Environmental Impact Statement

Uungula Wind Farm

Appendix L: Transport Assessment (Samsa Consulting, 2020)

May 2020

CWP Renewables Pty Ltd
(02) 4013 4640

P.O. Box 1708 Newcasltle NSW 2300
cwprenewables.com

Uungula Wind Farm Project

Transport Assessment

April 2020

SAMSA CONSULTING

TRANSPORT PLANNING & TRAFFIC ENGINEERING

Samsa Consulting Pty Ltd
Transport Planning & Traffic Engineering
ABN: 50 097 299 717
46 Riverside Drive, Sandringham, NSW 2219, AUSTRALIA
Phone: (+61) 414 971 956
E-mail: alansamsa@gmail.com
Skype: alan_samsa
Web: www.samsaconsulting.com

Contents

Appendices

1. Introduction

1.1 Project Background

CWP Renewables (CWPR) on behalf of Uungula Wind Farm Pty Ltd (the Proponent), proposes to develop a wind farm known as the Uungula Wind Farm (the Project) on rural land between Wellington and Twelve Mile in New South Wales. The Project Site is located within Dubbo Regional Council Local Government Area (LGA) to the west of Cudgegong River.

This assessment investigates transportation issues associated with wind farm component and equipment haulage. The report identifies a preferred transportation mode and haulage routes to various site access points. Prevailing transport constraints and impacts are identified and assessed. Appropriate site access locations from the public road network are also identified. The report will serve as a supporting background paper to the Project's Environmental Impact Statement (EIS).

1.2 Environmental Assessment Requirements

NSW Department of Planning & Environment issued Secretary's Environmental Assessment Requirements (SEARs), which require the traffic and transport assessment to assess the construction and operational traffic impacts of the Project. This Transport Assessment has addressed the SEARs for the construction and operational impacts of the project as follows:

- Assess the construction, operational and decommissioning traffic impacts of the development – refer to *Sections 3.2*, *3.3*, *4.3*, *4.5* and *4.7*.
- Details of traffic volumes (both light and heavy vehicles) and transport routes during construction, operation and decommissioning, including traffic associated with sourcing raw materials (water, sand and gravel) – refer to *Sections 3.2, 3.3*, *4.2* and *4.7* (specifically *Figures 3.1* and *3.2* as well as *Tables 4.2* and *4.3*).
- Assess the potential traffic impacts on road network function including intersection performance, site access arrangements and road safety including school bus routes and school zones – refer to *Sections 4.3.1* and *4.3.2*.
- Assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project, including over-size / over-mass (OSOM) routes from port during construction, operation and decommissioning – refer to *Sections 4.3.1*, *4.5* and *4.7*.
- Assessment of the likely transport impacts to the site access and haulage routes, site access point(s), any rail safety issues, any Crown land, particularly in relation to the capacity and conditions of the roads – refer to *Sections 4.3.1* and *4.3.2*.
- Details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades (including resulting from OSOM traffic haulage routes), road maintenance contributions, and any other traffic control measures developed in consultation with the relevant road authority – refer to *Section 5*.

Discussions were also held with Dubbo Regional Council previously who reiterated the transport-related issues to be covered by the SEARs.

1.3 Assessment Scope & Methodology

The scope of the assessment included the following tasks:

- Review of project background information.
- Project discussions with CWP Renewables project team.
- Discussions with Dubbo Regional Council and NSW Roads & Maritime Service (RMS).
- Desktop assessment of the surrounding road network, including preferred transportation routes.
- Traffic generation during construction, operational and decommissioning phases of the Project.
- Traffic distribution onto the surrounding local and regional road network.
- Assessment of transport impacts on the surrounding road network including site access, road safety, road capacity and road conditions.
- Discussion of mitigation measures to address potential transport impacts identified.
- Preparation of this Transport Assessment report to be used to support the Project's EIS.

1.4 Report Structure

The remainder of this assessment report is presented as follows:

Chapter 2 provides an overall project description as well as general details of the wind farm equipment specifications and components.

Chapter 3 describes the potential transport modes as well as existing transport conditions including transport routes and site access locations.

Chapter 4 assesses the transportation impacts during the construction and operation phases of the Project.

Chapter 5 discusses mitigation measures to address potential transport impacts identified.

Chapter 6 provides a summary and conclusions to the assessment.

2. Project Description

Uungula Wind Farm (the Project) is proposed to be located in the Dubbo Regional Council Local Government Area between Wuuluman and Twelve Mile, approximately 14 km east of Wellington, NSW. The Project generally consists of the installation, operation, maintenance and decommissioning of up to 97 wind turbine generators (WTGs), an Energy Storage Facility (ESF), ancillary infrastructure and temporary facilities.

The Project is designed to accommodate a contemporary WTG of up to 250 m in height with a nameplate capacity of approximately four (4) megawatts (MW) or greater. On these terms, and remaining subject to Development Consent and market changes, the Project is estimated to have an installed generating capacity of approximately 400 MW.

The region is dominated by agriculture including sheep, cattle and goat grazing, cropping for stock feed and sheep studs. Renewable energy projects have also entered the landscape since 2017, including the operational Bodangora wind farm located 7 km north of the Project Site and the operational Beryl solar farm located 30 km to the east. Other approved, but yet to be constructed solar farm developments are also located in proximity to the Project.

The town of Wellington located approximately 14 km west of the Project is the nearest population centre with the small village of Goolma located approximately 16 km north of the Project. Other towns near the Project Site include Gulgong and Mudgee approximately 34 km and 32 km to the north-east and south-east respectively. Lake Burrendong is located to the south of the Project Site which is part of the Water NSW bulk water storage complex which drains into the Macquarie River. The majority of the Project Site drains into local tributaries feeding ultimately into Lake Burrendong.

The wind farm layout will be developed within the boundaries of the Project Site shown in *Appendix A: Proposed Wind Farm Layout*.

The Project Site is currently used as rural farm land and this would continue to be the case after construction. Once the wind farm is operational it would be staffed by approximately 10 full time personnel (with additional periodic staff) and monitored remotely.

The life span of a wind farm is usually 25 to 30 years, after which time there would be an option to either decommission the site, restoring the area to its previous land use with regard to consent conditions and lease requirements, or to upgrade the equipment and extend the wind farm's operational life.

The Project elements are comprised of the WTGs, ancillary infrastructure and temporary facilities, details of which are found in the *Project Description* section of the Environmental Impact Statement (EIS) document.

3. Existing Conditions

3.1 Transport Mode

The assessment of transportation of WTG components to site involves the separate consideration of the transport mode between:

- Australian ports for imports and other local manufacturing plants located in Australia to the Uungula Wind Farm project site;
- Transportation through the towns / villages along the transport routes; and
- Site access off the public road network to the internal road network of the Uungula Wind Farm site.

The port of entry for imported WTG equipment and/or the location of manufacturing sites has not yet been resolved / confirmed although the *Rex J Andrews Route Study*[1] (*RJA Report*) has assumed the Port of Newcastle as the most likely entry point. Therefore, this assessment evaluates all potential transport routes from all directions around NSW and beyond, if applicable.

Both rail and road transport modes have been considered for transporting the imported and locally manufactured WTG and sub-station transformer components.

Rail Transport

Rail as a transport option is potentially possible via the rail network that runs to Gulgong and/or Wellington. This could be accessed from the eastern seaboard via the Country Regional Network (CRN) and/or the Australian Rail Track Corporation (ARTC) rail networks. However, while specially designed flat-bed cars and support systems are available to transport long loads of up to 40 m and the rail system can cope with heavy loads, the width of the blade container package or blade height and the size of the larger tower sections would not be able to be transported due to a lack of vertical and horizontal clearance within the electrified sections and at some structures along the route, such as bridges.

Problems of scheduling rail services and restriction on track capacity may also affect delivery and would require negotiation and confirmation with rail operators.

The problem also exists of handling and transporting WTG components from the rail hub to site, requiring road transport regardless, most likely through town centre areas. The extent of transportation handling is such that it is not considered feasible to use rail transport.

Therefore, road transport is considered to be the only feasible option for transporting the larger WTG components and the heavy mass transformers. The use of rail is not considered to be feasible and as an option, rail transport has not been pursued any further.

Road Transport

All main road routes to and through Gulgong, Wellington and Mudgee (being the closest centres to the Project Site) are primarily by either National Routes or State Highways and, subject to statutory permit conditions, can accommodate the proposed WTG components generating OSOM vehicles.

1 Rex J Andrews "*Route Study, Uungula Wind Farm Project Ex Port of Newcastle (Rev.7)*", 20/02/2020 (RJA Report)

An RMS permit would be obtained for road access for OSOM vehicles along the major road network (National Routes or State Highways) from areas of component manufacture or import to the Project Site areas. The nominated transport contractor would be responsible for obtaining all necessary transport permits, arranging escort services and any other third-party services as required by applicable regulations.

The road network has the flexibility to provide a single transportation mode from origin to the Project Site without the need for additional loading and handling operations.

Air Transport

Due to the OSOM nature of wind farm components and the potential difficulties associated with land transport, the option of air transport by helicopter has been considered. This type of transport has been used in rare circumstances for wind farm projects in difficult to access locations.

Air transport is considered to be the most direct transport mode and would reduce road impacts to the community. However, air transport is very (prohibitively) costly as there is only one type of helicopter available internationally for such a heavy payload. The helicopter would have significant noise and vibration impacts on the community and wind farm components need to be specifically designed for aerial transport, loading and unloading, which increases manufacturing costs.

In this case, while air transport has been canvassed as a transport option, it is economically unviable and least preferable from a noise and vibration perspective and therefore, has not been considered further.

3.2 Potential Road Transport Routes

3.2.1 Major Road Network Route Options

The primary Project Site access is via a new entrance off Twelve Mile Road, approximately 17 km east of Wellington by road, which is proposed to be used for all OSOM deliveries to the Project Site and the main access point for standard heavy and light vehicles. Secondary intersections and cross-over locations along Uungula Road and Ilgingery Road will facilitate the routes of internal roads throughout the Project Site required for construction and operational vehicles – refer to *Appendix A: Proposed Wind Farm Layout*.

The nearest sea port to the Project area is the Port of Newcastle, which is the most likely port of entry for WTG components. OSOM transport to the Project Site from Port of Newcastle has been identified by the *RJA Report*, a detailed route study prepared for the Project. It is notable that although future commercial procurement decisions will largely determine the most suitable port of entry, other ports of entry can be used which would then link with the studied route.

The *RJA Report* identified the preferred route from the Port of Newcastle to the Project Site to be via Industrial Drive, Pacific Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway (a detour around the Denman Bridge from the corner of Golden Highway and Denman Road via Bengalla Road and Wybong Road may be required for any vehicles exceeding 5.6 m in height, although at this stage no vehicles are proposed exceeding this height), Saxa Road (previously known as Cobbora Road), Mitchell Highway and eastbound travel along Goolma Road to Twelve Mile Road and the Project's primary site access.

Due to various road network and land use constraints, the preferred road transport route for OSOM on approach to the Project Site is via Dunedoo on the Golden Highway, left-turn south onto Saxa Road, left-turn south-east onto Mitchell Highway, left-turn north onto Goolma Road, and then right-turn onto Twelve Mile Road to the primary Project Site access location.

There are a number of potential transport routes that were identified, considered and initially assessed. The initial assessment took into account not only the preferred Project Site access location but also that road transport options from all travel directions needed to be considered. Effectively, transport from the various directions could travel along the following major State Road or highway routes:

- East and north-east – via Golden Highway and Castlereagh Highway.
- North and north-west – via Newell Highway, Mitchell Highway and/or Castlereagh Highway.
- West – via Mitchell Highway, or Golden Highway / Castlereagh Highway.
- South-west and south – via Newell Highway and Mitchell Highway.
- East and south-east – via Great Western Highway and Castlereagh Highway.

The above major road network provides transport routes to Gulgong in the east (for access to the eastern end of Goolma Road) and Wellington in the west (for access to the western end of Goolma Road and Twelve Mile Road) – refer to *Figure 3.1* following.

The major road network provides a relatively high standard of road infrastructure, generally suitable for transport by OSOM vehicles. These routes have relatively wide carriageways and road formations, pavement linemarking, and controlled access to side roads. In general, they have 100 km/h speed limits.

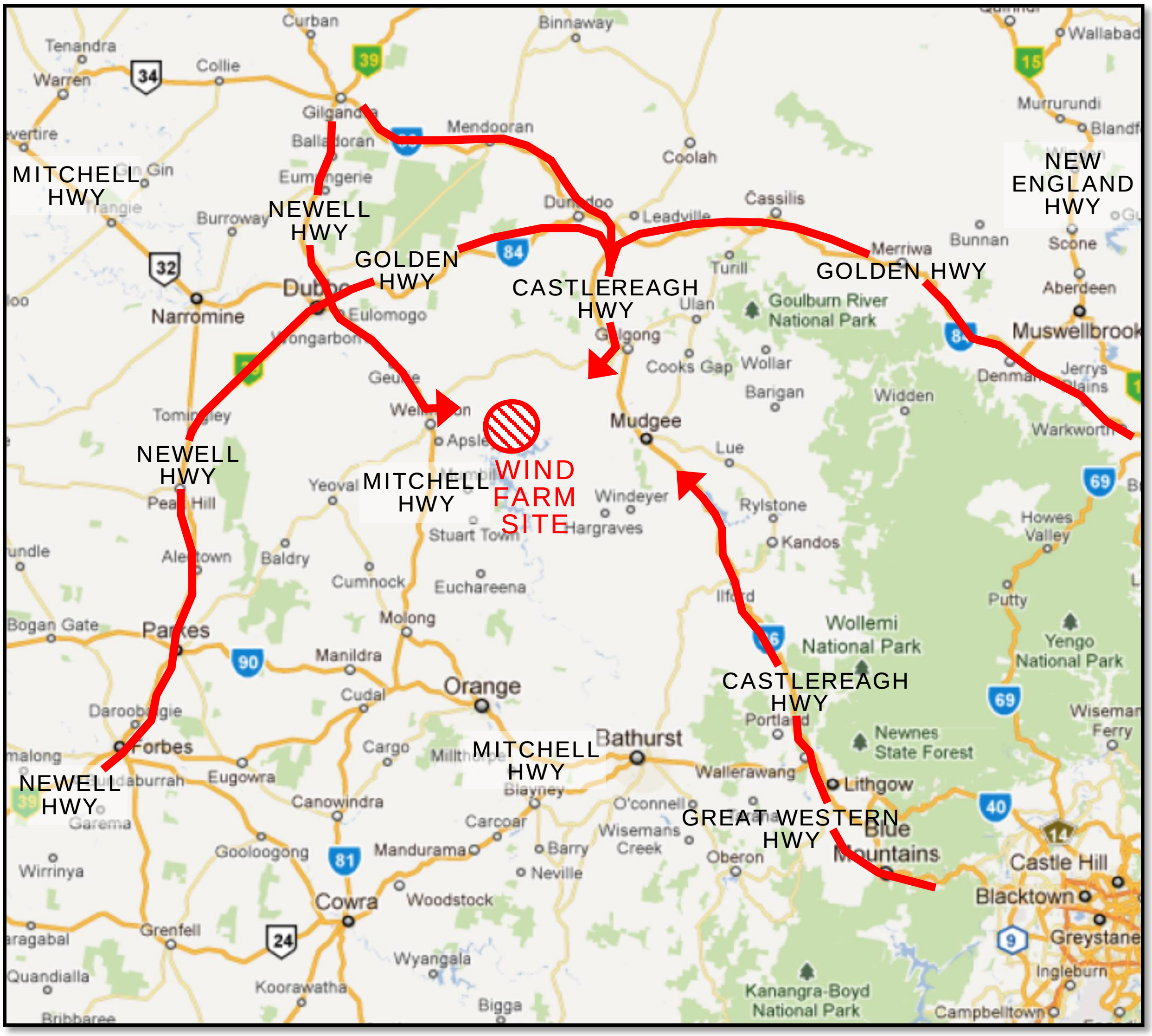


Figure 3.1: Regional Major Road Network & Transport Routes

3.2.2 *Access Route Options*

There are a number of options for road transport of non-OSOM components to Twelve Mile Road and the Project Site access location via the Gulgong and Wellington areas. These include the following (all are standard heavy vehicle routes on the major road network):

- Golden Highway to Gulgong and/or Mudgee via Ulan Road-Cassilis Road and Cope Road.
- Castlereagh Highway (north of Mudgee) to Goolma Road via Guntawang Road.
- Golden Highway to western end of Goolma Road via Saxa Road and Mitchell Highway.
- Mitchell Highway to Wellington and western end of Goolma Road.

Due to various road network and land use constraints, the preferred OSOM road transport route (identified in the *RJA Report*) is Golden Highway, left-turn south into Saxa Road, southbound travel along Saxa Road to Mitchell Highway (just north of Wellington), left-turn onto Mitchell Highway, left-turn again into Goolma Road, eastbound travel along Goolma Road before turning right into Twelve Mile Road and continuing eastbound to the primary Project Site access location. The road network and land use constraints of the alternative routes are as follows:

- Golden Highway to Mudgee via Ulan Road-Cassilis Road – these routes, which are of a relatively high standard and generally suitable for OSOM vehicle transport, are shorter for travel from the east (Golden Highway) but necessitate travel through Mudgee or Gulgong town centres. Both town centre areas have numerous and significant roadside obstructions (eg. intersection swept paths, roundabout islands, urban road furniture, etc.) including higher traffic volumes, which would result in significant disruption and rectification works.
- Castlereagh Highway (north of Mudgee) to Goolma Road via Guntawang Road – this route would necessitate travel through Mudgee town centre (with constraints as described above). Moreover, the southern end is also a longer route than the northern Goolma Road route.
- Mitchell Highway to Wellington and western end of Goolma Road – the connection to the western end of Goolma Road near Wellington could potentially be accessed via Mitchell Highway south of Dubbo. Whilst there are some constraints negotiating Dubbo and Wellington urban areas, these are not considered to be prohibitive for OSOM vehicle transport. However, the additional route length for transport from the east (along Golden Highway) is a constraint as are the increased traffic volumes on this important heavy vehicle route. From the Golden Highway / Castlereagh Highway junction, access to the western end of Twelve Mile Road would be approximately 110 km via the eastern end of Goolma Road but almost 150 km via Dubbo and Mitchell Highway.

Refer to *Figure 3.2* following, which shows:

- Proposed OSOM vehicle transport route, which was used for detailed assessment in this report.
- Standard heavy vehicle transport routes.

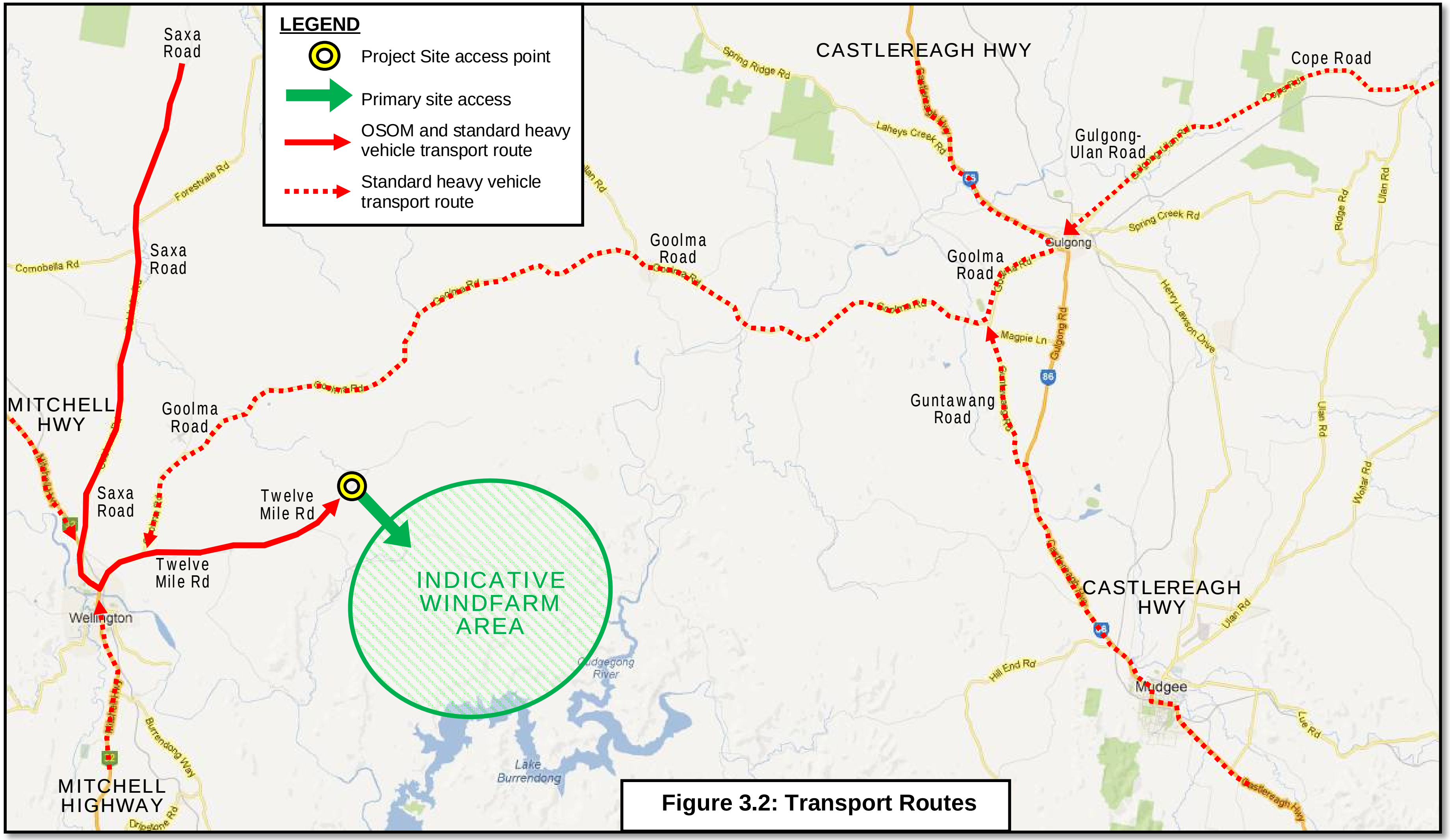


Figure 3.2: Transport Routes

3.3 Assessment of Proposed Transport Routes

THE *RJA Route Study Report* provides a detailed assessment of the proposed OSOM transport route from the Port of Newcastle to the primary Project Site access off the southern side of Twelve Mile Road. The following sections include the main characteristics / conclusions from the *RJA Report* of the major and local road networks in the area surrounding the proposed Project Site.

3.3.1 Major Road Network

Golden Highway

Golden Highway is a State Highway (SH84). It forms an arterial route from New England Highway between Branxton and Singleton to the Newell Highway at Dubbo, passing through Denman, Merriwa and Dunedoo. Between Dunedoo and Elong, Golden Highway is generally a two-lane, undivided road with varying shoulder widths and formations. The pavement condition is generally good, commensurate with its status as a State Highway and its suitability as a route for larger heavy vehicles, eg. B-doubles.

The general road environment can be described as flat to gently rolling terrain with some moderate curved alignments requiring lower advisory speeds within the background 100 km/h speed zone. The road environment and alignment are generally conducive to OSOM vehicle transport. Any specific OSOM vehicle issues would be covered under the RMS permit system for OSOM transportation along the major road network.

Pertinent road characteristics along Golden Highway and its intersection with Saxa Road, which would need to be considered by the transport contractor for OSOM transport, are detailed in the *RJA Report*.

Refer to *Section 5.3* and *Section 5.4* respectively for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

Mitchell Highway

Only approximately 2.5 km of Mitchell Highway will be required for OSOM transport between Saxa Road in the north and Goolma Road in the south. Mitchell Highway is a State Highway (SH7) and is the north-western branch of the Great Western Highway, which runs from Bathurst to Orange, Wellington, Dubbo and beyond. It forms an arterial route from Great Western Highway (west of Bathurst) in the south onward to Queensland via Bourke in the north.

Approaching Wellington, Mitchell Highway is a two-lane, undivided road with relatively wide shoulder widths and formations. The speed zoning is 80 km/h south of Saxa Road and reduces to 60 km/h prior to Goolma Road. The pavement condition is generally good, commensurate with its status as a State Highway and its suitability as a route for larger heavy vehicles, eg. B-doubles.

The general road environment can be described as flat terrain with some gentle curves. The road environment and alignment are generally conducive to OSOM vehicle transport. Any specific OSOM vehicle issues would be covered under the RMS permit system for OSOM transportation along the major road network.

Pertinent road characteristics along Mitchell Highway and its intersections with Saxa Road and Goolma Road, which would need to be considered by the transport contractor for

OSOM transport, are detailed in the *RJA Report*.

Refer to *Section 5.3* and *Section 5.4* respectively for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

3.3.2 Minor Road Network

Saxa Road

Saxa Road is a Regional Road (MR 353), forming a regional connection between Mitchell Highway at Wellington and the Golden Highway at Elong. It is a single carriageway, two-lane road with a 100 km/h speed zone.

Saxa Road is relatively consistent in condition and standard along its length. For the majority of its length, it is generally some 6 m wide incorporating two travel lanes and varying shoulder conditions. Centreline marking is generally provided with edge-line marking also available along wider carriageway sections. The pavement is asphalt, which is generally in good condition although there is a short section that is of a lesser standard – refer to *RJA Report*.

The general road environment can be described as relatively flat with sections of gently rolling terrain and some gentle curved alignments requiring lower advisory speeds within the background 100 km/h speed zone.

Saxa Road is a major link to the local community as it is the main access for the population in the area. The road is a B-Double route and there is one school bus that completes two runs per day servicing schools in Wellington.

Pertinent road characteristics along Saxa Road, which would need to be considered by the transport contractor for OSOM transport, are detailed in the *RJA Report*.

Refer to *Section 5.3* and *Section 5.4* respectively for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

Goolma Road

Only approximately 3.2 km of Goolma Road (at its western end) will be required for OSOM transport between Mitchell Highway in the west and Twelve Mile Road in the east. Goolma Road is a State Road (MR 233), forming the main route from Gulgong (Castlereagh Highway) in the east to Wellington (Mitchell Highway) in the west. It is a single carriageway, two-lane road with a 100 km/h speed zone.

Goolma Road varies in condition and standard along the relevant length at its western end. It is generally some 7 m to 8 m wide incorporating two travel lanes and varying shoulder conditions. Centreline marking is generally provided with edgeline marking also available. While pavement conditions vary, in general they are average to good with some below average sections characterised by potholes, rutting and soft shoulder areas.

NSW RMS, Mid-Western Regional Council and Dubbo Regional Council all have ongoing maintenance and improvement programmes for the roads and bridges under their authority along Goolma Road.

The general road environment at Goolma Road's relevant, western end can be described as relatively flat terrain with some moderate curved alignments requiring lower advisory speeds within the background 100 km/h speed zone. Goolma Road is a B-Double route and there is also a school bus route that runs along its length.

Pertinent road characteristics along Goolma Road, which would need to be considered by the transport contractor for OSOM transport are detailed in the *RJA Report*.

Refer to *Section 5.3* and *Section 5.4* respectively for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

Twelve Mile Road

At its western end, Twelve Mile Road is sealed with an approximate pavement width 5 m to 6 m and a generally soft shoulder area, which may require upgrade works, particularly for transport during wet weather. The road width generally reduces east of Uungula Road although there are sections of similar standard to those at the western end.

The road pavement condition is considered to be above average although there are some minor sections with rutting and potholes as well as previous patching works.

The road is generally not line-marked except for sporadic centreline marking through curved sections of the road to provide vehicle guidance. Guide posts are also provided at irregular intervals for guidance.

The general road environment can be described as flat to gently rolling terrain and there is no speed limit signage. There is a school bus route along this section of Twelve Mile Road.

The road is unsealed from approximately 22.7 km east of Goolma Road. The unsealed section is generally of average condition and up to approximately 5 m wide. East of Uamby Road, Twelve Mile Road narrows considerably and only provides 3 m to 4 m width.

Pertinent road characteristics along Twelve Mile Road, which would need to be considered by the transport contractor for OSOM transport are detailed in the *RJA Report*. In addition, it is recommended that passing bays, in the form of wider carriageway areas, be provided intermittently along the Twelve Mile Road route between Goolma Road and the site access point.

Refer to *Section 5.3* and *Section 5.4* respectively for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

Uungula Road / Ilgingery Road

Uungula Road and Ilgingery Road are unclassified local roads and a short section of Ilgingery Road may potentially be used during construction and operational activities as a site cross-over point to access a small number of WTGs at the western edge of the Project layout and for other minor, miscellaneous construction activities, eg. dust suppression.

Uungula Road starts at Twelve Mile Road in the north and continues to its junction with Ilgingery Road where it turns east and continues within the Project Site through farming land to Guroba Road. Ilgingery Road then continues to the south and terminates at the state water boundary of Lake Burrendong.

In general, the Uungula Road / Ilgingery Road route has relatively consistent conditions and standards along its length. The pavement is unsealed with a varying carriageway width of up to approximately 4 m, although there are numerous sections of narrower carriageway width and poor pavement, especially at the southern end. Although unsealed, the pavement conditions generally appear to be relatively stable although poor to average at best with substantial rutting, potholes and corrugations.

The general alignment is relatively flat to gently undulating with some smaller radius curves. There are some localised hilly sections also with relatively sharp crest alignments. The roads are currently used for large stock transport vehicles and other heavy vehicles during Council road maintenance works.

3.4 Wind Farm Site Access

The Project Site access points for all vehicles including OSOM vehicles (primarily those vehicles carrying WTG and electrical components) are as follows:

- The primary Project Site entrance point is proposed off the southern side of Twelve Mile Road approximately 13.5 km east of the Goolma Road junction – refer to *Figure 3.2* previously and *Appendix A: Proposed Wind Farm Layout*. This access would be used for all OSOM equipment deliveries (ie. all 97 WTGs) to the Project Site. The primary Project Site entry will only be accessed from a westerly direction (from Goolma Road via Twelve Mile Road), except to allow local service and/or resource suppliers located east of the primary Project Site entry along Twelve Mile Road the opportunity to participate in the Project. Therefore, an exception is sought to not prohibit heavy and light vehicles to use Twelve Mile Road east of the primary Project Site entry should service and/or resource suppliers be identified.

  The primary Project Site entrance and intersection of Twelve Mile Road will be designed and constructed to the satisfaction of Council, prior to the commencement of project construction, with the exception of pre-construction minor works.

  The primary Project Site access off the southern side of Twelve Mile Road is on a relatively long straight section of road with suitable sight distance in all directions. Local intersection widening will be required at the site access point and the intersection will be designed to allow relevant construction vehicles (including OSOM vehicles) to safely exit from and re-enter the road whilst minimising disruption to traffic and maintaining road safety. Thorough consultation will be undertaken with Council and RMS when developing the detailed designs for intersections with public roads and in the preparation of the Traffic Management Plan for the Project.
- A short section of Ilgingery Road may be used during construction and operational activities for OSOM, heavy and light vehicles as a site cross-over point to access four (4) WTG sites located on the western side of Ilgingery Road. It is noted that all vehicles will initially gain access via the primary Project Site entry (see above) and Project access tracks with vehicles effectively entering Ilgingery Road from the Project access track on the east and travelling a short distance northbound before leaving Ilgingery Road onto the Project access track to the west.
- The sections of Uungula, Wuuluman and Ilgingery Roads linking the Project back to Twelve Mile Road will not be used by the Project during the post-development consent, construction or operational periods for any vehicles, except to:
  - undertake pre-construction minor works;
  - construct intersection upgrades on Uungula Road and Ilgingery Road;
  - undertake dust suppression;

- utilise the secondary intersections and cross-overs identified above to facilitate construction and operational vehicles; and
- procure resources from licensed operators which are located along these roads.

3.5 Current Traffic Volumes

Traffic volume data for the previous Transport Assessment for the Uungula Wind Farm Project[2] was obtained from a number of sources including RMS data along the major road network, and Wellington Council (now part of Dubbo Regional Council) and Mid-Western Regional Council for the local road network. The obtained data was corroborated against sample hourly traffic counts that were undertaken (during peak periods) at relevant locations to determine traffic flows along Goolma Road and Twelve Mile Road in particular.

For this updated assessment, additional traffic volume information was obtained from available RMS and Council information for various road sections. The additional traffic volumes along the higher order road network were compared with estimated 2019 traffic volumes evaluated from the previous assessment[2] and the worst case (highest traffic volumes) were adopted for this assessment.

The estimated 2019 traffic volumes were evaluated by adopting a conservative (high) traffic growth rate of 2.5% per annum (compounded) or 16% over the six-year period between 2013 and 2019. The 16% growth over a six-year period is higher than the traffic growth rate from various RMS data stations in the regional area and thus is considered to be a reasonable (conservative) assumption.

Current 2019 traffic volumes along the minor local road network (eg. Twelve Mile Road) were assumed to be similar to 2013 traffic volumes because of the insignificant change in land use / traffic generators in the surrounding rural areas and the ‘closed’ nature of the local road network, which result in minimal through traffic flows.

Therefore, current (estimated) 2019 traffic volumes in vehicles per day (vpd) and vehicles per (peak) hour (vph) for the surrounding road network are shown in *Table 3.1* following. Peak hour traffic flows have been assumed to be between 12% and 15% of daily traffic flows for the more heavily trafficked roads.

Table 3.1: Current (Estimated) 2019 Traffic Volumes

Road	Vehicles Per Day (vpd)	Vehicles Per Hour (vph)	Traffic Volume Source
Golden Highway	2,050	170	RMS traffic data (2019)
Mitchell Highway	2,520	230	RMS traffic data (2019)
Saxa Road	150	<30	Councils’ traffic data (October 2013)
Goolma Road (western end)	870	120	Council traffic data (March 2013)

2 Samsa Consulting “*Uungula Wind Farm Project: Transport Assessment*”, May 2013

Road	Vehicles Per Day (vpd)	Vehicles Per Hour (vph)	Traffic Volume Source
Twelve Mile Road	<100	<20	Council traffic data (January to March 2007) – corroborated by on-site observations and sample counts (2013)

4. Impact Assessment

Construction includes all physical works to enable the operation, including, but not limited to, the construction and installation of WTGs, construction and installation of the ESF, construction of ancillary Infrastructure, road upgrades carried out before the commencement of operation and establishment or construction of any temporary facilities, which were not already established as part of the pre-construction minor works.

Subject to staging requirements, construction activity is likely to occur over approximately 24 to 30 months with rehabilitation undertaken during and following the completion of construction.

4.1 Construction Vehicle Types

The type of construction vehicles proposed to access the Project Site depends on the equipment and/or personnel being transported and their function on the site. Access to construction site offices and facilities buildings would generally be available for conventional two-wheel drive vehicles. Access to individual WTG locations may be restricted to four-wheel drive or multiple wheel drive vehicles depending on the internal road network conditions.

The WTG components generally comprise a nacelle and gearbox assembly, hub, blades (three no.) and tower in three to six sections. Transport of blades would be typically undertaken one at a time or potentially two loads for multi-piece blades. The nacelle and gearbox assembly are transported separately to limit transport weights. To facilitate transportation and ease of installation the tower support structure would be manufactured in three to six sections, depending on heights chosen.

The larger dimension WTG items such as the blades, nacelles and the larger diameter lower tower components may, when transported, exceed the road standard clearance restrictions and require special transportation permits. There is anticipated to be no issues for transporting the smaller sections of the smaller sized WTG components.

Due to the size and weight of the WTG components it is expected that many of the delivery vehicles will be ‘over-size’ (width and/or length), ‘over-mass’ or both. These vehicles will be regarded as OSOM vehicles, resulting in restricted access and requiring special RMS operating permits to allow them to travel on public roads.

The permit system requires transport contractors to state the registration details of the trucks/ trailers used for each load, so the link between permissions and equipment is stringent.

Trucks being used for all escorted loads are given an inspection by the escort at the start of every trip, while other trucks are required to meet regulated maintenance requirements and these procedures are regularly audited to ensure compliance. Under these operating procedures, there would be no further actions required by local Councils to ensure that trucks are fit for purpose. Notwithstanding, the transport contractor would be expected to comply with any additional requirements from any relevant party (ie. Councils, RMS, etc.), if requested to do so.

'Over-mass' loads will be carried on trailers, or combinations of trailers, with sufficient axle groups to ensure compliance with point load and overall load limits for the road surface. As a point of reference, the heaviest load based on an assessment of current turbine specifications from a variety of turbine manufacturers is 125 tonnes (comprising the entire nacelle / gearbox configuration in one unit). Such loads are typically carried on trailers with 10-plus axles, with each axle having up to 8 tyres. Allowing for the weight of the trailers themselves, typical axle weights under such configurations are in the range of 12 to 13 tonnes, or less than 2 tonnes per tyre. This is less than a typical semi-trailer with 11 tonnes per axle but only 4 tyres per axle, resulting in 2.75 tonnes per tyre.

OSOM vehicles therefore incur less loading stress on the road surface, especially when run under escort with limited speed, than normal heavy vehicle traffic. Furthermore, both 'over-size' and 'over-mass' vehicles feature trailers with steering on some or all rear axles. This technology ensures improved manoeuvrability, minimises stress on the equipment and the load, and reduces or eliminates tyre scrubbing and the associated stresses on the road surface when cornering.

The fleet of vehicles engaged to deliver OSOM components will typically consist of the following:

- Extendable blade trailers of standard semi-trailer width with up to 4 rear axles, some or all of which will be steerable.
- Heavy duty low loaders, with up to 10-plus rear axles and with each axle having 8 or more tyres to spread the load of the heavier WTG components. These low loaders may have the ability to carry loads up to 30 m in length, and may widen up to 5 m to reduce pressures on the road surface. Depending on the extendable length of these trailers, some of the rear axles may be self-steering.
- Dolly / jinker arrangements to carry loads longer than 30 m, where permitted to do so by permits and the WTG supplier. The rear axle groups on the jinker arrangements are steerable.
- A variety of high-power prime movers, typically rated 130 to 200 tonnes gross combination mass (GCM), as required depending on the total combination weight, ie. WTG load + trailer + prime mover.

Refer to the *RJA Report* for diagrams of typical transport vehicles that are used for wind farm component delivery.

Over-size vehicles are those over 19 m in length, 2.5 m in width and/or 4.3 m in height and their operating permits would require one or more escort vehicles to accompany them. Over-mass vehicles are those with a gross mass greater than 42.5 tonnes.

As mentioned previously, each WTG generator comprises a nacelle (approximately 125 tonnes), hub (approximately 25 tonnes), three blades (approximately 7 tonnes each and in the order of 85 m long) and three to six tower sections (approximately 50 tonnes each).

The components would typically be carried on specially designed trailers with axles that extend up to 4.2 m in total width to carry the hubs and nacelles. The blades, which may be in the order of 85 m long, are carried on specialised trailers which have steerable rear axles allowing negotiation of relatively small radius curves provided that the inside of the curve is clear of obstacles.

The standard design vehicle for swept path adequacy in the provision of intersections and the design of parking and turning areas would generally be (as a minimum) the Austroads single unit truck / bus of 12.2 m length. However, provision would be made, where possible, to allow for a 'B-double' swept path, which requires a wider area allowing for manoeuvring by semi-trailers and over-size (length) vehicles. The design of access roads and junctions would need to allow for widths of up to 4.5 m and weights complying with RMS maximum loading.

4.2 Construction Phase Traffic Generation

Traffic-generating tasks include:

- Initial site set-up and access construction during the pre-construction period.
- Construction staff movements, wind farm component deliveries (including OSOM transport), concrete material deliveries and other general deliveries during construction works.
- Operational staff movements during operation and maintenance.
- Decommissioning and reinstatement construction activities.

During the construction phase, several tasks would generate traffic. These are categorised as follows:

- Wind farm component delivery.
- Construction material delivery.
- Construction staff transport.

It is anticipated that works will commence within one to five years of Development Consent being awarded. The timing of construction will principally be driven by additional permits and authorisations, post-Development Consent tender, contractor selection, optimisation, detailed design and procurement processes and a final investment decision. An indicative Project timeline is presented in *Table 4.1* below.

Table 4.1: Anticipated Project Timeline

Phase	Approximate Duration
Detailed design, contract development and pre-construction	9 months
Construction and commissioning	24 to 30 months
Operation	30 years
Maintenance	Annual and ongoing
Repowering or decommissioning	Completion of project life

4.2.1 Transport of Wind Farm Components

The transport of the various wind farm components would generate traffic as shown in *Table 4.2* below.

Table 4.2: Wind Farm Component Transportation

Wind farm Component	Characteristics	Traffic Generation
Nacelle	Weight is up to 125 tonnes, one per WTG.	Traffic generation for 1 WTG: 1 over-mass vehicle Traffic generation for 97 WTGs: 97 over-mass vehicles
Drivetrain	Weight is up to 60 tonnes, one per WTG.	Traffic generation for 1 WTG: 1 over-mass vehicle Traffic generation for 97 WTGs: 97 over-mass vehicles
Blades	Three blades per WTG. Single blade per vehicle.	Traffic generation for 1 WTG: 3 over-size (length) vehicles Traffic generation for 97 WTGs: 291 over-size (length) vehicles
Hub	Typical weight is approximately 40 tonnes, one per WTG in single load.	Traffic generation for 1 WTG: 1 low-loader vehicle Traffic generation for 97 WTGs: 97 low-loader vehicles
Tower	Typically, three to five sections, each weighing between 20 and 65 tonnes depending on the section and measuring between approximately 15 m to 30 m long.	Traffic generation for 1 WTG: 5 low-loader (over-mass) vehicles Traffic generation for 97 WTGs: 485 low-loader (over-mass) vehicles
Additional Materials	Typically for each WTG, additional miscellaneous equipment to be delivered to the site would require approximately five container (semi-trailer) trucks.	Traffic generation for 1 WTG: 5 semi-trailer trucks Traffic generation for 97 WTGs: 485 semi-trailer trucks
Substation Transformers	The substation transformers would have a typical weight potentially exceeding 100 tonnes (design dependent). Transportation of transformers would be by road and would involve direct loading onto a platform trailer (assumed seven in number although this is dependent on network connection design.	Traffic generation: 7 over-mass vehicles + 10 semi-trailers of support equipment
Substation Buildings	There would be up to three buildings at each substation location to house switching equipment.	Traffic generation: 3 over-mass vehicles

Wind farm Component	Characteristics	Traffic Generation
Switching Equipment	Semi-trailer for transportation of switching components at the point of connection.	Traffic generation: 20 semi-trailers of components and associated equipment.
Overhead Transmission Lines	Semi-trailer for transportation of power poles, conductors, wires and other materials.	Traffic generation: dependant on final details of pole numbers, spacing and location but assume a minimum 20 semi-trailers of poles and associated transmission line equipment.
WTG Erection Cranes	Assume four cranes (2 main cranes and 2 tailing cranes) moving between WTG sites. These would travel to the preferred Project Site access point at the start of construction and then leave at the end.	Traffic generation: 4 over-mass vehicles + 30 semi-trailers of support equipment.

As a worst-case, based on delivery of a total of three whole WTGs per week and working on a six-day week, a maximum of some five OSOM loads per day would be generated. With the addition of a maximum of three semi-trailer loads of other equipment / components in the one day, it is assumed that the delivery of wind farm components would generate a maximum 16 heavy vehicle trips per day, inclusive of 10 OSOM vehicle trips per day (although only five loaded).

With respect to traffic distribution of wind farm component transport, this would largely depend on the origin of component manufacture. As mentioned previously, the most likely scenario is for WTG cargo to be imported to Newcastle because there is no local manufacturing capability in Australia for these components. Therefore, the preferred access route (as described in *Section 3.2* and shown in *Figures 3.1* and *3.2*) would be most likely used for transport of blades, nacelles and hubs.

Tower sections for WTGs may be manufactured in Australia at a number of different locations. Alternatively, if these are imported from overseas they will likely be arriving at the same port with the WTG components.

Depending on selection of the suitable suppliers, electrical equipment may be sourced from various locations around Australia however it is expected that the main transformers will arrive at the Port of Newcastle and commence road transport from there following the same route identified for the WTG Components. If alternate supply locations are chosen within Australia for transformers or other electrical components, alternate transport routes via the major road network and standard heavy vehicle road network will be assessed and addressed within a Traffic Management Plan in consultation with the relevant authorities. The minor access routes shall remain consistent with this assessment.

4.2.2 *Transport of Construction Materials*

The major construction materials to be transported include gravel / road base for construction of site access roads, constituent materials for the on-site concrete batch plant, steel reinforcement deliveries for foundation construction, steel strands and cabling for the transmission lines, and other miscellaneous materials deliveries for site offices and the like. Construction material delivery would typically generate the following traffic generation.

The source of resources for construction is a commercial procurement decision which will occur post-Development Consent. The routes used to move the resources through the surrounding towns and road network will be along the major road network and standard heavy vehicle road network, or alternatively along routes permitted by the resource suppliers' permitting and approvals process.

Concrete

Assuming the use of slab (gravity) foundations, each tower would require approximately 600 m^3 of reinforced concrete. Concrete would be delivered from three on-site batching plants via the internal site road network to access each WTG location and thus, would not be required to travel along the external public road network.

Cement for foundations will be sourced by the civil construction company awarded to undertake the Project. This may be sourced locally or from alternative suppliers.

Gravel (aggregate) and sand will be sourced locally and as close to the Project Site where it is practicable to do so, including recycling material excavated from foundations and earthworks where possible. Several landowners have expressed interest in allowing gravel extraction from their properties, which would require the necessary extraction permits prior to use. Local quarries located in Dubbo, Mudgee, Molong and Maryvale are also potential sources for imported sand and aggregate. Examples of supply sources include:

- Boral in Dubbo, Maryvale and Mudgee
- Hanson in Dubbo and Molong
- Holcim in Mudgee and Dubbo

Delivery of constituent materials (eg. cement, sand, aggregate, water) for the on-site batching plants is assumed to be a maximum 100 truck-loads per week resulting in 200 truck movements per week. This would be reduced if suitable local material such as aggregate and sand is able to be sourced on-site. In addition, it is assumed that some 20 truck-loads per week (or 40 truck movements per week) would be required to deliver steel reinforcement material.

As a peak at any one time during the construction period, concrete material and foundation deliveries would result in 200 truck movements of concrete materials and 40 truck movements of steel reinforcement per week along each of the relevant access routes.

The above truck movements would reduce by approximately 25% if mono-pile foundations were able to be used and generally reduced if a combination of foundation designs (combined slab plus rock anchor design) is implemented.

Gravel / road base

Road base material will be required for construction of on-site access roads to WTG sites and the substations. Part of the road base requirement may be sourced from material extracted from WTG footings with the remainder sourced on-site (subject to permissions) or imported to the Project Site. Where additional material is required, local supplies of the same geological type would be sourced from nearby quarries or external aggregate suppliers.

The on-site road network (estimated at a maximum of 90 km in length) and hardstand areas for cranes are proposed to be constructed using a compacted road base or similar.

The public road upgrades and construction of on-site road network and hardstand areas would result in a potential 100 km length of road construction. Assuming an average 6.0 m wide road formation and 250 mm depth of material, approximately 150,000 m^3 of material would be required. It is assumed that much of this material could be readily sourced on-site. In the event of a shortfall of on-site material, the remainder would need to be sourced from external (off-site) locations[3].

Given the scale of the Project it is anticipated that there will be minimal waste material exported from the Project Site during construction. Top soil cleared from surfaces during the construction phase will be used for remediation, and rock excavated for WTG footing preparations will be used for road base, back fill for foundations and / or erosion control purposes as far as practicable. Ancillary waste, such as packaging associated with component and stock pile deliveries, will be disposed of according to Local Council requirements and will form part of the EMS.

Inter-turbine cabling

It is anticipated that approximately 50 cable drums of 700 m capacity for inter-turbine cabling would be required for the Project. These would be transported by semi-trailer with two drums per load. The resulting traffic generation would be some 25 truck-loads over the course of the project. It is anticipated that during peak periods when cabling is required, some five truck-loads (or 10 two-way truck movements per week) would deliver these materials to site along any of the relevant access routes.

Water

It is estimated that in the order of 15 mega litres (ML) of water would be required to produce the quantity of concrete required for gravity footings for 97 WTGs, and as such, this has been assumed as the maximum amount of water required for use in concrete batching.

In addition, it is estimated that a further 80 ML of water would be required for road construction and dust suppression activities. This would provide sufficient volume for all new and upgraded on-site access road construction and dust suppression activities, including those associated with the approximate 10 km of unsealed public roads (only where they are to be used for construction).

Transport of off-site water to site is estimated be an average of some 86 truck-loads per week (or 172 two-way truck movements per week) throughout the construction period, equating to approximately 36 two-way truck movements per day. These movements

3 This figure would be clarified once the detail design of the Project is undertaken by the construction contractor.

would travel to the Project Site access via Goolma Road / Twelve Mile Road (western end) unless water providers are located on the local road network east of the primary Project site entry.

Other miscellaneous deliveries

Other miscellaneous deliveries include general construction materials and equipment as well as site office operations equipment. It is estimated that some 15 delivery loads per week (or 30 two-way vehicle movements per week) would be required throughout the construction period.

These miscellaneous deliveries are all assumed to be sourced from nearby centres (eg. Gulgong, Wellington, Mudgee and Dubbo) and would be transported to the Project Site access location from surrounding areas via the relevant transport routes.

4.2.3 Construction Staff Traffic

Construction staff numbers will fluctuate over the construction period dependent on the activities being undertaken. For the majority (18 months) of the 24 to 30-month construction period, it is anticipated that average construction staff numbers would be up to approximately 150 staff. During peak construction periods (requiring more labour-intensive activities such as during concrete pours for WTG foundations), it is anticipated that construction staff numbers would increase up to 250 staff.

Assuming there will be some shared journey-to-work trips by construction staff (resulting from car-pooling and similar initiatives), an average of 1.25 persons per car has been adopted for traffic generation purposes. During general staffing periods, traffic generation would be some 120 light vehicles (cars) or 240 light vehicle trips per day. During peak staffing periods, traffic generation would be some 200 light vehicles (cars) or 400 light vehicle trips per day along the surrounding road network.

It should be noted that this traffic generation is considered to be a conservative case (high traffic generating) scenario and that if car occupancy was able to be increased, staff traffic generation has the potential to be significantly less. Consequently, impacts from traffic on the surrounding road network and intersections would be reduced.

It is assumed that construction staff trip distribution would be split equally between the east (Gulgong-Mudgee area) and west (Wellington-Dubbo area), resulting in 120 construction staff vehicle movements per day (200 construction staff vehicle movements per day during peak staffing periods) from each direction along Goolma Road to the site access locations via Twelve Mile Road. Furthermore, it is assumed that the majority of construction staff would ‘follow’ the wind farm cluster construction and therefore, the trip distribution split would occur at any location along the travel routes during the course of the construction period.

4.2.4 Total Traffic Generation

The above sections provide the basis for estimating the average total traffic generation over the construction period. Traffic generation used in this transport assessment ranges from a moderate (average) scenario, that would apply for the great majority (18 months) of the 24 to 30-month construction period, to a conservative (high) scenario, which assumes that peak construction staff numbers would coincide with other peak traffic generating activities such as concrete pours and access road construction, as well as delivery of WTG components.

While the conservative (high) scenario could potentially occur, it is more likely that peak access road construction activities would be undertaken during the earlier stages of the construction program and not necessarily coincide with peak construction staff numbers and other peak construction activities such as concrete foundation pours. Nonetheless, this conservative overlap of activities has been adopted to consider a 'worst-case' scenario as well as the more applicable and relevant moderate (average) scenario.

Typically, the conservative (high) traffic generation scenario would apply for only some six months out of the total 24 to 30-month construction period. This six-month period would coincide with construction of WTG foundations and delivery of WTG components. It should be noted that it would not necessarily be for a continuous six months. For the remaining 18 to 24-months, a moderate (average) traffic generation scenario has been assumed, although realistically there would be at least one month at either end of the construction period where a low traffic generation period would apply, eg. during pre-construction tasks and pre-commissioning.

Traffic generation for both moderate and conservative (in brackets) scenarios is shown in *Table 4.3* below and has been classified into daily movement trips (ie. two-way trips), shown as vehicles per day (vpd) and peak hour trips (where applicable), shown as vehicles per hour (vph).

Table 4.3: Project Traffic Generation

Traffic Generating Activity		Mitchell Highway	Saxa Road#	Goolma Road	Twelve Mile Road
Construction staff (light vehicles only)	vpd vph	120 (200) 60 (100)	20 (40) 10 (20)	240 (400) 120 (200)	240 (400) 120 (200)
Wind farm component delivery (OSOM vehicles)	vpd vph	0 (10) 0 (4)	0 (10) 0 (4)	0 (10) 0 (4)	0 (10) 0 (4)
Wind farm component delivery (non-OSOM heavy vehicles)	vpd vph	0 (6) 0 (2)	0 (6) 0 (2)	0 (6) 0 (2)	0 (6) 0 (2)
Concrete batch plant material delivery (heavy vehicles)	vpd vph	20 (20) 5 (6)	0 (0) 0 (0)	40 (40) 5 (6)	40 (40) 5 (6)
Delivery of steel reinforcement (heavy vehicles)	vpd vph	4 (4) 2 (2)	0 (0) 0 (0)	8 (8) 2 (2)	8 (8) 2 (2)
Inter-turbine cabling delivery (heavy vehicles)	vpd vph	1 (1) 1 (1)	0 (0) 0 (0)	2 (2) 1 (1)	2 (2) 1 (1)
Water deliveries (heavy vehicles)	vpd vph	18 (18) 6 (8)	0 (0) 0 (0)	36 (36) 6 (8)	36 (36) 6 (8)
Other miscellaneous construction deliveries (HVs)	vpd vph	2 (2) 1 (1)	0 (0) 0 (0)	4 (4) 2 (2)	4 (4) 2 (2)
TOTAL Light vehicles	vpd vph	120 (200) 60 (100)	20 (40) 10 (20)	240 (400) 120 (200)	240 (400) 120 (200)
Heavy vehicles	vpd vph	45 (51) 15 (20)	0 (6) 0 (2)	90 (96) 16 (21)	90 (96) 16 (21)
OSOM vehicles	vpd vph	0 (10) 0 (4)	0 (10) 0 (4)	0 (10) 0 (4)	0 (10) 0 (4)

Apart from the OSOM transport, some nominal staff traffic generation has been assigned along Saxa Road.

4.3 Effect of Construction Phase Traffic Generation

4.3.1 Road Capacity

In order to assess the potential impacts on road capacity, the traffic generation of heavy vehicles and the staff traffic generation (refer to *Table 4.3* previously) have been added to current daily and peak hour traffic flows to obtain future traffic flows (for both moderate and conservative traffic generation scenarios) along the affected road network.

Future traffic volumes in vehicles per day and vehicles per hour for roads along the preferred access route are shown in *Table 4.4* following. The traffic volumes are broken up into light vehicles (LV) and heavy vehicles (HV) with the heavy vehicle proportion assumed to be between 10% and 15% of the total traffic volume. The figures in brackets are for the conservative (high) traffic generation scenario.

Table 4.4: Future Traffic Volumes

Traffic Scenario		Mitchell Highway	Saxa Road	Goolma Road	Twelve Mile Road
Daily Traffic – vehicles per day					
Current traffic#	LV	2,150	130	750	90
	HV	370	20	120	10
Wind farm traffic generation	LV	120 (200)	20 (40)	240 (400)	240 (400)
	HV	45 (61)	0 (16)	90 (106)	90 (106)
Combined future traffic	LV	2,270 (2,350)	150 (170)	990 (1,150)	330 (490)
	HV	415 (431)	20 (36)	210 (226)	100 (116)
Hourly (Peak) Traffic – vehicles per hour					
Current traffic#	LV	200	25	100	16
	HV	30	5	20	4
Wind farm traffic generation	LV	60 (100)	10 (20)	120 (200)	120 (200)
	HV	15 (24)	0 (6)	16 (25)	16 (25)
Combined future traffic	LV	260 (300)	35 (45)	220 (300)	136 (216)
	HV	45 (54)	5 (11)	36 (45)	20 (29)

Current traffic derived from *Table 3.1*. HV % assumed to be between 10% and 15% of total traffic volume.

Road capacity can be expressed and qualified along a section of the rural road network as its 'level of service' (LoS). Typically, the LoS is based on road capacity analysis as described in Austroads' "*Guide to Traffic Engineering Practice, Part 2 – Roadway Capacity*". Road capacity can be expressed in total vehicles per day and/or vehicles per hour.

The level of service descriptions are as follows:

LOS A: Free flow conditions, high degree of freedom for drivers to select desired speed and manoeuvre within traffic stream. Individual drivers are virtually unaffected by the presence of others in the traffic stream.

LOS B: Zone of stable flow, reasonable freedom for drivers to select desired speed and manoeuvre within traffic stream.

LOS C: Zone of stable flow, but restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.

LOS D: Approaching unstable flow, severely restricted freedom for drivers to select desired speed and manoeuvre within traffic stream. Small increases in flow generally cause operational problems.

LOS E: Traffic volumes close to capacity, virtually no freedom to select desired speed or manoeuvre within traffic stream. Unstable flow and minor disturbances and/or small increases in flow would cause operational break-downs.

LOS F: Forced flow conditions where the amount of traffic approaching a point exceeds that which can pass it. Flow break-down occurs resulting in queuing and delays.

Road capacity for two-lane, two-way sections of a rural road network is largely based on a combination of design speed, travel lane and shoulder width, sight distance restrictions, traffic composition, directional traffic splits and terrain[4]. This provides a basic level of service and associated service flow rate under prevailing road and traffic conditions. Based on their road and traffic characteristics, the levels of service and flow rates for the affected sections of the rural road network along the preferred access route is shown in *Table 4.5* following.

Table 4.5: Rural Road Network Service Flow Rates

Road Section	Level of Service (LoS)				
	A	B	C	D	E
Mitchell Highway	240 vph 2,400 vpd	420 vph 4,500 vpd	660 vph 6,800 vpd	1,020 vph 10,900 vpd	1,760 vph 18,500 vpd
Saxa Road	130 vph 1,350 vpd	290 vph 3,150 vpd	520 vph 5,450 vpd	780 vph 7,950 vpd	1,450 vph 13,900 vpd
Goolma Road	105 vph 1,050 vpd	260 vph 2,850 vpd	480 vph 5,250 vpd	730 vph 7,800 vpd	1,440 vph 13,800 vpd
Twelve Mile Road	85 vph 850 vpd	210 vph 2,250 vpd	390 vph 4,250 vpd	590 vph 6,300 vpd	1,160 vph 12,200 vpd

Based on the above service flow rates, the current 2019 traffic volumes and additional wind farm generated construction traffic volumes of the rural roads along both access routes (conservative scenario peak volumes used as a worst-case scenario), 'before and after' levels of service can be expected as shown in *Table 4.6* following.

4 Austroads "*Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity*", Section 3

Table 4.6: Rural Road Network – Current and Future Levels of Service

Road Section	Current LoS	Future LoS
Mitchell Highway	B	B
Saxa Road	A	A
Goolma Road	A / B	B / C
Twelve Mile Road	A	A / C

From the above table, it is clearly evident that operating conditions (levels of service) along the rural road network would only change marginally from existing conditions, even after the addition of the conservative scenario (maximum peak) wind farm generated construction traffic.

The majority of the rural road network under consideration has significant spare capacity and is operating at high levels of service (LoS A or B).

In summary, the addition of heavy vehicles and construction staff traffic during peak construction periods is able to be absorbed by the rural and urban road networks with appropriate road infrastructure upgrades and appropriate construction traffic management.

4.3.2 Goolma Road / Twelve Mile Road Junction

Under current traffic volumes, the current Goolma Road / Twelve Mile Road intersection layout (BAR: basic right-turn / BAL: basic left-turn) is considered to be adequate. Sight distance is more than satisfactory in all directions and the T-junction is quite wide with separate turn areas for east and west movements.

During Project construction, the increased traffic generation and in particular, the higher turning movements at the subject intersection may warrant auxiliary and/or protected (channelised) turn lane intersection treatments, eg. AUR: auxiliary right-turn / AUL: auxiliary left-turn or CHR: channelised right-turn / CHL: channelised left-turn (refer to *Figure 4.1* following).

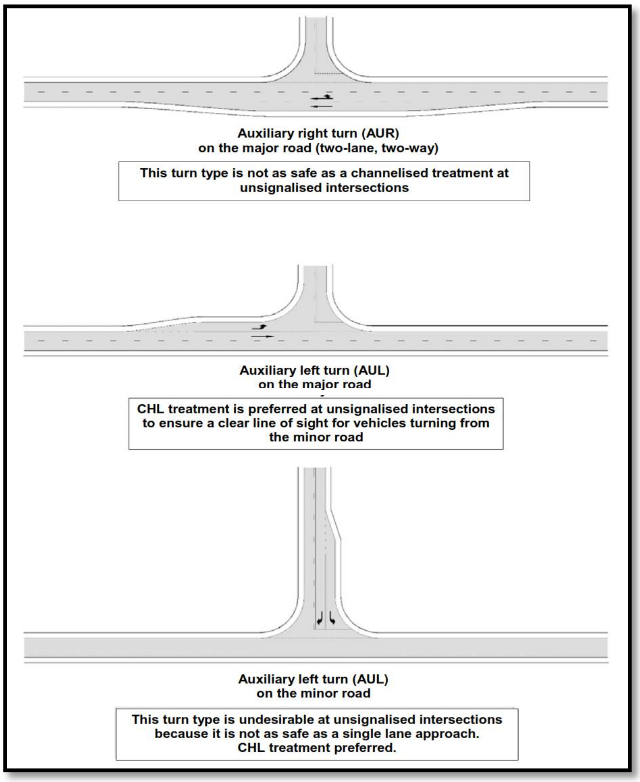


Figure A.6 from Austroads "*Guide to Road Design Part 4: Intersections and Crossings – General*"

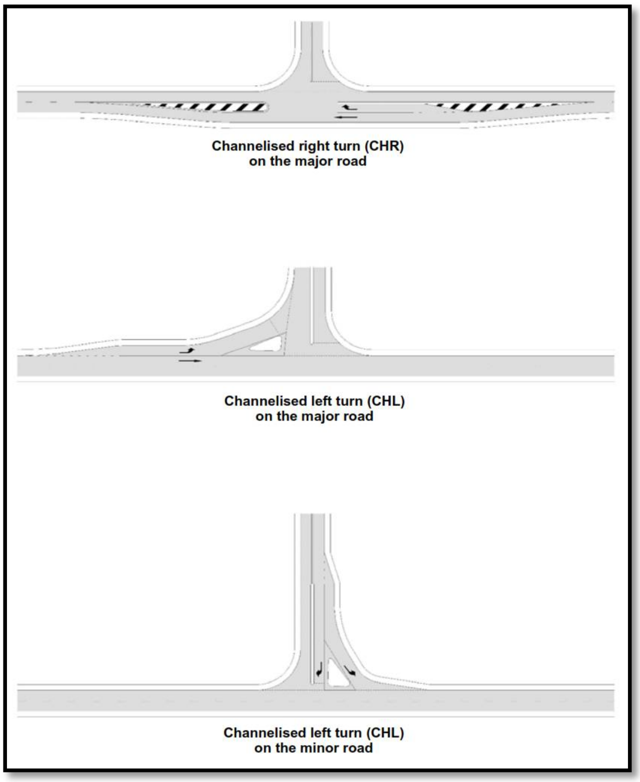


Figure A.8 from Austroads "*Guide to Road Design Part 4: Intersections and Crossings – General*"

Figure 4.1: Typical Rural Intersection Treatments

4.3.3 *Site Access and Road Safety*

Construction traffic is proposed to access the various WTG sites via an internal site access road network off the primary wind farm Project Site access point (described previously in *Section 3.4*). Where sight distance issues onto the public road network are identified, a combination of suitable road upgrade works and appropriate temporary traffic control (conforming to RMS and/or Austroads guidelines as well as relevant Australian Standards) will be required to warn road users of turning truck traffic and other similar construction-related traffic movements.

Suitable on-site manoeuvring areas would be available so that larger vehicles are able to safely manoeuvre into the site off the public road network, around the site and out of the site onto the public road network. The location and layout of the all site access locations would be confirmed with the relevant road authorities taking into account set back of property boundaries and swept path turn radii for over-size (length) vehicle movements.

OSOM vehicles to be used for wind farm component delivery would be subject to permits issued by the National Heavy Vehicle Regulator and Transport for NSW which would include controls to manage complementary road use. These would be resolved in detail by the selected transport contractor when seeking approvals from relevant road authorities.

All vehicles would enter and exit the Project Site to/from the public road network in a forward direction only. All vehicles generated by construction staff would be accommodated within on-site parking areas.

To ensure adequate road safety is maintained, a comprehensive Traffic Management Plan (TMP) would be prepared by the Proponent in conjunction with the relevant road authorities. The TMP would detail appropriate construction traffic controls and management measures and all aspects would be implemented in co-ordination with the Councils and RMS. It is acknowledged that on occasions, local traffic will be inconvenienced. However, the management measures within the TMP would endeavour to mitigate any impacts. The TMP would include, but not be limited to, provisions for the following typical issues:

- Details of all transport routes and traffic types to be used for development-related traffic.
- Protocol for undertaking dilapidation surveys in consultation with the relevant road authorities.
- Protocol for the repair of any roads identified in the dilapidation surveys to have been damaged during construction or decommissioning works.
- Details of the measures that would be implemented to minimise traffic safety issues and disruption to local users of the transport route(s) during construction or decommissioning works, including the following:
  - consideration of potential interaction with other State Significant Development in the local area in consultation with the applicant(s) of those projects;
  - temporary traffic controls, including detours and signage;
  - notifying the local community about project-related traffic impacts;
  - minimising potential for conflict with school buses, stock movements and rail services;
  - implement measures to minimise development-related traffic on the public road network outside of standard construction hours;

- implement measures to minimise dirt tracked onto the sealed public road network from Project-related traffic;
- ensuring loaded vehicles entering or leaving the site have their loads covered or contained;
- providing sufficient parking on-site for all Project-related traffic;
- responding to any emergency repair or maintenance requirements during construction and/or decommissioning;
- traffic management system for managing OSOM vehicles; and
- comply with the traffic conditions in the Development Consent.

- Drivers code of conduct that addresses the following:
  - travel speeds;
  - fatigue management;
  - procedures to ensure that drivers adhere to the designated transport routes;
  - procedures to ensure that drivers implement safe driving practices; and
  - include a detailed program to monitor and report on the effectiveness of these measures and the code of conduct.

4.3.4 Internal Access Roads

The construction and maintenance of the wind farm will require the construction of an internal site road network to reach all the WTG locations as well as the substations sites. This internal site road network will allow access across the entire Project Site thus providing the flexibility of external transportation to consolidated site access locations and then access to entire wind farm Project Site.

In some cases, the site road network works will involve upgrading existing access tracks and in others constructing new ones. Initial route selection for the access roads has been determined taking into consideration topography, drainage and potential erosion impacts – refer to *Appendix A: Proposed Wind Farm Layout*.

The internal site road network will consist of private roads and will not be accessible to the public. Access will be controlled by locked gates. The internal site access roads will generally be a minimum 6.0 m wide with regular passing bays, which could include hardstands and turning heads to accommodate construction vehicles and cranes required to assemble the WTGs. Hardstand areas would be required around each WTG site for the safe operation of large cranes. These areas would also provide turning / manoeuvring and passing opportunities for delivery vehicles.

The internal roads will be an all-weather graded surface. Ongoing operational maintenance of on-site roads would be undertaken by the wind farm operator.

4.3.5 Road Condition Maintenance

There are a number of public road works that would be required to enable transport of components and materials to the wind farm sites. These have been identified in general previously in this assessment but would be confirmed and resolved in detail by the selected transport contractor when seeking approvals from relevant road authorities.

Prior to commencement of construction or decommissioning and in consultation with the relevant road authorities, the following would be undertaken:

- Prepare a pre-dilapidation survey of the transport route.

- Prepare a post-dilapidation survey of the transport route within one (1) month of the completion of construction or decommissioning works other than pre-construction minor works, or other timing as may be agreed by the applicable road authority.
- Rehabilitate and/or make good any project-related damage identified in the post-dilapidation survey within two (2) months of the completion of the survey, or other timing as may be agreed by the relevant road authority. Agreement will be reached with the relevant road authority on the requirements to make good any project-related road damage.

4.4 Operational Phase Traffic Generation

The operational phase of the Project includes operation of the development, but does not include commissioning trials of equipment or use of temporary facilities. Once operational, the Project would be monitored both by on-site staff and through remote monitoring. Aspects of the Project operation to be dealt with by on-site staff would include safety management, environmental condition monitoring, landowner management, routine servicing, malfunction rectification and site inspections. Those functions to be overseen by remote monitoring include WTG performance assessment, wind farm reporting, remote resetting and maintenance co-ordination. Pro-active computer control systems monitor the performance of the WTGs and ensure that any issues are dealt with by on-site staff or contractors, as appropriate.

Maintenance staff will be on-site throughout the year, making routine checks of the WTGs on an ongoing basis. Major planned servicing would be carried out approximately twice a year on each WTG. Each major service visit would involve a number of service vehicles (two technicians per vehicle) on-site. Maintenance staff will work within the O&M compound and throughout the Project Site during normal operation.

On-site maintenance will require permanent access to the WTGs to address technical and mechanical servicing requirements. Replacement of major components, such as WTG blades, may require the use of cranes and ancillary equipment.

Management of regrowth and existing vegetation will be necessary within the overhead transmission line corridors to reduce the threat of fire and physical damage to the transmission line, and to allow access for maintenance vehicles. This will be carried out using mechanical, manual and chemical clearing methods prior to construction activities commencing and as part of ongoing maintenance activities for the duration of the Project.

Following construction of the overhead transmission line, maintenance will most likely be limited to yearly inspections in a 4WD vehicle to check the integrity of the transmission poles and other associated infrastructure. Occasionally, access by medium and heavy vehicles may be required to repair or maintain overhead transmission line components. Access will be gained via dedicated on-site internal roads within the overhead transmission line corridor.

Traffic generation during operations would be relatively minor. There is proposed to be approximately 10 to 20 operational / maintenance staff servicing the WTGs, likely to be based in the surrounding, local areas. Typically, this would comprise an estimated 10 permanent jobs with others engaged in employment on the site on a periodic basis.

It is understood operational traffic would consist of 4WD-type service vehicles travelling between individual WTG sites along the internal road network after gaining access off the public road network from the Project Site access locations. It is envisaged that with journey-to-work and home trips, this would amount to a maximum of 40 trips per day, which would readily be absorbed into the spare capacity of the existing road network.

There is the possibility that the operational wind farm may attract tourist traffic along the roads surrounding the sites. However, it is considered that this would not significantly increase traffic volumes or cause any unfavourable impacts.

4.5 Effect of Operation Phase Traffic Generation

Based on the relatively minor traffic generation during operations described above, traffic and road network impacts would be negligible. The current road network has significant spare capacity and is used by 4WD-type vehicles, which are proposed to be used for servicing the various sites.

All vehicles generated by operations staff would be accommodated within on-site parking areas.

4.6 Cumulative Impacts

At present, there are a number of known nearby major developments or projects that may result in cumulative impacts in conjunction with the subject Uungula Wind Farm Project. These include the following projects:

- Crudine Ridge Wind Farm (currently under construction)
- Liverpool Range Wind Farm (currently in pre-construction phase)
- Nearby solar farm projects including at Wellington, Wellington North, Maryvale and Mumbil (all currently at various stages of pre and early-stage construction).

Once the construction dates / timetables are finalised for the Uungula Wind Farm Project, the cumulative impact of the above projects (and potentially other future projects) would need to be considered with respect to transport and traffic operations.

Generally, any impacts would initially need to be considered as part of construction traffic management plans to minimise cumulative construction impacts. This is particularly relevant for wind farm projects such as Uungula, which generate the great majority of their transport impacts during the construction phase.

Typical mitigation measures may include:

- Independent scheduling of construction activities and deliveries for each project so that they do not overlap in order to minimise road transport movements.
- Region-wide traffic management.
- Shared road infrastructure upgrade works.
- Targeted dilapidation and reinstatement programs.
- Collective community consultation programs.

4.7 Decommissioning

At the end of the operational life of the Project, all above ground infrastructure will be dismantled and removed from the Project Site. This may not include the connection infrastructure which may be essential to be retained. WTG tower bases would be cut back to below ploughing level or topsoil built up over the footing to achieve a similar result. The land will be returned to near prior condition and use. A compressor and rock crusher may be needed to carry out the cutting work.

Internal roads, if not required for ongoing farming purposes or fire access, would be removed and the Project Site reinstated as close as possible to its original condition and use. Access gates, if not required for farming purposes, would also be removed. Individual landowners will be involved in any discussion regarding the removal or hand-over of infrastructure on their property.

The underground transmission lines are buried below ploughing depth and contain no harmful substances. Further, removing them would involve further unnecessary vegetation disturbance. Accordingly, they would be left in the ground and only recovered if economically and environmentally viable. Terminal connections would be cut back to below ploughing levels.

All decommissioning work would be the responsibility of the Project owner and provision for this has been included in the lease arrangements agreed with the landowners.

Traffic generation during decommissioning would be similar to traffic generation during the initial set-up of the Project Site with an anticipated maximum of the same order as the moderate (average) traffic generation scenario, that would apply for the great majority of the construction period.

Based on the assessment of the road capacity during the construction phase (detailed above in *Section 4.3.1*), traffic and road network impacts would be minimal with only marginal changes from existing conditions. Although the road network conditions at the completion of the Project in 30 years are unknown, it is considered that based on current conditions, the road network would have significant spare capacity and be able to accommodate the necessary heavy vehicles to be used during the decommissioning.

As per the construction phase, a comprehensive TMP would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities. This would aim to ensure adequate road safety and road network operations are maintained.

5. Mitigation Measures

5.1 General Management of Potential Impacts

The management of potential impacts caused by the proposed wind farm project would cover the construction, operation and decommissioning phases of the Project. With respect to the potential traffic impacts during the decommissioning phase, these essentially mirror the construction phase impacts, although would occur over a shorter time period.

For management of potential impacts during the construction phase, the following general measures would need to be undertaken:

- Engage a licensed and experienced transport contractor with experience in transporting similar wind farm component loads. The contractor would be responsible for obtaining all required approvals and permits from the RMS and local Councils and for complying with conditions specified in the approvals. Transport contractors would also conduct any dilapidation surveys and arrange for detailed pavement and infrastructure inspections (eg. bridge loading adequacy) to ensure all access routes are suitable prior to carrying out the transport tasks.
- Develop a TMP in conjunction with the transport contractor and relevant road authorities and implement all aspects of the TMP in co-ordination with the local Councils and RMS – refer to previous *Section 4.3.2* for typical details to be included in a TMP.
- Undertake road infrastructure upgrade works to allow OSOM transport along the proposed designated transport routes to access the Project Site – details of specific works are included in the *RJA Report*.
- There are a number of locations along the OSOM transport route where relatively sharp curve alignments and/or narrow carriageways would require over-size (length) vehicles to use the full carriageway width. This would require traffic management in the form of temporary, short-term, full road closures ('rolling' road closures as vehicles pass critical locations) aided by escort vehicles.
- Prepare road dilapidation reports covering pavement, drainage and bridge structures in consultation with RMS and the local Councils for all of the proposed transport routes before and after construction. Regular inspection regimes undertaken in consultation between local Councils and the proponent would be developed. Any damage resulting from construction traffic, except that resulting from normal wear and tear, would be repaired to pre-existing conditions.
- Consider establishing a 'car pool' initiative or providing bus services for construction staff from nearby centres to minimise construction staff trips.
- For decommissioning, similar general measures would be necessary as those detailed for construction. However, the TMP for decommissioning would need to be revised to address traffic operation and volume changes in the future years during the decommissioning phase.

For management of potential impacts during the operations phase, the following general measures would need to be undertaken:

- Establish a procedure to ensure the ongoing maintenance of the internal on-site access roads during the operation phase. This maintenance would include sedimentation and erosion control structures, where necessary.

5.2 Road Authority Approvals

The use of licensed and experienced contractors for transporting wind farm equipment is essential to ensure the minimisation of any impacts on the road network and traffic operations. There are a number of transport contractors who are experienced in the specialised transport of OSOM vehicle loads. These contractors operate closely with road authorities and are able to arrange all required permits for undertaking the transport tasks. They would also carry out detailed transport route assessments and confirm the requirement for any road infrastructure upgrades and/or bridge strengthening works.

In obtaining approval and permits for OSOM transport, the following documents are pertinent:

- NSW RMS "*Additional Access Conditions: Oversize and overmass heavy vehicles and loads*" November 2017
- NSW RTA "*Road Transport (General) Act 2005: General Class 1 Oversize (Load-Carrying Vehicle) Notice 2007 under Division 3 of Part 2 of the Road Transport (Mass, Loading and Access) Regulation 2005*" August 2007
- NSW RTA "*Road Transport (General) Act 2005: General Class 1 Oversize (Special Purpose Vehicle) Notice 2007 under Division 3 of Part 2 of the Road Transport (Mass, Loading and Access) Regulation 2005*" August 2007

Consultation with RMS regarding their requirements for transporting OSOM vehicle loads resulted in the following pertinent issues:

- Generally, the wider and longer OSOM transport will require two pilot vehicles and contact with NSW Police for further guidance (pilot vehicles).
- OSOM permits are required to be 'specific' permits for each vehicle if they will be travelling along designated roads or locations. Additional and specific OSOM permits may be required for loads with greater dimensions than covered by a General Class 1 Oversize Notice.
- A specific permit:
  - prescribes the travel conditions that apply to a particular vehicle;
  - identifies the vehicle to which the permit applies; and
  - identifies the registered operator of the vehicle.
- The permit may also specify conditions to secure payment for:
  - damage caused to roads, bridges or other property by the OSOM vehicle;
  - road work that must be conducted before the vehicle can travel on a particular route; or
  - costs incurred by RMS to evaluate the proposed route or provide any special escort services.
- An over-mass permit will be required for each nacelle component.

- An over-size (length) permit will be required for each blade component. The requirement for over-mass permits for blade components will depend on the type of vehicle used to transport them. However, preliminary assessment indicates that over-mass permits may not be required for blade components.
- Transport of blade components will most likely utilise a rear-end steering system on a trailer or low loader.
- An over-mass permit will be required for each tower component.
- An over-mass permit will be required for the sub-station transformer unit.
- An over-mass permit will be required for each crane.
- Night transport is generally available along the major road network (between 1 am and sunrise or 6 am, whichever is earlier).
- Transport through the any urban areas (eg. Wellington) must generally occur during daylight periods. It is recommended that if the transport routes pass through any school zones or adjacent to any schools, transport also be restricted to outside school drop-off and pick-up times (8:00 am to 9:30 am and 2:30 pm to 4:00 pm) to prevent conflicts with these activities.
- As part of the transport permit process, the Proponent will work with RMS and local Councils to undertake a detailed sufficiency assessment of bridges and other structures along the transport route to confirm strengthening requirements, if any. This may apply to several bridge crossings along Castlereagh Highway, Goolma Road and Twelve Mile Road as well as the minor, unsealed local roads.

5.3 Potential Road Infrastructure Upgrades

As well as the construction of an internal on-site road network that links up the various WTG sites and associated wind farm infrastructure, road upgrade works are likely to be required at a number of locations to accommodate the increased heavy vehicle volumes and OSOM transport vehicles. The latter issue would be confirmed by a licensed transport contractor as part of their transport route assessment based on specific vehicles to be used.

Prior to the commencement of the relevant phase of construction the Proponent will undertake any road upgrades developed in consultation with and to the satisfaction of the local Council and RMS. Works will be undertaken by a suitably qualified contractor subject to the relevant authorisation. Site establishment and construction works may be undertaken in parallel with the road upgrades subject to preparation, approval and implementation of a TMP in consultation with the relevant road authority. Site access points would be gated and secured, and appropriate warning signs erected.

The specific road infrastructure upgrades that may be required and/or would need to be considered by the chosen transport contractor prior to commencement of construction would be developed in consultation with Council and designed to their satisfaction. Reference should be made to the *RJA Report* and its findings for potential road infrastructure upgrades. It is acknowledged that some of the works identified by the *RJA Report* may have already been undertaken recently due to other projects in the area (eg. Bodangora Wind Farm) and thus an updated site assessment in consultation with Council would identify the required road infrastructure upgrades dependant on the actual road conditions pre-construction.

5.4 Typical Transport Route Upgrade & Risk Mitigation Measures

Full structural road upgrades are not normally required for the routes intended to provide wind farm access. Exceptions include where access is via an under-rated bridge or where there are obstructions that overhang the road or limit the width of the vehicle / load that can pass. Mitigation strategies typically comprise the following.

Road Surface

As a general rule, ground clearances as low as 300 mm should be considered for over-mass trailers. Depending on the specifications of the transport equipment to be used, road camber, rise, fall and undulations may require review. Placing limits on vehicle speed ensures that even with heavy loads, the stresses on the road surface can be minimised. Whilst a sealed road surface is ideal, the vehicles are designed to and capable of travelling on unsealed surfaces such as those found on wind farm sites during construction – see *Figure 5.1* below. Therefore, temporary surfaces of crushed rock or similar material are normally adequate, on the basis that any such surface is properly drained to prevent loaded vehicles becoming bogged. There is not anticipated to be any significant impacts to road safety and/or traffic operations as a result of this type of road surfacing measure.

Figure 5.1: Typical unsealed access road within wind farm site

Road width

Larger WTG loads require a road width of up to 5.0 m, which is sometimes more than the width of minor roads that service remote wind farm sites. Consideration needs to be given to ensure adequate road width for OSOM transport, although it is not normal to increase the width of a sealed surface if it already exists at less than 5.0 m. Where the road width is restricted (be it sealed or unsealed), the common approach is to clear sufficient vegetation from the sides of the road to allow shoulders of crushed rock to be laid. The level of the surface of any such preparation needs to match the edge of the existing road, to prevent tyre damage (and in the case of sealed roads, the break-up of the edge of the sealed section) when the vehicle is required to run wide for corners or to move over for on-coming traffic – see *Figure 5.2* below for increased unsealed road width.

Swept path analysis is generally undertaken once the WTG has been determined for the project, to ensure that any obstacles such as ditches or traffic furniture can be identified and remedied ahead of time. Where further road modifications are required to allow for 'cutting in' of vehicle rear wheels, crushed rock in-fill is normally sufficient on the basis that the vehicles are travelling slowly enough on the curves / turns to ensure minimum road stresses. Where temporary or crushed rock road surfaces are used, a regime of regular maintenance should be employed when OSOM vehicles are travelling to / from the wind farm site.

Figure 5.2: Typical unsealed increase in width of (public) road

Overhead obstacles

OSOM vehicles can generally travel with a combined total height of 5.2 m without the need for an overhead pilot. Any obstructions or height risks such as low bridges (see *Figure 5.3* below), overhead power lines, hanging wires or tree branches would be identified. Where there is a bridge risk, detailed calculations would be done to ensure the loads as specified by the selected WTG manufacturer do not present any risk of a bridge strike. If this is possible, alternative route(s) should be sought. Overhanging wires can be provided with additional temporary support if required, whereas any overhanging tree branches would be cut back or restrained away from the path of the vehicle.

Bridges and culverts

In the event that there are bridges and/ or culverts which are deemed not strong or wide enough (typically less than 5.0 m travel path width) to support WTG transport equipment, the options are as follows:

- Build a temporary diversion with a structure to provide the necessary support, whilst leaving the original structure in place.
- Reinforce the existing structure by means of steel plates / girders as required to provide the necessary support. Reinforcement can be provided either below the structure, or as additional support on top of the existing road surface.
- As a last resort, if other options are not feasible or practicable, consideration may be given to the replacement of the bridge / culvert with a structurally suitable permanent upgrade to support the projected wind farm component loads.

The selection of any of the above options is dependent on a full technical assessment from a qualified structural engineer which typically occurs during the detailed design phase of the project, once the dimensions and loads are known.

Figure 5.3: Identification of bridge underpass height risk

6. Summary & Conclusions

The following pertinent issues summarise the transport assessment for the proposed Uungula Wind Farm project:

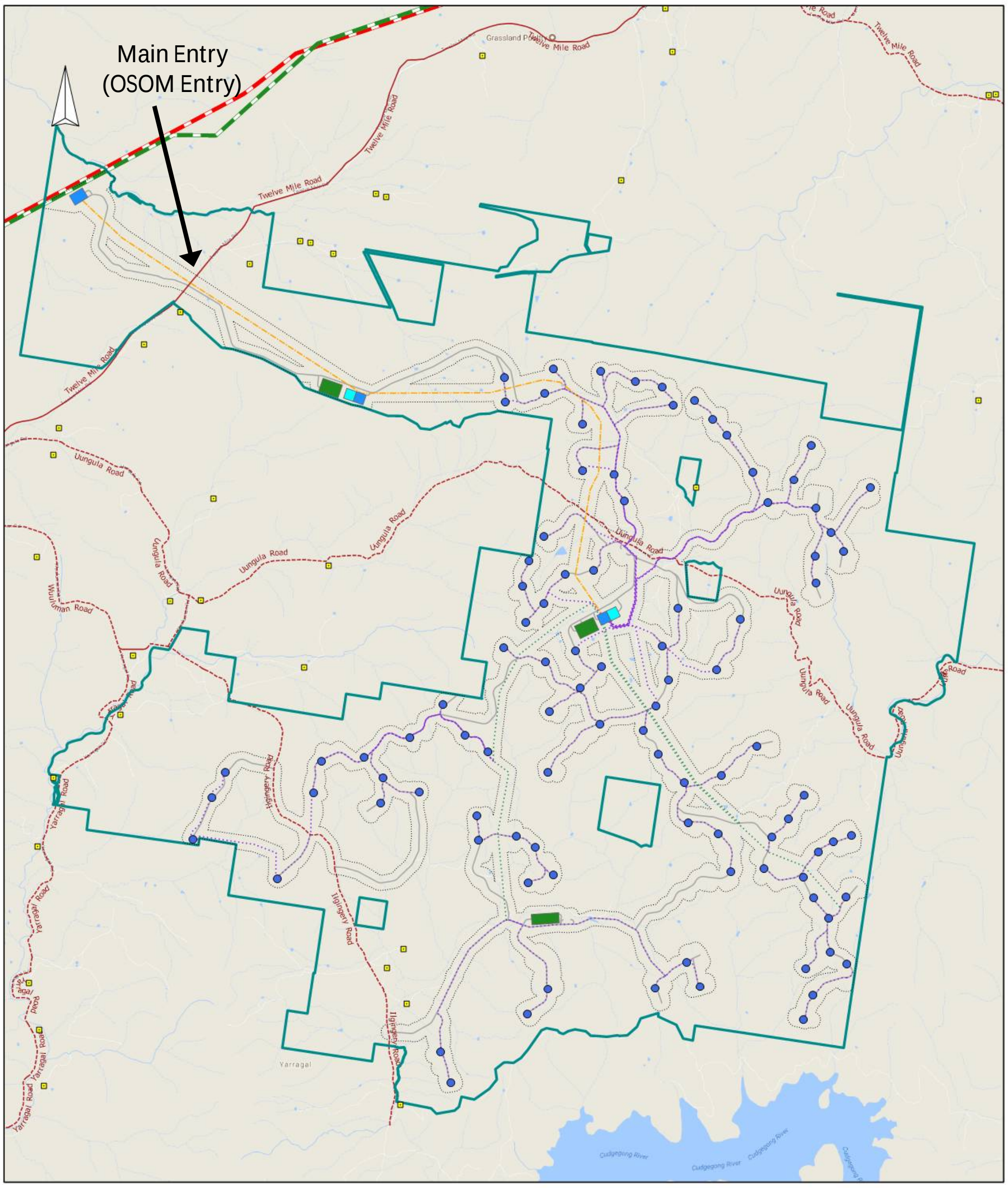
- The wind farm would consist of up to 97 wind turbine generators (WTGs) to be located on rural land between Wuuluman and Twelve Mile, approximately 14 km east of Wellington, NSW.
- Road transport is the preferred method of transport. Rail is not feasible due to larger wind farm components not being able to be accommodated by the rail system, lack of vertical and horizontal clearance in some sections, double handling, problems of scheduling rail services and potential restriction on track capacity.
- The primary Project Site access provides a consolidated site access location off the southern side of Twelve Mile Road for all transportation including OSOM vehicles and standard light and heavy vehicles.
- The preferred transport route for OSOM vehicles is via Golden Highway, Saxa Road, Mitchell Highway (north of Wellington) and Goolma Road to the primary Project Site entrance off Twelve Mile Road.
- The major road network and standard heavy vehicle road network provides transport routes to and through Gulgong and Wellington, which connects to the minor road network and the Project Site access location via Goolma Road and Twelve Mile Road.
- The source of resources for construction is a commercial procurement decision which will occur post-Development Consent. The routes used to move the resources through the surrounding towns and road network will be along the major road network and standard heavy vehicle road network, or alternatively along routes permitted by the resource suppliers' permitting and approvals process.
- The major and minor road networks all have significant spare capacity.
- All WTG locations and ancillary infrastructure would be able to be accessed from the primary Project Site access point via the internal Project Site road network. This includes the use of a short section of Ilgingery Road as a cross-over point.
- During the construction phase, several tasks would generate traffic including wind farm component delivery, construction material delivery, concrete pours and construction staff transport. For the majority of the construction period, maximum daily traffic generation would be 240 light vehicle trips and up to 90 non-OSOM heavy vehicle trips per day. During peak activities, the maximum daily traffic generation would increase to a maximum of 400 light vehicle trips and up to 106 heavy vehicle trips per day inclusive of 10 OSOM vehicle trips.
- During peak construction activities, all affected roads on the road network would maintain satisfactory levels of service and adequately absorb construction-generated traffic.
- It is proposed that during peak traffic generation activities such as concrete pours and for OSOM vehicles to be used for wind farm component delivery, escort vehicles and appropriate traffic management would be adopted to ensure safe passage from the public road network onto the Project Site.

- Traffic generation during operations would be minimal resulting in a maximum of up to 40 trips per day. Consequently, traffic and road network impacts would be negligible during the operational phase.
- Along the OSOM transport routes, where vehicles may require the use of the full carriageway width, traffic management would be required in the form of temporary, short-term, full road closures (‘rolling’ road closures as vehicles pass critical locations) aided by escort vehicles.
- It is recommended that passing bays, in the form of wider carriageway areas, be provided intermittently along the Twelve Mile Road transport route between Goolma Road and the site access point.
- During Project construction, the increased traffic generation and in particular, the higher turning movements at the Goolma Road / Twelve Mile Road intersection may warrant auxiliary and/or protected (channelised) turn lane intersection treatments.
- A TMP would be prepared in conjunction with the transport contractor and relevant road authorities and all aspects would be implemented in co-ordination with the local Council and NSW RMS.
- The use of licensed and experienced contractors for transporting wind farm components would ensure a minimisation of transport impacts. They would arrange required OSOM vehicle permits, carry out a detailed transport route assessment and confirm the requirement for any road / bridge infrastructure upgrades.
- Traffic generation during decommissioning would be similar to the moderate (average) traffic generation scenario that would apply for the great majority of the construction period. Traffic and road network impacts are anticipated to be minimal with only marginal changes from existing conditions. A comprehensive TMP would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities to ensure adequate road safety and road network operations are maintained.
- While there are a number of nearby major projects that may result in cumulative impacts, once the construction dates / timetables are finalised for the Uungula Wind Farm Project, the cumulative impact of the above projects (and potentially other future projects) would need to be considered with respect to transport and traffic operations.

In conclusion, it is considered that with appropriate road network upgrades and suitable construction traffic management, the proposed Uungula Wind Farm Project would not create any significant adverse impacts with respect to transport issues such as traffic operations, road capacity on the surrounding road network, site access and road safety. The management of heavy vehicle movements during construction would be appropriately covered by a TMP to be prepared prior to construction starts, while the use of a specialised and licensed transport contractor would ensure that the transport of OSOM WTG components would be carried out in an appropriate manner.

Appendix A

Proposed Wind Farm Layout



LEGEND

- Dwellings
- Existing Unsealed Road
- Existing Sealed Road
- Wind Turbine Generator (97)
- Project Site
- Development Corridor
- Wind farm access tracks
- Site Compound
- Substation
- Energy Storage Facility

Existing Powerlines:

- 132kV
- 330kV

Proposed Powerlines:

- Underground (medium to low voltage)
- Overhead (medium to low voltage)
- Overhead (high voltage)

SCALE BAR

0 5 km

COMPANY

UUNGULA WIND FARM PTY LTD

cwp Renewables

TITLE

Project Layout

DATE	SCALE	DWG NO	REV	VER
18/02/20	1:64000	UWF-049	A	1
DRAWN BY	**CHECKED BY**	**SHEET**	**JOB NO**	**SIZE**
J PETERSEN	M FLOWER	1 OF 1	110247	A3