg	-	< 0.05	-	-
Heptachlor	0.05	mg/kg	-	< 0.05	-	-
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	-	-
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	-	-
Methoxychlor	0.05	mg/kg	-	< 0.05	-	-
Toxaphene	0.5	mg/kg	-	< 0.5	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	< 0.05	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	< 0.05	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Dibutylchlorendate (surr.)	1	%	-	134	-	-
Tetrachloro-m-xylene (surr.)	1	%	-	116	-	-

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Environment Testing

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Nitroglycerine (NG)	Melbourne	Jun 24, 2023	14 Days
- Method: USEPA Method 8332			
Explosives	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2230 Determination of Explosive by HPLC			
VIC EPA Metals : Metals M17	Melbourne	Jun 24, 2023	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Melbourne	Jun 22, 2023	14 Days
- Method: LTM-GEN-7080 Moisture			
Eurofins Suite B4			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Polycyclic Aromatic Hydrocarbons	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Suite B14: OCP/OPP			
Organochlorine Pesticides	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270)			
Organophosphorus Pesticides	Melbourne	Jun 24, 2023	14 Days
- Method: LTM-ORG-2200 Organophosphorus Pesticides by GC-MS (USEPA 8270)			

Company Name:	Agon Environmental Pty Ltd - SA	**Order No.:**		**Received:**	Jun 22, 2023 1:49 PM
Address:	3/224 Glen Osmond Road Fullarton SA 5063	**Report #:**	1001497	**Due:**	Jun 29, 2023
		Phone:	08 8338 1009	**Priority:**	5 Day
		Fax:		**Contact Name:**	Sophie Hambour
Project Name:	Goyder North				
Project ID:	JC1345				

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						HOLD	Nitroglycerine (NG)	Organochlorine Pesticides	Explosives	Suite B14: OCP/OPP	VIC EPA Metals : Metals M17	Moisture Set	Eurofins Suite B1	Eurofins Suite B4
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	N-SS01	Jun 19, 2023		Soil	M23-Jn0051772		X		X			X		
2	N-SS03	Jun 19, 2023		Soil	M23-Jn0051773		X					X		
3	N-SS04	Jun 19, 2023		Soil	M23-Jn0051774				X			X		X
4	N-SS05	Jun 19, 2023		Soil	M23-Jn0051775						X	X		
5	N-SS06	Jun 19, 2023		Soil	M23-Jn0051776					X		X		
6	N-SS07	Jun 19, 2023		Soil	M23-Jn0051777						X	X	X	
7	N-SS08	Jun 19, 2023		Soil	M23-Jn0051778					X		X		
8	N-SS09	Jun 19, 2023		Soil	M23-Jn0051779			X			X	X		
9	N-SS10	Jun 19, 2023		Soil	M23-Jn0051780					X	X	X		
10	N-SS11	Jun 19, 2023		Soil	M23-Jn0051781			X				X		
11	N-SS12	Jun 19, 2023		Soil	M23-Jn0051782					X		X		
12	N-SS13	Jun 19, 2023		Soil	M23-Jn0051783						X	X	X	
13	N-SS14	Jun 19, 2023		Soil	M23-Jn0051784			X				X		

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Address: 3/224 Glen Osmond Road
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SA 5063

Project Name: Goyder North
Project ID: JC1345

Order No.:
Report #: 1001497
Phone: 08 8338 1009
Fax:

Received: Jun 22, 2023 1:49 PM
Due: Jun 29, 2023
Priority: 5 Day
Contact Name: Sophie Hambour

Eurofins Analytical Services Manager : Savini Suduweli

Sample Detail						HOLD	Nitroglycerine (NG)	Organochlorine Pesticides	Explosives	Suite B14: OCP/OPP	VIC EPA Metals : Metals M17	Moisture Set	Eurofins Suite B1	Eurofins Suite B4
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X
14	N-SS15	Jun 19, 2023		Soil	M23-Jn0051785						X	X		
15	N-SS16	Jun 19, 2023		Soil	M23-Jn0051786					X	X	X		
16	N-SS17	Jun 19, 2023		Soil	M23-Jn0051787			X				X		
17	N-SS18	Jun 19, 2023		Soil	M23-Jn0051788				X			X	X	
18	N-SS19	Jun 19, 2023		Soil	M23-Jn0051789		X	X				X		
19	N-SS20	Jun 19, 2023		Soil	M23-Jn0051790				X			X		X
20	N-SS21	Jun 19, 2023		Soil	M23-Jn0051791		X		X		X	X		
21	N-SS02	Jun 19, 2023		Soil	M23-Jn0051792	X								
Test Counts						1	4	5	5	5	8	20	3	2

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Nitroglycerine (NG)	mg/kg	< 5			5	Pass	
Method Blank							
Explosives							
1.3-Dinitrobenzene (1.3-DNB)	mg/kg	< 0.5			0.5	Pass	
1.3.5-Trinitrobenzene (1.3.5-TNB)	mg/kg	< 1			1	Pass	
2-Nitrotoluene (2-NT)	mg/kg	< 0.5			0.5	Pass	
2.4- & 2.6-Dinitrotoluene	mg/kg	< 1			1	Pass	
3-Nitrotoluene (3-NT)	mg/kg	< 0.5			0.5	Pass	
4-Nitrotoluene (4-NT)	mg/kg	< 0.5			0.5	Pass	
Hexahydro-1.3.5-trinitro-1.3.5-triazine (RDX)	mg/kg	< 0.5			0.5	Pass	
Nitrobenzene (NB)	mg/kg	< 0.5			0.5	Pass	
TNT	mg/kg	< 1			1	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Barium	mg/kg	< 10			10	Pass	
Beryllium	mg/kg	< 2			2	Pass	
Boron	mg/kg	< 10			10	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Cobalt	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Manganese	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Molybdenum	mg/kg	< 5			5	Pass	
Nickel	mg/kg	< 5			5	Pass	
Selenium	mg/kg	< 2			2	Pass	
Silver	mg/kg	< 2			2	Pass	
Tin	mg/kg	< 10			10	Pass	
Zinc	mg/kg	< 5			5	Pass	
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-HCH	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-HCH	mg/kg	< 0.05			0.05	Pass	
d-HCH	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-HCH (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organophosphorus Pesticides							
Azinphos-methyl	mg/kg	< 0.2			0.2	Pass	
Bolstar	mg/kg	< 0.2			0.2	Pass	
Chlorfenvinphos	mg/kg	< 0.2			0.2	Pass	
Chlorpyrifos	mg/kg	< 0.2			0.2	Pass	
Chlorpyrifos-methyl	mg/kg	< 0.2			0.2	Pass	
Coumaphos	mg/kg	< 2			2	Pass	
Demeton-S	mg/kg	< 0.2			0.2	Pass	
Demeton-O	mg/kg	< 0.2			0.2	Pass	
Diazinon	mg/kg	< 0.2			0.2	Pass	
Dichlorvos	mg/kg	< 0.2			0.2	Pass	

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Environment Testing

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Dimethoate	mg/kg	< 0.2			0.2	Pass	
Disulfoton	mg/kg	< 0.2			0.2	Pass	
EPN	mg/kg	< 0.2			0.2	Pass	
Ethion	mg/kg	< 0.2			0.2	Pass	
Ethoprop	mg/kg	< 0.2			0.2	Pass	
Ethyl parathion	mg/kg	< 0.2			0.2	Pass	
Fenitrothion	mg/kg	< 0.2			0.2	Pass	
Fensulfothion	mg/kg	< 0.2			0.2	Pass	
Fenthion	mg/kg	< 0.2			0.2	Pass	
Malathion	mg/kg	< 0.2			0.2	Pass	
Merphos	mg/kg	< 0.2			0.2	Pass	
Methyl parathion	mg/kg	< 0.2			0.2	Pass	
Mevinphos	mg/kg	< 0.2			0.2	Pass	
Monocrotophos	mg/kg	< 2			2	Pass	
Naled	mg/kg	< 0.2			0.2	Pass	
Omethoate	mg/kg	< 2			2	Pass	
Phorate	mg/kg	< 0.2			0.2	Pass	
Pirimiphos-methyl	mg/kg	< 0.2			0.2	Pass	
Pyrazophos	mg/kg	< 0.2			0.2	Pass	
Ronnel	mg/kg	< 0.2			0.2	Pass	
Terbufos	mg/kg	< 0.2			0.2	Pass	
Tetrachlorvinphos	mg/kg	< 0.2			0.2	Pass	
Tokuthion	mg/kg	< 0.2			0.2	Pass	
Trichloronate	mg/kg	< 0.2			0.2	Pass	
LCS - % Recovery							
Nitroglycerine (NG)	%	120			75-125	Pass	
LCS - % Recovery							
Explosives							
1.3-Dinitrobenzene (1.3-DNB)	%	112			70-130	Pass	
1.3.5-Trinitrobenzene (1.3.5-TNB)	%	108			70-130	Pass	
2-Nitrotoluene (2-NT)	%	114			70-130	Pass	
2.4- & 2.6-Dinitrotoluene	%	112			70-130	Pass	
3-Nitrotoluene (3-NT)	%	122			70-130	Pass	
4-Nitrotoluene (4-NT)	%	116			70-130	Pass	
Hexahydro-1.3.5-trinitro-1.3.5-triazine (RDX)	%	115			70-130	Pass	
TNT	%	103			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	117			70-130	Pass	
TRH C10-C14	%	86			70-130	Pass	
TRH C6-C10	%	113			70-130	Pass	
TRH >C10-C16	%	91			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	90			70-130	Pass	
Toluene	%	94			70-130	Pass	
Ethylbenzene	%	104			70-130	Pass	
m&p-Xylenes	%	104			70-130	Pass	
Xylenes - Total*	%	105			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	93			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Acenaphthene	%	93			70-130	Pass	
Acenaphthylene	%	100			70-130	Pass	
Anthracene	%	101			70-130	Pass	
Benz(a)anthracene	%	92			70-130	Pass	
Benzo(a)pyrene	%	104			70-130	Pass	
Benzo(b&j)fluoranthene	%	127			70-130	Pass	
Benzo(g.h.i)perylene	%	83			70-130	Pass	
Benzo(k)fluoranthene	%	128			70-130	Pass	
Chrysene	%	98			70-130	Pass	
Dibenz(a.h)anthracene	%	103			70-130	Pass	
Fluoranthene	%	93			70-130	Pass	
Fluorene	%	89			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	87			70-130	Pass	
Naphthalene	%	75			70-130	Pass	
Phenanthrene	%	103			70-130	Pass	
Pyrene	%	93			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	83			80-120	Pass	
Barium	%	89			80-120	Pass	
Beryllium	%	114			80-120	Pass	
Boron	%	98			80-120	Pass	
Cadmium	%	107			80-120	Pass	
Chromium	%	87			80-120	Pass	
Cobalt	%	90			80-120	Pass	
Copper	%	104			80-120	Pass	
Lead	%	90			80-120	Pass	
Manganese	%	84			80-120	Pass	
Mercury	%	109			80-120	Pass	
Molybdenum	%	87			80-120	Pass	
Nickel	%	101			80-120	Pass	
Selenium	%	82			80-120	Pass	
Silver	%	106			80-120	Pass	
Tin	%	91			80-120	Pass	
Zinc	%	103			80-120	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	104			70-130	Pass	
4.4'-DDD	%	90			70-130	Pass	
4.4'-DDE	%	82			70-130	Pass	
4.4'-DDT	%	83			70-130	Pass	
a-HCH	%	80			70-130	Pass	
Aldrin	%	87			70-130	Pass	
b-HCH	%	88			70-130	Pass	
d-HCH	%	80			70-130	Pass	
Dieldrin	%	100			70-130	Pass	
Endosulfan I	%	85			70-130	Pass	
Endosulfan II	%	75			70-130	Pass	
Endosulfan sulphate	%	87			70-130	Pass	
Endrin	%	71			70-130	Pass	
Endrin aldehyde	%	87			70-130	Pass	
Endrin ketone	%	78			70-130	Pass	
g-HCH (Lindane)	%	93			70-130	Pass	
Heptachlor	%	97			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heptachlor epoxide			%	118			70-130	Pass	
Hexachlorobenzene			%	97			70-130	Pass	
Methoxychlor			%	70			70-130	Pass	
LCS - % Recovery									
Organophosphorus Pesticides									
Diazinon			%	85			70-130	Pass	
Dimethoate			%	80			70-130	Pass	
Ethion			%	87			70-130	Pass	
Fenitrothion			%	87			70-130	Pass	
Methyl parathion			%	78			70-130	Pass	
Mevinphos			%	75			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
Nitroglycerine (NG)	M23-Jn0046594	NCP	%	106			70-130	Pass	
Spike - % Recovery									
Explosives				Result 1					
1.3-Dinitrobenzene (1.3-DNB)	M23-Jn0046594	NCP	%	97			70-130	Pass	
2-Nitrotoluene (2-NT)	M23-Jn0046594	NCP	%	86			70-130	Pass	
2.4- & 2.6-Dinitrotoluene	M23-Jn0046594	NCP	%	93			70-130	Pass	
3-Nitrotoluene (3-NT)	M23-Jn0046594	NCP	%	102			70-130	Pass	
4-Nitrotoluene (4-NT)	M23-Jn0046594	NCP	%	93			70-130	Pass	
Nitrobenzene (NB)	M23-Jn0046594	NCP	%	84			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C10-C14	M23-Jn0051917	NCP	%	89			70-130	Pass	
TRH >C10-C16	M23-Jn0051917	NCP	%	84			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M23-Jn0048480	NCP	%	85			70-130	Pass	
Acenaphthylene	M23-Jn0048480	NCP	%	73			70-130	Pass	
Anthracene	M23-Jn0048480	NCP	%	95			70-130	Pass	
Benz(a)anthracene	M23-Jn0048480	NCP	%	127			70-130	Pass	
Benzo(a)pyrene	M23-Jn0048480	NCP	%	102			70-130	Pass	
Benzo(b&j)fluoranthene	M23-Jn0048480	NCP	%	72			70-130	Pass	
Benzo(g.h.i)perylene	M23-Jn0048480	NCP	%	100			70-130	Pass	
Benzo(k)fluoranthene	M23-Jn0048480	NCP	%	77			70-130	Pass	
Chrysene	M23-Jn0048480	NCP	%	77			70-130	Pass	
Dibenz(a.h)anthracene	M23-Jn0048480	NCP	%	84			70-130	Pass	
Fluoranthene	M23-Jn0048480	NCP	%	71			70-130	Pass	
Fluorene	M23-Jn0048480	NCP	%	85			70-130	Pass	
Indeno(1.2.3-cd)pyrene	M23-Jn0048480	NCP	%	123			70-130	Pass	
Naphthalene	M23-Jn0048480	NCP	%	103			70-130	Pass	
Phenanthrene	M23-Jn0048480	NCP	%	109			70-130	Pass	
Pyrene	M23-Jn0048480	NCP	%	71			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Manganese	M23-Jn0046867	NCP	%	115			75-125	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	M23-Jn0049428	NCP	%	100			70-130	Pass	
4.4'-DDD	M23-Jn0049428	NCP	%	78			70-130	Pass	
4.4'-DDE	M23-Jn0049428	NCP	%	76			70-130	Pass	
4.4'-DDT	M23-Jn0049428	NCP	%	76			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
a-HCH	M23-Jn0049428	NCP	%	89			70-130	Pass	
Aldrin	M23-Jn0049428	NCP	%	77			70-130	Pass	
b-HCH	M23-Jn0049428	NCP	%	85			70-130	Pass	
d-HCH	M23-Jn0049428	NCP	%	91			70-130	Pass	
Dieldrin	M23-Jn0049428	NCP	%	70			70-130	Pass	
Endosulfan I	M23-Jn0049428	NCP	%	87			70-130	Pass	
Endosulfan II	M23-Jn0049428	NCP	%	82			70-130	Pass	
Endosulfan sulphate	M23-Jn0049428	NCP	%	77			70-130	Pass	
Endrin	M23-Jn0049428	NCP	%	76			70-130	Pass	
Endrin aldehyde	M23-Jn0049428	NCP	%	80			70-130	Pass	
Endrin ketone	M23-Jn0049428	NCP	%	78			70-130	Pass	
g-HCH (Lindane)	M23-Jn0049428	NCP	%	95			70-130	Pass	
Heptachlor	M23-Jn0049428	NCP	%	73			70-130	Pass	
Heptachlor epoxide	M23-Jn0049428	NCP	%	96			70-130	Pass	
Hexachlorobenzene	M23-Jn0049428	NCP	%	80			70-130	Pass	
Methoxychlor	M23-Jn0049428	NCP	%	76			70-130	Pass	
Spike - % Recovery									
Organophosphorus Pesticides				Result 1					
Dimethoate	M23-Jn0043776	NCP	%	86			70-130	Pass	
Ethion	M23-Jn0043776	NCP	%	130			70-130	Pass	
Fenitrothion	M23-Jn0043776	NCP	%	105			70-130	Pass	
Methyl parathion	M23-Jn0043776	NCP	%	88			70-130	Pass	
Spike - % Recovery									
Organophosphorus Pesticides				Result 1					
Diazinon	M23-Jn0050154	NCP	%	115			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M23-Jn0051786	CP	%	98			75-125	Pass	
Barium	M23-Jn0051786	CP	%	117			75-125	Pass	
Beryllium	M23-Jn0051786	CP	%	105			75-125	Pass	
Boron	M23-Jn0051786	CP	%	100			75-125	Pass	
Cadmium	M23-Jn0051786	CP	%	108			75-125	Pass	
Chromium	M23-Jn0051786	CP	%	108			75-125	Pass	
Cobalt	M23-Jn0051786	CP	%	105			75-125	Pass	
Copper	M23-Jn0051786	CP	%	82			75-125	Pass	
Lead	M23-Jn0051786	CP	%	105			75-125	Pass	
Mercury	M23-Jn0051786	CP	%	108			75-125	Pass	
Molybdenum	M23-Jn0051786	CP	%	105			75-125	Pass	
Nickel	M23-Jn0051786	CP	%	91			75-125	Pass	
Selenium	M23-Jn0051786	CP	%	94			75-125	Pass	
Silver	M23-Jn0051786	CP	%	106			75-125	Pass	
Tin	M23-Jn0051786	CP	%	108			75-125	Pass	
Zinc	M23-Jn0051786	CP	%	92			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C6-C9	M23-Jn0051788	CP	%	101			70-130	Pass	
TRH C6-C10	M23-Jn0051788	CP	%	96			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M23-Jn0051788	CP	%	78			70-130	Pass	
Toluene	M23-Jn0051788	CP	%	87			70-130	Pass	
Ethylbenzene	M23-Jn0051788	CP	%	87			70-130	Pass	
m&p-Xylenes	M23-Jn0051788	CP	%	89			70-130	Pass	
o-Xylene	M23-Jn0051788	CP	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Xylenes - Total*	M23-Jn0051788	CP	%	90			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M23-Jn0051788	CP	%	84			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Nitroglycerine (NG)	M23-Jn0051772	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Duplicate									
Explosives				Result 1	Result 2	RPD			
1.3-Dinitrobenzene (1.3-DNB)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
1.3.5-Trinitrobenzene (1.3.5-TNB)	M23-Jn0051772	CP	mg/kg	< 1	< 1	<1	30%	Pass	
2-Nitrotoluene (2-NT)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
2.4- & 2.6-Dinitrotoluene	M23-Jn0051772	CP	mg/kg	< 1	< 1	<1	30%	Pass	
3-Nitrotoluene (3-NT)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
4-Nitrotoluene (4-NT)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Hexahydro-1.3.5-trinitro-1.3.5-triazine (RDX)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Nitrobenzene (NB)	M23-Jn0051772	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TNT	M23-Jn0051772	CP	mg/kg	< 1	< 1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	M23-Jn0051918	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C6-C10	M23-Jn0051918	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M23-Jn0051918	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M23-Jn0051918	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M23-Jn0051918	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M23-Jn0051918	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	M23-Jn0051918	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	M23-Jn0051918	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M23-Jn0051918	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M23-Jn0051776	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

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Environment Testing

Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	M23-Jn0051776	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	M23-Jn0051776	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	M23-Jn0048407	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Organophosphorus Pesticides				Result 1	Result 2	RPD			
Azinphos-methyl	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Bolstar	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Chlorfenvinphos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Chlorpyrifos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Chlorpyrifos-methyl	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Coumaphos	M23-Jn0051776	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Demeton-S	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Demeton-O	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Diazinon	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Dichlorvos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Dimethoate	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Disulfoton	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
EPN	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ethion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ethoprop	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ethyl parathion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Fenitrothion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Fensulfothion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Fenthion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Malathion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Merphos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Methyl parathion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Mevinphos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Monocrotophos	M23-Jn0051776	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Naled	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Omethoate	M23-Jn0051776	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Phorate	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Pirimiphos-methyl	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Pyrazophos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ronnel	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Terbufos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	

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Duplicate									
Organophosphorus Pesticides				Result 1	Result 2	RPD			
Tetrachlorvinphos	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Tokuthion	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Trichloronate	M23-Jn0051776	CP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M23-Jn0051785	CP	mg/kg	8.6	9.7	12	30%	Pass	
Barium	M23-Jn0051785	CP	mg/kg	130	160	19	30%	Pass	
Beryllium	M23-Jn0051785	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Boron	M23-Jn0051785	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Cadmium	M23-Jn0051785	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M23-Jn0051785	CP	mg/kg	39	45	15	30%	Pass	
Cobalt	M23-Jn0051785	CP	mg/kg	22	27	19	30%	Pass	
Copper	M23-Jn0051785	CP	mg/kg	28	32	13	30%	Pass	
Lead	M23-Jn0051785	CP	mg/kg	37	45	21	30%	Pass	
Mercury	M23-Jn0051785	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Molybdenum	M23-Jn0051785	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Nickel	M23-Jn0051785	CP	mg/kg	41	52	24	30%	Pass	
Selenium	M23-Jn0051785	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Silver	M23-Jn0051785	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Tin	M23-Jn0051785	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Zinc	M23-Jn0051785	CP	mg/kg	77	93	20	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M23-Jn0051786	CP	mg/kg	8.3	8.2	<1	30%	Pass	
Barium	M23-Jn0051786	CP	mg/kg	79	80	1.5	30%	Pass	
Beryllium	M23-Jn0051786	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Boron	M23-Jn0051786	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Cadmium	M23-Jn0051786	CP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M23-Jn0051786	CP	mg/kg	37	37	1.3	30%	Pass	
Cobalt	M23-Jn0051786	CP	mg/kg	15	15	<1	30%	Pass	
Copper	M23-Jn0051786	CP	mg/kg	29	29	<1	30%	Pass	
Lead	M23-Jn0051786	CP	mg/kg	27	28	2.0	30%	Pass	
Manganese	M23-Jn0051786	CP	mg/kg	360	360	1.2	30%	Pass	
Mercury	M23-Jn0051786	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Molybdenum	M23-Jn0051786	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Nickel	M23-Jn0051786	CP	mg/kg	32	32	<1	30%	Pass	
Selenium	M23-Jn0051786	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Silver	M23-Jn0051786	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Tin	M23-Jn0051786	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Zinc	M23-Jn0051786	CP	mg/kg	58	59	1.9	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Indeno(1.2.3-cd)pyrene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M23-Jn0051787	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	M23-Jn0051787	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	M23-Jn0051787	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C10-C14	M23-Jn0051790	CP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M23-Jn0051790	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M23-Jn0051790	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C10-C16	M23-Jn0051790	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M23-Jn0051790	CP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M23-Jn0051790	CP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M23-Jn0051790	CP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

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Comments

Sample Integrity

Custody Seals Intact (if used)	No
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised by:

Catherine Wilson	Analytical Services Manager
Edward Lee	Senior Analyst-Organic
Harry Bacalis	Senior Analyst-Volatile
Mary Makarios	Senior Analyst-Metal

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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