APPENDIX 14

Crudine Ridge Wind Farm Traffic and Transport Study

Samsa Consulting Pty Ltd

Crudine Ridge Wind Farm Project

Transport Assessment

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1. Introduction

1.1 Project Background

Wind Prospect CWP Pty Ltd is a partnership between the Wind Prospect Group (WP) and Continental Wind Partners and is a locally based wind farm development company with an office in Newcastle, NSW. Wind Prospect CWP Pty Ltd propose to develop a wind farm on rural land near Pyramul, New South Wales, midway between Mudgee and Bathurst. The proposed development is known as the Crudine Ridge Wind Farm and would accommodate up to 106 wind turbines, with an installed capacity of approximately 165 megawatts (MW) of energy.

The Project site is located across two Local Government Areas (LGAs): Bathurst Regional Council and Mid Western Regional Council. The Project site spans an approximate 16 km length across Crudine Ridge on which the wind turbines, transmission lines and ancillary structures are proposed to be located – refer to *Appendix A: Proposed Wind Farm Layout*.

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 assessment (EA).

1.2 Director General's & Other Authority Requirements

Planning NSW's Director General's Requirements (DGRs) require the traffic and transport assessment to assess the construction and operational traffic impacts of the project including:

- Details of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation;
- Assess the potential traffic impacts of the project on road network function (including intersection level of service) and road safety;
- Assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over-dimensional vehicles) during construction and operation, including full details of any required upgrades to roads, bridges, site access provisions (for safe access to the public road network) or other road features;
- Details of measures to mitigate and/or manage potential impacts;
- Details of access roads within the site including how these would connect to the existing public road network (ie. site access) and ongoing operational maintenance requirements for on-site roads; and
- Consideration of relevant Council traffic / road policies.

In addition to the above DGRs, NSW Roads & Maritime Services (RMS) requires the traffic and transport assessment to include the following:

- Preparation of a Traffic Management Plan (TMP) to address management of additional traffic during construction (and decommissioning) and site access issues;
- Hours and days for construction and operation;
- Unloading and loading of transport and service vehicles, particularly over-size vehicles;
- On-site internal road network layout, parking facilities and infrastructure;
- Details of local climatic conditions that may affect road safety; and
- Any cumulative impacts from other proposed and approved developments in the surrounding area.

1.3 Assessment Scope & Methodology

The scope of the assessment included the following tasks:

- Review of project background information.
- Project discussions with Wind Prospect CWP project team.
- Discussions with relevant Councils and RMS.
- Site visits to the wind farm sites and surrounding road network, including preferred transportation routes.
- Spot traffic counts were undertaken at various locations to confirm counts obtained from RMS and Council sources.
- Traffic generation during construction and operational 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 as part of the Project's Environmental Assessment (EA).

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 Details

2.1 Project Description

The Crudine Ridge Wind Farm project consists of up to 106 wind turbines with a rated capacity between 1.5 MW to 3.4 MW each. The wind turbines would be three bladed, multi-pitch, horizontal axis machines, with a maximum height of approximately 160 m, ie. from the base of the tower to blade tip when the blade is in the vertical position.

Turbines would be chiefly located on the higher altitude ridges within the site boundary, where they would be well spaced and positioned with a high regard for landscape amenity, existing land use, ecological conservation, and cultural heritage values, and in accordance with relevant legislation – refer to site diagram in *Appendix A: Proposed Wind Farm Layout*.

The subject wind farm would also consist of ancillary structures and equipment, which would be positioned in accordance with site constraints. These would typically include:

- Access roads (internal site road network) connecting the public road network to the wind turbine locations and substations.
- Overhead and underground electrical cabling.
- Main and secondary collector substations.
- Underground electrical interconnection lines and control cables within each of the wind turbine clusters, connecting to the main and secondary collector substations.
- Internal overhead electrical interconnection lines and control cables between the main and secondary collector substations.
- Switching station.
- External overhead electrical interconnection lines (up to 132 kV single or double circuit) and associated communications cables between the main collector substation and the switching station;
- Permanent storage compounds.
- Up to six permanent wind monitoring masts.
- Concrete batching plants and rock crushing compounds.
- Cleared areas to store construction materials and wind turbine components (construction laydown areas).
- Construction site offices and site parking.
- Appropriate wind farm signage both during the construction and operational phases of the proposed development.
- Crane hardstand areas for the erection, assembly, commissioning, maintenance, recommissioning and decommissioning of the wind turbines.

The wind farm would connect to the TransGrid 132 kV overhead transmission line 15 km east of the Crudine ridgeline with the switching station compound to be located adjacent to the point of connection.

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 monitored remotely, with

maintenance staff undertaking regular services in line with the selected wind turbine.

The life span of a wind farm is usually 20 to 25 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.

2.2 Equipment Features

The model of wind turbine that will be used for the Project has not yet been resolved as final turbine selection will occur through a competitive tender process pending Development Consent. However, in terms of generation capacity, the wind turbines currently available in the market place that are under consideration for this Project vary in the range from 1.5 MW to 3.4 MW. By way of example the Suzlon S88, 2.1 MW machine (as installed at the Capital Wind Farm, east of Lake George, NSW) is typical of the type of wind turbine that could be used.

Consideration will also be given to the use of different turbine sizes and manufacturers across the site to better utilise the on-site wind resource profile. Under this circumstance, turbine dimensions would still fall within the permissible turbine sizes considered in the Environmental Assessment (EA).

The wind turbine components generally comprise a nacelle and gearbox assembly, hub, blades (three no.) and tower in three to five sections. Transport of blades would be typically undertaken one at a time with a length of up to 63 m. 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 five sections, depending on heights chosen.

The larger dimension wind turbine 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 wind turbine components.

2.2.1 Turbine Rotor

Potentially, the turbines to be used for the Project will be three-bladed, semi-variable speed, pitch-regulated machines with rotor diameters between 74 m and 126 m and a swept area ranging from of 4,300 m^2 to 12,470 m^2. Typically turbines of this magnitude begin to generate energy at wind speeds in the order of 3.5 m/s (12.6 km/h) and shut down (for safety reasons) in wind speeds greater than 25 m/s (90 km/h).

Wind turbine blades are typically made from glass fibre reinforced with epoxy or plastic attached to a steel hub, and include lightning rods for the entire length of the blade. The blades typically rotate at about 12 rpm at low wind speeds and up to 18 rpm at higher wind speeds.

2.2.2 Towers

The supporting structures are comprised of a reducing cylindrical steel tower fitted with an internal ladder or lift. The largest tower height under consideration is 101.5 m with an approximate diameter at the base of 4.5 m narrowing to 2.5 m at the top. However it is

important to note that the rotor diameter suitable for this wind turbine is 101 m and therefore falls within the maximum proposed blade tip height of 160 m. Similarly, the longest blade length under consideration is 63 m, however it is important to note that the tower height suitable for this wind turbine is 94 m and therefore also falls within the maximum proposed blade tip height of 160 m. Alternative tower heights of between 80 and 100 m are also under consideration, however this is not exhaustive since new models and certified designs are continually entering the market place. The tower will typically be manufactured and transported to site in three to five sections for on-site assembly.

2.2.3 Blade Tip

The blade tip will comprise the highest point of the wind turbine when in a vertical position. Given the turbines under consideration, a blade tip height of 160 m is considered to be the maximum. As new turbine models are regularly appearing on the market, blade tip height may vary by up to 5 m to accommodate potential changes to tower heights and blade lengths of new machines.

2.2.4 Nacelle

The nacelle is the housing constructed of steel and fibreglass that is mounted on top of the tower and can be 10 m long x 4 m high x 4 m wide. It encloses the gearbox, generator, transformers (model dependant), motors, brakes, electronic components, wiring and hydraulic and lubricating oil systems. Weather monitoring equipment located on top of the nacelle will provide data on wind speed and direction for the automatic operation of the wind turbine.

2.2.5 Footings

Three types of foundation for the wind turbines will be considered pending geotechnical investigation of the ground conditions at the Project site.

Slab (gravity) foundations would involve the excavation of approximately 450 cubic metres (m^3) of ground material to a depth of approximately 2.5 m. Approximately 200 m^3 would, if suitable, be used as backfill around the turbine base. Remaining excavation material will be used for the on-site road infrastructure, where necessary. A slab foundation would involve installation of shuttering and steel reinforcement, followed by the pouring of concrete.

If slab plus rock anchor foundations are required, the construction of the foundation for each machine would involve the excavation of approximately 300 m^3 of ground material to a depth of approximately 2.5 m. Slab plus rock anchor foundations require shuttering and steel reinforcement, drilling of rock anchor piles up to a depth of approximately 20 m, concrete pour, after which the rock anchors are stressed and secured once the concrete has cured sufficiently.

Alternatively, if a single mono-pile foundation is required (rock anchor), approximately 50 m^3 of ground material would be removed by a rock drill to a depth of approximately 10 m, of which 30 m^3 would, if suitable, be used as back fill. If a mono-pile foundation is used, a tubular section with tower connection flange attached is inserted in the hole and concrete is then poured in-situ.

Detailed geotechnical surveys will be carried out during pre-construction work to determine the necessary foundation type per wind turbine. It is feasible that more than one type of foundation may be required for the Project, following the assessment of the individual wind turbine locations. New wind turbines are continually coming on to the market and it is

possible that minor variations to these typical dimensions could occur prior to final wind turbine selection. This impact assessment assumes the use of slab foundations, which allows for the largest (worst-case) footprint and most concrete use for all turbines.

2.2.6 Crane Hardstand and Assembly Areas

Site access roads would have areas of hardstand (approximately 30 m by 50 m) adjacent to each wind turbine for use during component assembly and by cranes during installation. The clearing of native vegetation for the construction of access roads and hardstand areas will be avoided where possible.

The roads would be surfaced with local stone material to required load-bearing specifications. The nature and colour of surface stone would be selected to minimise visual impact prior to construction. The roads and hardstand areas would be maintained throughout the operational life of the Project and used principally for the periodic maintenance of the wind turbines.

2.2.7 Monitoring Masts

There are currently two temporary wind monitoring masts installed on the subject site; one 60 m mast located in the Pyramul Cluster and one 100 m mast located in the Sallys Flat Cluster, recording wind data for Project development and planning.

Up to six permanent wind monitoring masts, up to 100 m high, are proposed to be installed on-site. Locations for these masts are yet to be determined and will be influenced by the final wind turbine selection, but may include the locations of the existing temporary monitoring masts. These permanent masts will provide information for the performance monitoring of the wind turbines. The wind monitoring masts would be of a guyed, narrow lattice or tubular steel design.

Permanent met masts will require low voltage cable connection for power and also a communications cable to be laid. The trench required for this will be much smaller than for the cables between turbines. The connection would come directly from the closest turbine.

2.2.8 Main Collector Substation

The main collector substation will include up to two transformers with capacities ranging between 80 megavolt ampere (MVA) or alternatively a single 180 MVA transformer to step-up the voltage to 132 kV, together with ancillary equipment.

The main collector substation will occupy an area approximately 150 m by 150 m and will be surrounded by a 3 m high security fence. It will include an array of busbars, circuit breakers, isolators, various voltage and current transformers and a static compensator-capacitor as agreed with TransGrid.

Transportation of the transformers, which are typically 90 tonnes each, would be by road and would involve the direct loading onto a platform trailer.

2.2.9 Secondary Collector Substation

The secondary collector substation would consist of up to three medium voltage transformers stepping up to 132 kV to minimise on site reticulation losses alongside other ancillary electrical assets such as transformer hardstands, environmental bunding, circuit breakers, busbars, voltage control and communication equipment.

The secondary collector substation will occupy an area approximately 25 m by 25 m and

will be surrounded by a 3 m high security fence.

Transportation of the transformers, which are typically 90 tonnes each, would be by road and would involve the direct loading onto a platform trailer.

2.2.10 Switching Station

The switching station will occupy an area approximately 75 m by 100 m and will be surrounded by a 3 m high security fence. The ground surface within the enclosure will be covered partly with a layer of crushed rock and partly by concrete slabs. The 0.75 ha area includes a provision for a 15 m buffer of land surrounding the equipment required by TransGrid.

The switching station will most likely require a communications tower, which is expected to be up to 20 m in height depending on geographic conditions.

Construction access would be via Bombandi Road which is currently unsealed, although the section of Bombandi Road between Castlereagh Highway and the proposed switching station would be upgraded with an all weather access road. Within the proposed switching station compound, an all weather access driveway incorporating provision for car parking would be constructed.

2.2.11 Overhead and Underground Cabling

The electrical cables from the wind turbine sites will comprise a mix of underground and overground cabling and will connect either directly to the main collector sub-station or via the secondary collector substation.

The underground cable routes will generally be between the turbines and follow the route of the internal access roads. The final route will minimise vegetation clearing and avoid potential erosion and heritage sites, and will also depend on the ease of excavation, ground stability and cost.

Control cables will interconnect the wind turbine generators and the operation facilities building. Computerised controls within each wind turbine will automatically control start-up, speed of rotation and cut-out at high wind speeds and during faults. Recording systems will monitor wind conditions and energy output at each of the turbines. Remote monitoring and control of the Project will also be employed. Control cables will consist of optic fibre, twisted pair or multi-core cable and will be located underground within the groups of turbines.

The installation of buried earthing conductors and electrodes will also be required in the vicinity of the turbines, the facilities building and the sub-stations as required.

A single or double circuit internal overhead transmission line of voltage up to 132 kV may be constructed for connection between the secondary collector substation and the main collector substation or via the secondary collector substation to minimise internal reticulation losses. The 132 kV overhead transmission line will be up to 30 m in height comprising of two cross arms with insulators with an average span length of 250 m. Above-ground control cables would also be strung from the poles of the internal overhead line located between the secondary collector substation and the main collector substation.

A single or double circuit 132 kV external transmission line will be constructed between the main collector substation and switching station for energy export into the grid. The 132 kV overhead transmission line will be up to 30 m in height comprising of two cross arms with insulators with an average span length of 250 m.

3. Existing Conditions

3.1 Transport Mode

The assessment of transportation of wind turbine 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 Crudine Ridge wind farm 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 Crudine Ridge wind farm site.

The port of entry for imported wind turbine equipment and/or the location of manufacturing sites has not yet been resolved / confirmed. 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 wind turbine and sub-station transformer components.

Rail Transport

Rail as a transport option is potentially possible via the Country Rail Infrastructure Authority (CRIA) rail network that runs to Kandos. This could be accessed from the eastern seaboard via the RailCorp rail network. 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 en-route structures 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 wind turbine components from the rail hub to site, requiring road transport in any case. The extent of transportation handling is such that it is not considered feasible to use rail transport.

Therefore, road transport is the only feasible option for transporting the larger wind turbine 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 road routes to Mudgee and Bathurst (being the main centres in close proximity to the proposed wind farm site) are primarily by either National Routes or State Highways and, subject to statutory permit conditions, can accommodate the proposed wind turbine components generating over-mass and over-dimension vehicles.

A NSW Roads & Maritime Services (RMS) permit may be obtained for road access for over-mass and over-dimension vehicles along the major road network (National Routes or State Highways) from areas of component manufacture or import to the Mudgee and Bathurst areas. The nominated transport contractor would be responsible for obtaining all necessary

transport permits, arranging escort services and any other 3rd party services as required by applicable regulations.

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

Air Transport

Due to the over-size 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 previously for wind farm projects in difficult to access locations.

Air transport is considered to be the most direct and efficient transport mode, often with a significant reduction in impacts to the community. However, air transport is costly and wind farm components may not necessarily be designed for aerial transport, loading and unloading.

In this case, while air transport has been considered as a transport option, it is unlikely to be practicable with respect to the economically feasible for this Project.

3.2 Road Transport Routes

3.2.1 Major Road Network Route Options

Road transport routes are required to access two site entry locations (described in detail in *Section 3.2.6* below):

- Southern access off the northern side of Hill End Road approximately 4.9 km west of Turondale Road
- Northern access off the southern side of Aarons Pass Road approximately 2.5 km east of Pyramul Road.

In addition to the above two major site access locations, there would be minor and limited construction access required to the switching station site (off Castlereagh Highway via Bombandi Road) and the external transmission line route (potentially off Crudine Road via the transmission line easement).

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

- East and north-east – via Golden Highway and Castlereagh Highway (while the Ulan Road-Cassilis Road route between Golden Highway and Mudgee is viable and shorter than the Castlereagh Highway route, it necessitates travel through Mudgee town centre – constraints discussed in sections below)
- North and north-west – via Newell Highway and/or Castlereagh Highway
- West – via Golden Highway and Castlereagh Highway
- South-west and south – via Newell Highway, Golden Highway and Castlereagh Highway. Potential alternative route is via Mid Western Highway and Great Western Highway (Bathurst)
- East and south-east – via Great Western Highway (Bathurst)

The above major road network provides transport routes to Mudgee in the north (for access to the northern site entry location) and Bathurst in the south (for access to the southern site entry location): refer to *Figure 3.1* below. The major road network provides a relatively high standard of road infrastructure, generally suitable for transport by heavy and over-dimension 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.

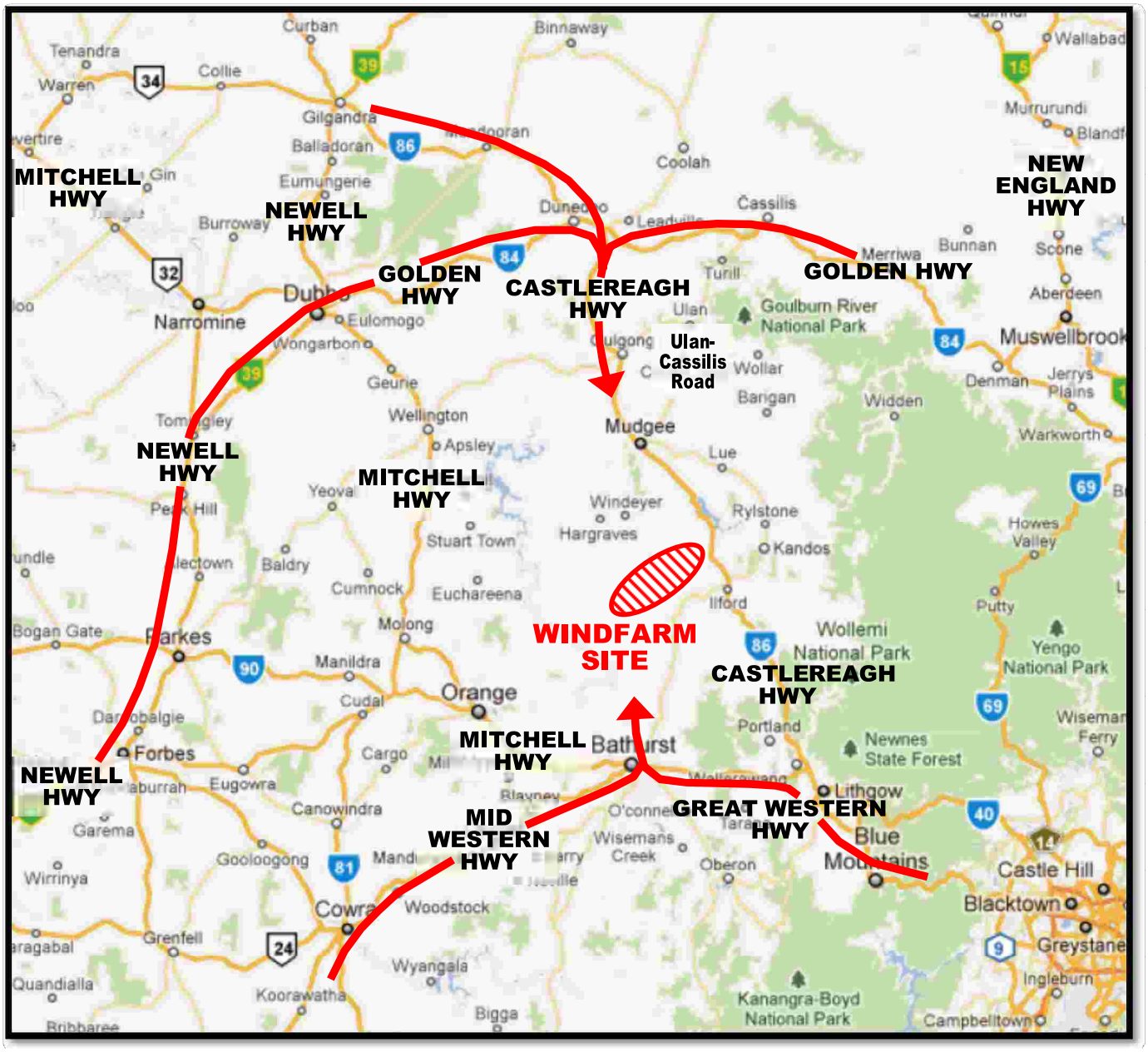


Figure 3.1: Regional Major Road Network & Transport Routes

3.2.2 Northern Access Route Options

There are a number of options for road transport of components to the northern site entry location via the Mudgee area. These include the following:

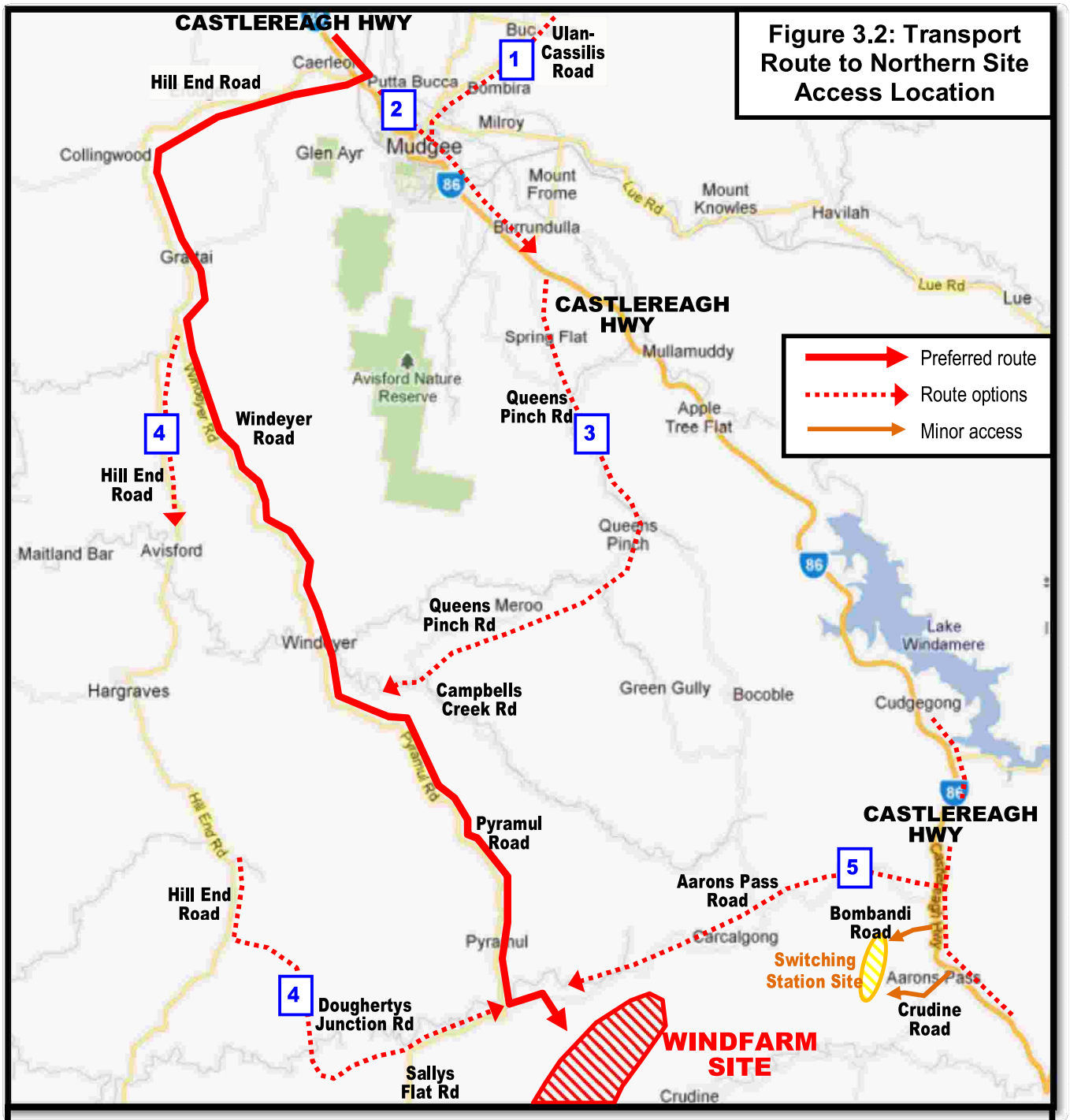
- Golden Highway to Mudgee via Ulan Road-Cassilis Road

- Castlereagh Highway to Pyramul Road and Aarons Pass Road via Queens Pinch Road and Campbells Creek Road
- Hill End Road to Pyramul Road and Aarons Pass Road via Doughertys Junction Road
- Castlereagh Highway to Aarons Pass Road (also relevant travelling from the south via Lithgow or Bathurst)
- Hill End Road to Pyramul Road and Aarons Pass Road via Windeyer Road

Due to various road network and land use constraints, the preferred road transport route is Castlereagh Highway, right-turn west into Hill End Road, left-turn east into Windeyer Road, through to Pyramul Road and left-turn east into Aarons Pass Road. The road network and land use constraints of the alternative routes are as follows:

- Golden Highway to Mudgee via Ulan Road-Cassilis Road – this route, which is of a relatively high standard and suitable for over-size vehicle transport, is shorter for travel from the east (Golden Highway) but necessitates travel through Mudgee town centre. The town centre area has 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 to Pyramul Road and Aarons Pass Road via Queens Pinch Road and Campbells Creek Road – the Castlereagh Highway route through Mudgee would result in significant disruption to the town centre due to numerous obstructions and higher traffic activity. The Queens Pinch Road / Campbells Creek Road connection between Castlereagh Highway and Pyramul Road is unsuitable due to numerous sections of tight horizontal alignment along steep grades over the central range area, which would restrict the transport of long and oversize loads without significant realignment upgrades. While the carriageway width is generally adequate, there are sections of unpaved road in relatively poor condition. The route also has several causeways and two narrow (less than 4 m), single-lane bridges requiring 'give way' from one direction.
- Hill End Road to Pyramul Road and Aarons Pass Road via Doughertys Junction Road – the Doughertys Junction Road connection between Hill End Road and Aarons Pass Road (via Sallys Flat Road) is unsuitable due to a combination of sections of tight horizontal and vertical alignment, narrow carriageway width and poor pavement conditions, which would restrict the transport of long and oversize loads without significant roadworks. Roadside trees would also result in numerous obstructions for movement of large vehicles.
- Castlereagh Highway to Aarons Pass Road – the Aarons Pass Road connection to site access west of Castlereagh Highway is unsuitable due to an unsealed carriageway of generally poor quality, numerous sections of tight horizontal and vertical alignment, and several causeways. These would restrict the transport of long and oversize loads without significant roadworks. This route's limitations prevent direct access from the east for travel north and south off Castlereagh Highway.

Refer to *Figure 3.2* below showing the preferred transport route assessed in detail, other route options considered and the minor access route required to the switching station site and the external transmission line route.



1. Ulan-Cassilis Road route is shorter from east (Golden Highway) but necessitates travel through Mudgee town centre resulting in disruptions and significant obstructions.
2. Castlereagh Highway route through Mudgee results in significant disruption and obstructions through the town centre. Moreover, there is no suitable access west from the highway, south of Mudgee.
3. Queens Pinch Road / Campbells Creek Road connection between Castlereagh Highway and Pyramul Road is unsuitable due to sections of tight alignment along steep grades.
4. Doughertys Junction Road connection between Hill End Road and Aarons Pass Road (via Sallys Flat Road) is unsuitable due to sections of tight alignment, narrow carriageway width and poor pavement conditions.
5. Aarons Pass Road connection to site access west of Castlereagh Highway is unsuitable due to sections of tight horizontal and vertical alignment, and poor pavement conditions. This prevents access north and south along Castlereagh Highway.

3.2.3 *Assessment of Preferred Northern Access Route*

Major Road Network

Castlereagh Highway

Castlereagh Highway is a State Highway (SH86), forming an arterial route from Great Western Highway (west of Lithgow) in the south to Gilgandra in the north. With respect to the Mudgee area, it provides a north-south link between the east-west Golden Highway and Mudgee.

Approaching Mudgee, Castlereagh Highway is generally a two-lane, undivided road with varying shoulder widths and formations. The pavement condition is generally average to 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 sharper curves requiring lower advisory speeds within the background 100 km/h speed zone. The road environment and alignment are generally conducive to over-size vehicle transport. Any over-size vehicle issues would be covered under the RMS permit system for over-size transportation along the major road network.

Traffic volumes along Castlereagh Highway north of Mudgee in 2005 varied from approximately 3,700 vehicles per day (vpd), north of Hill End Road, to almost 5,000 vpd, approaching the Mudgee urban area[1]. From site observations and spot counts along Castlereagh Highway, it is estimated that daily traffic volumes are currently of the same order as those recorded in 2005.

Rural Roads

Hill End Road

Hill End Road (MR216) is a regional road connecting the town of Hill End to Castlereagh Highway in the north and Sofala in the east.

Hill End Road varies in condition and standard along its length. For the majority of its length between Castlereagh Highway and Windeyer Road, it is generally some 6 to 7 m wide incorporating two travel lanes. There are some narrower sections formed due to overhanging roadside tree foliage. Centreline marking is generally provided and pavement conditions are generally average to good.

The general road environment can be described as flat to gently rolling terrain with some sharper curves requiring lower advisory speeds within the background 100 km/h speed zone.

Traffic volumes along Hill End Road, north of Grattai, were approximately 1,200 vpd in 2009[2]. From site observations and spot counts, it has been estimated that current daily traffic volumes are likely to be approximately the same as those recorded in 2009. There is a school bus route that runs along Hill End Road in this section.

The following road characteristics are noted along the Hill End Road route, which would need to be considered by the transport contractor:

1 Traffic volume data from 2005 provided by Mid Western Regional Council
2 Traffic volume data from 2009 provided by Mid Western Regional Council

- The right-turn from Castlereagh Highway into Hill End Road is tight and would require some intersection upgrade widening works and adjustments to the central median and signposting on the Hill End Road leg to provide adequate swept path for longer vehicles.
- Approximately 5.3 km west of Castlereagh Highway, a bridge will need to be confirmed for loading adequacy.
- Approximately 2.5 km north of the Windeyer Road turn-off, there is a narrow, single-lane bridge requiring 'give way' from the south. Bridge carriageway width is only some 4.0 m and bridge loading adequacy will need to be confirmed.
- Approximately 350 m north of the Windeyer Road turn-off, a bridge will need to be confirmed for loading adequacy.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Windeyer Road / Pyramul Road

Windeyer Road and Pyramul Road are unclassified local roads. Windeyer Road starts at Hill End Road in the north, continues to Windeyer village, where it then becomes known as Pyramul Road. Pyramul Road continues south to terminate at a junction with Aarons Pass Road and Sallys Flat Road. The length of this portion of the route is almost 34 km.

In general, the Windeyer Road / Pyramul Road route has relatively consistent conditions and standards along its length even though there are sections of sealed and unsealed pavement. Carriageway width varies from approximately 5 m to 6 m with little or no linemarking. The pavement conditions generally appear to be relatively stable in both sealed and unsealed sections.

The general alignment is gently undulating to rolling with some smaller radius curves. There are a number of minor sags due to causeways, which may require road upgrades to accommodate over-size and heavy transport.

Traffic volumes range from approximately 230 vpd along the northern Windeyer Road end (albeit in 1992) to less than 100 vpd along the southern Pyramul Road end in 2004[3]. Site observations and spot counts indicate that these traffic volume levels are still current. This is further confirmed by the 'closed' arrangement of the local road network with its minimal local traffic generators.

The following road characteristics are noted along the Windeyer Road / Pyramul Road route, which would need to be considered by the transport contractor:

- The left-turn from Hill End Road into Windeyer Road is tight and would require some intersection upgrade widening works to provide adequate swept path for longer vehicles.
- Approximately 1.3 km south of the Hill End Road turn-off, a bridge will need to be confirmed for loading adequacy.
- Approximately 2.9 km south of Hill End Road, a sharp right curve may require upgrade works, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised

3 Traffic volume data from August 2004 provided by Mid Western Regional Council and 1992 from RMS counting station 99.461

- Approximately 3.6 km south of Hill End Road, the carriageway narrows across a small bridge, which will need to be confirmed for loading adequacy.
- Approximately 5.7 km south of Hill End Road, a sharp right curve within a slight crest alignment may require upgrade works, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 8.1 km south of Hill End Road, there is a narrow, single-lane bridge requiring 'give way' from the south. Bridge carriageway width is less than 4.0 m and bridge loading adequacy will need to be confirmed.
- Approximately 9.3 km south of Hill End Road, a sharp left curve may require upgrade works, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 9.6 km south of Hill End Road, there is a narrow, single-lane bridge requiring 'give way' from the south. Bridge carriageway width is less than 4.0 m and bridge loading adequacy will need to be confirmed.
- From approximately 13.4 km south of Hill End Road, a series of sharp right and left curves may require upgrade works, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 15.3 km south of Hill End Road, the Meroo Creek Bridge will need to be confirmed for loading adequacy.
- School speed zone exists through Windeyer village from approximately 15.7 km to 16.2 km south of Hill End Road.
- Approximately 17.0 km south of Hill End Road, there is a slight sag alignment across a causeway.
- Approximately 19.2 km south of Hill End Road, the carriageway narrows across a small bridge, which will need to be confirmed for loading adequacy.
- Approximately 19.8 km south of Hill End Road, a sharp left curve would require carriageway width upgrades and some clearance of trees / vegetation on the inside of the curve to allow adequate swept path for transport by longer vehicles.
- From approximately 20.3 km to 20.7 km south of Hill End Road, a series of sharp curves on grade are likely to require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- From approximately 22.9 km to 26.1 km south of Hill End Road, the carriageway is unsealed.
- Approximately 23.1 km south of Hill End Road, there is a slight sag alignment across a narrowed causeway.
- Approximately 24.1 km south of Hill End Road, there is a sharp left curve within a sag alignment across a narrowed causeway that would require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- Approximately 24.3 km south of Hill End Road, a sharp right curve may require upgrade for transport by longer vehicles, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- Approximately 26.1 km south of Hill End Road, the carriageway is sealed.
- Approximately 26.2 km south of Hill End Road, a small bridge will need to be confirmed for loading adequacy.

- From approximately 27.2 km to 28.4 km south of Hill End Road, the carriageway is unsealed.
- Approximately 27.8 km south of Hill End Road, there is a slight sag alignment across a causeway.
- Approximately 28.0 km south of Hill End Road, there is a slight sag alignment across a narrowed causeway within a left curve, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- Approximately 28.4 km south of Hill End Road, the carriageway is sealed.
- Approximately 28.7 km south of Hill End Road, a sharp right curve within a crest alignment, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles
- From approximately 29.6 km to 31.2 km south of Hill End Road, the carriageway is unsealed.
- Approximately 30.3 km south of Hill End Road, there is a slight sag alignment across a narrowed causeway, which may require upgrade for transport by over-size vehicles, depending on vehicle ground clearance.
- Through the Pyramul village area, overhanging roadside tree foliage narrows the travel width.
- Approximately 33.5 km south of Hill End Road (approximately 400 m north of Aarons Pass Road / Sallys Flat Road), there is a narrow, single-lane bridge with a carriageway width less than 4.0 m. Bridge loading adequacy will need to be confirmed.
- The left-turn from Pyramul Road into Aarons Pass Road is tight and would require some intersection upgrade widening works to provide adequate swept path for longer vehicles.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Aarons Pass Road

Aarons Pass Road is an unclassified local road between the Pyramul Road / Sallys Flat Road junction in the west to Castlereagh Highway in the east. The length of Aarons Pass Road proposed to be used for transport is only approximately 2.5 km at its western end.

At the western end along the proposed transport route to the northern site access location, Aarons Pass Road has relatively consistent conditions and standards of unsealed pavement, which is of average to poor quality. Carriageway width varies from approximately 5 m to 6 m.

There are a number of trees that may require foliage trimming to allow higher loads through. Furthermore, stock move across the road from adjacent rural properties.

The general alignment is flat to gently undulating with some larger radius curves. There are a number of minor sag alignments due to causeways, which may require road upgrades to accommodate over-size and heavy transport (see below).

Traffic volumes were approximately 23 vpd, east of Pyramul Road in 2004[4]. Site observations and spot counts indicate that these very low traffic volume levels are still

4 Traffic volume data from May 2004 provided by Mid Western Regional Council

current. This is further confirmed by the 'closed' arrangement of the local road network with its minimal local traffic generators.

The following road characteristics are noted along Aarons Pass Road, which would need to be considered by the transport contractor:

- Approximately 0.5 km east of Pyramul Road, there is a sag alignment across a causeway, which may require upgrade for transport by longer vehicles depending on the vehicle ground clearance.
- Approximately 1.1 km east of Pyramul Road, there is a sag alignment across a causeway, which may require upgrade for transport by longer vehicles depending on the vehicle ground clearance.
- Approximately 1.9 km east of Pyramul Road, there is a sag alignment across a causeway, which may require upgrade for transport by longer vehicles depending on the vehicle ground clearance.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Bombandi Road / Crudine Road (Minor Access Routes)

Both Bombandi Road and Crudine Road are unclassified local roads running west off Castlereagh Highway. Only the eastern sections of each road are proposed to be used for minor and limited transport to the switching station site (Bombandi Road) and the external transmission line route (Crudine Road).

Crudine Road at its eastern end is sealed with average pavement conditions and a carriageway width of approximately 5 m to 6 m. For travel further west / south, Crudine Road conditions deteriorate somewhat with unsealed surfaces, narrower carriageway widths and poor horizontal and vertical alignment.

Bombandi Road is sealed for a length of only some 60 m from its junction with Castlereagh Highway after which it becomes a relatively narrow unsealed road of approximately 4 m to 5 m width.

At Castlereagh Highway, both roads form 'Give Way' controlled T-junctions. The Crudine Road junction has a protected right-turn bay off Castlereagh Highway. Adequate sight distance along Castlereagh Highway is available at both junctions.

Although traffic volumes were not available for either road, site observations and spot counts indicate very low traffic volume levels less than 100 vpd. This is reinforced by the 'closed' arrangement of the local road network with its minimal local traffic generators and the condition of both roads along other sections (narrow, unsealed, poor alignment).

It is understood that the currently unsealed section of Bombandi Road required for minor access, would be upgraded with an all weather access road.

3.2.4 Southern Access Route Options

There are a number of options for road transport of components to the southern site entry location via the Bathurst or Lithgow areas. These include the following:

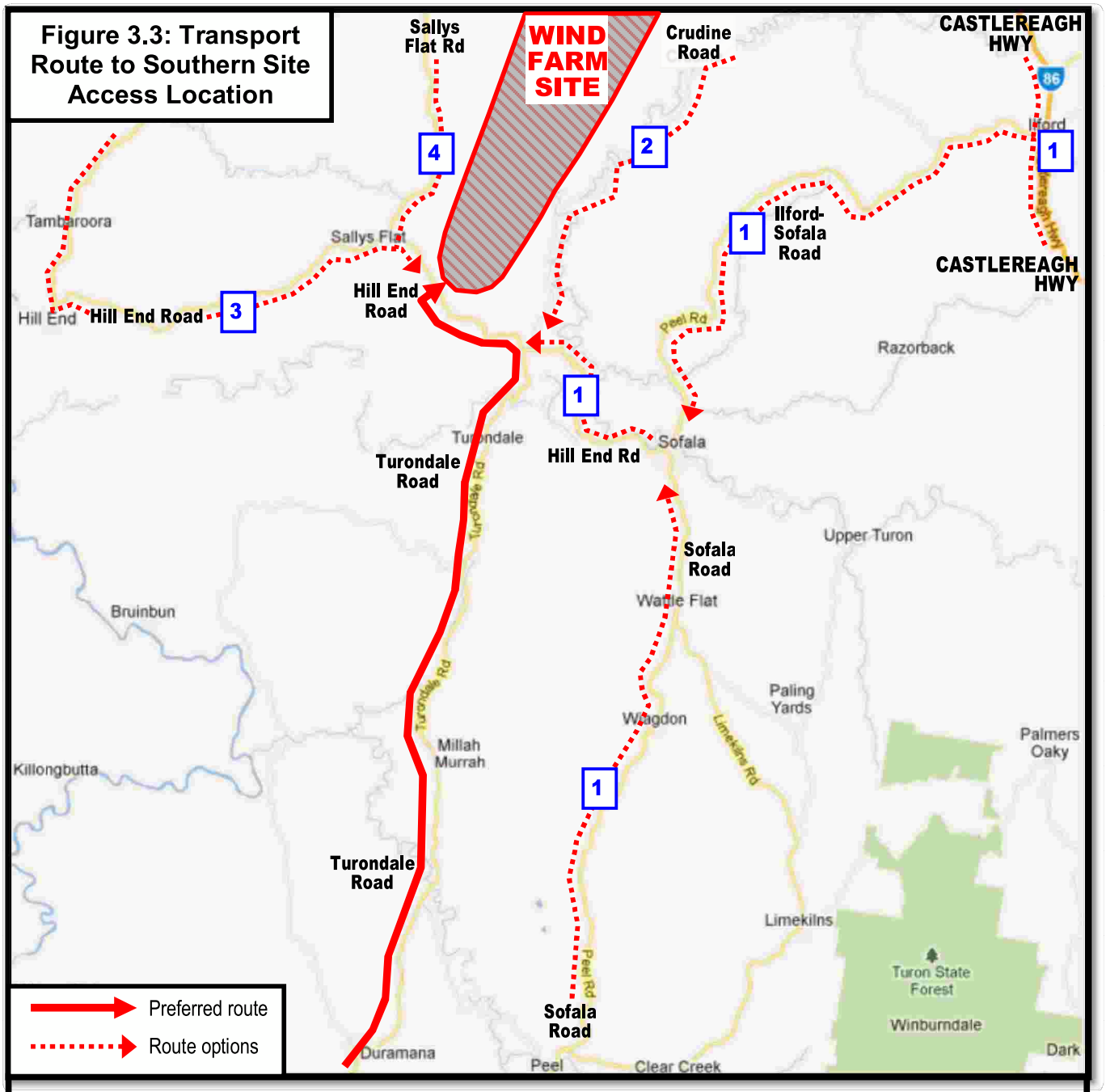
- Castlereagh Highway to Hill End Road via Sofala-Ilford Road
- Castlereagh Highway to Hill End Road via Crudine Road

- Great Western Highway to Hill End Road via Gilmour Street (Bathurst) and Sofala Road
- Hill End Road route (from north and west) via Hill End township
- Sallys Flat Road connection to southern site access from northern site access (Pyramul Road / Aarons Pass Road)
- Great Western Highway to Hill End Road via Gilmour Street (Bathurst), Eleven Mile Drive, Wellington Street, Duramana Road and Turondale Road

Due to various road network constraints, the preferred road transport route that was assessed in detail is Great Western Highway, right-turn north into Gilmour Street (Bathurst), left-turn west into Eleven Mile Drive, continue into Wellington Street, right-turn north into Duramana Road, through to Turondale Road and left-turn west into Hill End Road. The road network constraints of the alternative routes are as follows:

- Castlereagh Highway to Hill End Road via Sofala-Ilford Road – the eastern section of Hill End Road (east of Turondale Road / Crudine Road) is largely unsuitable due to sections of tight horizontal alignment, narrow carriageway widths and poor pavement conditions (rutting and potholes), particularly along the westernmost section for a length of some 3 km, which is unsealed. Although some road upgrade works have been recently undertaken along the eastern section including sealing of carriageway and minor realignment upgrades, significant road upgrade works would be required for the westernmost section. The above limitations precludes any transport from the east from Sofala via Sofala Road (from Bathurst), and from Castlereagh Highway (travelling south from Mudgee and north from Lithgow) via Ilford-Sofala Road.
- Great Western Highway to Hill End Road via Gilmour Street (Bathurst) and Sofala Road – as per the above description, Hill End Road, east of Turondale Road / Crudine Road, prevents access west from Sofala without significant roadworks. Therefore, the Sofala Road route north from Bathurst is not feasible.
- Castlereagh Highway to Hill End Road via Crudine Road – the Crudine Road connection between Castlereagh Highway and Hill End Road is unsuitable due to several sections of tight horizontal and vertical alignment, numerous causeways and poor unsealed pavement conditions.
- Hill End Road route (from north and west) via Hill End township – travel from the north (Mudgee) via the Hill End Road route requires travel through the Hill End township area. This route is not preferred due to its length from the north (almost 90 km from Castlereagh Highway turn-off north of Mudgee), and narrow carriageway widths and a very tight corner within the township area.
- Sallys Flat Road connection to southern site access from northern site access (Pyramul Road / Aarons Pass Road) – the Sallys Flat Road connection to southern site access from Pyramul Road / Aarons Pass Road is unsuitable due to numerous sections of tight horizontal alignment, several causeways and narrow carriageway widths, and poor, unsealed pavement conditions.

Refer to *Figures 3.3* and *3.4* below showing the preferred transport route that was assessed in detail and other route options considered.



1 ▪ Eastern section of Hill End Road (east of Turondale Road) is unsuitable due to sections of tight horizontal alignment, narrow carriageway widths and poor pavement conditions. This precludes any transport from the east via Sofala Road (from Bathurst), and Castlereagh Highway (travelling south from Mudgee and north from Lithgow) via Ilford-Sofala Road.

2 ▪ Crudine Road connection between Castlereagh Highway and Hill End Road is unsuitable due to sections of tight horizontal and vertical alignment, numerous causeways and poor pavement conditions.

3 ▪ Hill End Road route (from north and west) via Hill End township is not preferred due to its length from the north, and narrow carriageway widths and a very tight corner within the township.

4 ▪ Sallys Flat Road connection to southern site access from northern site access (Pyramul Road / Aarons Pass Road) is unsuitable due to sections of tight horizontal alignment, narrow carriageway widths and poor pavement conditions.

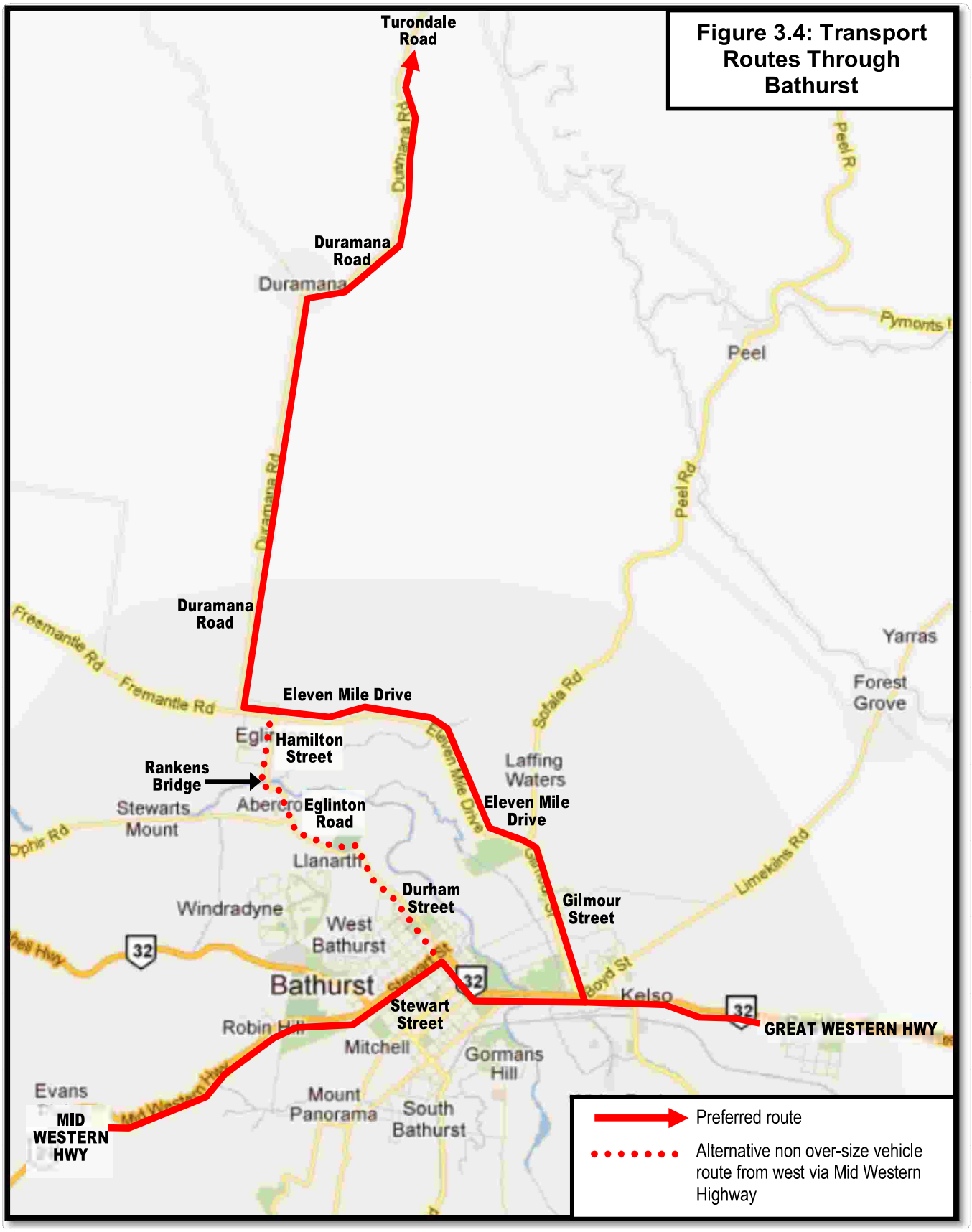


Figure 3.4: Transport Routes Through Bathurst
Turondale Road
Duramana Road
Duramana
Duramana Road
Duramana Road
Peel
Pymonts
Peel Rd
Freemantle Rd
Fremantle Rd
Eleven Mile Drive
Hamilton Street
Rankens Bridge
Eglinton Road
Stewarts Mount
Abercrombie
Laffing Waters
Eleven Mile Drive
Sofala Rd
Yarras
Forest Grove
Limekilns Rd
Ophir Rd
Llanarth
Durham Street
Windradyne
West Bathurst
Gilmour Street
Bell Hwy
32
Bathurst
Stewart Street
Boyd St
Kelso
GREAT WESTERN HWY
Robin Hill
Mitchell
Gormans Hill
Evans
Mount Panorama
South Bathurst
MID WESTERN HWY
Preferred route
Alternative non over-size vehicle route from west via Mid Western Highway

3.2.5 Assessment of Preferred Southern Access Route

Major Road Network

Great Western Highway

Great Western Highway is a State Highway (SH32), forming part of National Route A32 from the Sydney metropolitan area in the east to Bathurst and beyond in the west. With respect to the Bathurst area, it provides a link east to Lithgow, Blue Mountains and beyond to Sydney, while to the west it connects to Orange, Dubbo and beyond.

Approaching Bathurst, Great Western Highway is generally a two-lane, undivided road with available overtaking lanes. 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. Within the Bathurst urban area, the highway becomes a four-lane road incorporating two travel lanes in each direction separated by a central median.

The general road environment for the highway approach to Bathurst can be described as rolling terrain with some sharper curves requiring lower advisory speeds within the background 100 km/h speed zone. The road environment and alignment are generally conducive to over-size vehicle transport. Any over-size vehicle issues would be covered under the RMS permit system for over-size transportation along the major road network.

Traffic volumes along Great Western Highway in 2010 at Raglan Creek, Bathurst were almost 23,000 vpd[5].

Mid Western Highway

Mid Western Highway is part of National Route A24, travelling west from Bathurst to Sturt Highway (A20) at Hay in western NSW. Relevantly, it provides a south-western connection into Bathurst from the Cowra area and its surrounding major road network.

Approaching Bathurst, Mid Western Highway is generally a two-lane, undivided road with varying shoulder widths and formations and available overtaking lanes. The pavement condition is generally average to good, commensurate with its National Route status and its suitability as a route for larger heavy vehicles, eg. B-doubles.

The general road environment can be described as rolling terrain with some sharper curves requiring lower advisory speeds within the background 100 km/h speed zone. The road environment and alignment are generally conducive to over-size vehicle transport. Any over-size vehicle issues would be covered under the RMS permit system for over-size transportation along the major road network.

Traffic volumes along Mid Western Highway on the western outskirts of Bathurst in 2005 were approximately 3,700 vpd[6]. From site observations and spot counts along Mid Western Highway, it is estimated that daily traffic volumes are currently of the same order as those recorded in 2005.

5 Traffic volume data from 2010 provided by Bathurst Regional Council
6 RMS counting station no.99.847

Bathurst Urban Area

Gilmour Street / Eleven Mile Drive (Wellington Street)

On approaching Bathurst, the transportation route ideally needs to be diverted around the town's central urban area due to greater vehicular and pedestrian traffic, road furniture, street alignments and traffic controls (eg. central medians, roundabouts). From the east, the Gilmour Street / Eleven Mile Drive (Wellington Street) route was preferred to most directly gain access to Duramana Road and have the least constraints and impacts.

Gilmour Street is an extension of the Sofala Road route south to Great Western Highway. It intersects Great Western Highway at a signalised T-junction. Great Western Highway is a divided four-lane road with right and left-turn bays into Gilmour Street. Gilmour Street is a typical two-lane urban collector road north of Great Western Highway with dual turn lanes on its approach to the T-junction.

Gilmour Street is largely residential along its length to Eleven Mile Drive, a distance of almost 3 km. It has a background 60 km/h speed limit with a 40 km/h school speed zone immediately north of the highway junction.

Eleven Mile Drive travels west from Gilmour Street and becomes known as Wellington Street, west of the Hamilton Street roundabout (approximately 5.7 km west of Gilmour Street). Eleven Mile Drive serves to connect Eglinton to the eastern side of Bathurst. It has a single travel lane in either direction and connects to Gilmour Street at a 'Give Way' controlled T-junction.

Eleven Mile Drive has a mix of recreational (racecourse at eastern end), semi-rural (centre) and residential (western end) land uses along its length to Duramana Road, a distance of approximately 6.3 km. It has a mix of speed limits: 60 km/h at its eastern end, 80 km/h through the centre and 50 km/h at its western end.

In 2006, traffic volumes along Gilmour Street were approximately 5,200 vpd near the highway junction, along Eleven Mile Drive were approximately 1,500 vpd and along Wellington Street (western end of Eleven Mile Drive) were approximately 2,200 vpd[7]. It is assumed that current traffic volumes have remained at similar levels to those in 2006.

The following road characteristics are noted along the Gilmour Street / Eleven Mile Drive route, which would need to be considered by the transport contractor:

- The right-turn from Great Western Highway into Gilmour Street would require utilisation of adjacent through lanes and adjustment works to the Gilmour Street central median and signposting.
- If arriving from the west (Mid Western Highway route), the left-turn into Gilmour Street would require significant intersection upgrade works to allow adequate swept path area for longer vehicles. This would include relocation of signposting, street lighting, traffic signals and other road furniture.
- A 40 km/h school speed zone for approximately the first 500 m of Gilmour Street north of Great Western Highway.
- Approximately 1.5 km north of Great Western Highway, the Hereford Street roundabout has a tight through alignment, which may require adjustment works to allow over-size vehicle transport.

7 Traffic volume data from 2006 provided by Bathurst Regional Council

- For the left-turn from Gilmour Street into Eleven Mile Drive, the intersection layout area, particularly a central median in Eleven Mile Drive, would restrict the available swept path of longer over-size vehicles. As well as needing to use the full carriageway widths of adjacent contra lanes, adjustment works to the central median and signposting would be required to allow over-size vehicles to turn left.
- Approximately 700 m west of Gilmour Street, there is a relatively tight right curve, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 2.9 km west of Gilmour Street, there is a bridge / culvert, which will need to be confirmed for loading adequacy.
- Approximately 5.7 km west of Gilmour Street, the Hamilton Street roundabout has a tight through alignment, which may require adjustment works to allow over-size vehicle transport.
- Approximately 6.2 km west of Gilmour Street, immediately east of Alexander Street, there is a central pedestrian refuge that reduces the travel lane width of the carriageway, which may require adjustment to allow over-size vehicle transport.
- At the Eleven Mile Drive (Wellington Street) / Duramana Road T-junction, intersection carriageway width upgrades are likely to be required to allow adequate swept path for the right-turn north by longer vehicles. The full road carriageway width would also be required to achieve adequate swept path area.
- Overhead obstructions in the urban area such as power lines, traffic signals, etc. appear to be adequate, although these would need to be confirmed depending on the heights of the transportation to be used.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Durham Street / Eglinton Road / Hamilton Street

On approaching Bathurst from the west via Mid Western Highway, the transportation route needs to travel via Stewart Street (Great Western Highway), skirting the town's central business district. The Durham Street / Eglinton Road / Hamilton Street route through to Eleven Mile Drive (Wellington Street) has a number of constraints for over-size vehicle transport including the left-turn into Durham Street from Stewart Street, the sharp right curve on the approach to Rankens Bridge (25 km/h advisory speed) and the left-turn from Hamilton Street into Eleven Mile Drive (Wellington Street). Therefore, this route is only suitable for regular heavy vehicles, ie. up to semi-trailer sized trucks. The potential over-size vehicle route would turn right at Durham Street (Great Western Highway) and then travel along the highway before turning left into Gilmour Street, after which it would follow the Gilmour Street / Eleven Mile Drive route (described above).

Durham Street intersects with Stewart Street (Great Western Highway) at a signalised T-junction. Great Western Highway is a typical two-lane urban collector road north of the T-junction with dual lanes on its approach to the T-junction.

Durham Street is largely residential along its length to Eglinton Drive up to approximately Esrom Street. Eglinton Drive continues in a semi-rural and residential environment to Rankens Bridge and then across to Hamilton Street, which is again residential. There is a 60 km/h speed limit along the subject route.

Traffic volumes along the route range from approximately 10,500 vpd along Durham Street (2011), approximately 4,600 vpd along Eglinton Road (2005) and approximately 2,300 vpd along Hamilton Street (1999)[8].

The following road characteristics are noted along the Durham Street / Eglinton Road / Hamilton Street route, which would need to be considered by the transport contractor:

- The left-turn from Great Western Highway into Durham Street is problematic for over-length vehicles due to the intersection layout area.
- For the right-turn into Durham Street, significant intersection upgrade works would be required to allow adequate swept path area for longer vehicles. This would include relocation of signposting, traffic signals, other road furniture and possibly street lighting.
- While there are significant constraints for over-size vehicle transport along this route, which make it problematic, standard heavy vehicles would be able to use the route as per existing operations.
- As mentioned previously, the left-turn into Gilmour Street would require major intersection upgrade works to allow adequate swept path area for longer vehicles. This would include relocation of signposting, street lighting, traffic signals and other road furniture. It is considered that the extent of upgrade works and the potential disruption to the urban area make it very problematic for over-size vehicle transport.
- Overhead obstructions in the urban area such as power lines, traffic signals, etc. appear to be adequate, although these would need to be confirmed depending on the heights of the transportation to be used.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Rural Roads

Duramana Road / Turondale Road

Duramana Road and Turondale Road are unclassified local roads. Duramana Road starts at Eleven Mile Drive (Wellington Street) in the south, continues through Duramana, after which it becomes known as Turondale Road. Turondale Road continues north to terminate at a junction with Hill End Road. The length of this portion of the route is approximately 41 km.

In general, the Duramana Road / Turondale Road route has relatively consistent conditions and standards along its length apart from a short section in the Eglinton urban area at the southern end (wider road with kerb and gutter) and a section at the northern end at the Coles Bridge across Turon River (tight curves and steep grades). Along the rural sections of the route, carriageway width varies from approximately 5 m to 7 m incorporating two travel lanes with periodic lengths of centreline linemarking. The pavement conditions are generally good with stable sealed carriageway edges, although there is infrequent patching and rutting resulting in an average pavement.

The general alignment is gently undulating and straight until Duranama and then becomes more undulating with some smaller radius curves to the north.

Traffic volumes range from approximately 550 vpd (2001) at the southern end of the route

8 Traffic volume data from 2011, 2005 and 1999 provided by Bathurst Regional Council

before Duranama to approximately 150 vpd (2009) at the northern end of the route[9]. Site observations and spot counts indicate that these traffic volume levels are still of the same order, particularly the older recorded counts at the southern end of the route. There is a school bus route that runs along Duramana Road / Turondale Road.

The following road characteristics are noted along the Duramana Road / Turondale Road route, which would need to be considered by the transport contractor:

- Approximately 3.1 km north of Eleven Mile Drive (Wellington Street), there is a relatively sharp crest alignment, which may impede transport of over-length loads depending on vehicle ground clearance.
- Approximately 7.2 km north of Eleven Mile Drive, the carriageway narrows across a small bridge / culvert, which will need to be confirmed for loading adequacy.
- Approximately 7.4 km north of Eleven Mile Drive, there is a tight right curve with a 35 km/h advisory speed, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 15.6 km north of Eleven Mile Drive, the Harold Cranston Bridge across Winburndale Rivulet will need to be confirmed for loading adequacy.
- Approximately 16.5 km north of Eleven Mile Drive, the bridge across Cheshire Creek will need to be confirmed for loading adequacy.
- Approximately 17.5 km to 17.8 km north of Eleven Mile Drive, there is a series of tight curves followed by a crest, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- Approximately 22.6 km north of Eleven Mile Drive, the carriageway narrows across a small bridge over Millah Murrah Creek, which will need to be confirmed for loading adequacy.
- Approximately 23.3 km to 23.6 km north of Eleven Mile Drive, there is a series of tight curves, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 25.7 km north of Eleven Mile Drive, there is a small wooden deck bridge, which will need to be confirmed for loading adequacy.
- Approximately 26.8 km north of Eleven Mile Drive, the carriageway narrows across a small bridge / culvert, which will need to be confirmed for loading adequacy.
- Approximately 29.9 km to 30.3 km north of Eleven Mile Drive, there is a series of tight curves, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 30.6 km north of Eleven Mile Drive, there is a tight reverse curve, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised adjacent to the safety barrier.
- Approximately 36.3 km north of Eleven Mile Drive, there is a series of tight curves and a sag alignment, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles. The sag alignment would need to be confirmed for adequacy so that it does not impede transport of over-length loads depending on vehicle ground clearance.

9 Traffic volume data from 2001 and 2009 (respectively) provided by Mid Western Regional Council

- Approximately 37.8 km to 38.3 km north of Eleven Mile Drive, there is a steep downgrade into a series of very tight, hairpin curves on the approach and departure from the Coles Bridge over Turon River, which is less than 4.0 m wide. This section of the route would require significant upgrade works to the road alignment for transport by longer vehicles including bridge approach works and possibly bridge strengthening works, depending on the bridge's loading adequacy.
- Approximately 39.3 km north of Eleven Mile Drive, there are two tight left curves, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- Approximately 39.9 km north of Eleven Mile Drive, there is a tight reverse curve within a crest alignment, which may require carriageway width upgrades to allow adequate swept path for transport by longer vehicles.
- At the Turondale Road / Hill End Road T-junction, intersection carriageway width upgrades may be required to allow adequate swept path for the left-turn west by longer vehicles.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

Hill End Road

Hill End Road (MR216) is a regional road connecting the town of Hill End to Castlereagh Highway in the north and Sofala in the east.

The relevant section of Hill End Road for the southern access route is generally some 6 to 7 m wide with no linemarking. There are some narrower sections formed due to alignment constraints and recently installed safety barriers. Pavement conditions are generally good.

The general road environment can be described as hilly terrain with some sharper curves requiring lower advisory speeds within the background 100 km/h speed zone.

Traffic volumes along this section of Hill End Road are unknown, although less than 100 vpd were recorded in 2005 west of Sofala[10]. From site observations and spot counts, it has been estimated that current daily traffic volumes along the subject section of Hill End Road are likely to be approximately the same as those recorded in 2005.

The following road characteristics are noted along the Hill End Road route, which would need to be considered by the transport contractor:

- Approximately 2.0 km west of Turondale Road, there is a tight right curve, although there appears to be adequate swept path width for longer vehicles if the full carriageway is utilised.
- Approximately 2.4 km west of Turondale Road, there is a tight left curve, which is likely to require upgrade works (benching on inside of curve) to allow adequate swept path for transport by longer vehicles.
- Approximately 2.9 km to 3.3 km west of Turondale Road, there is a series of tight curves with a narrowed carriageway width due to safety barriers. This road section is likely to require upgrade works (benching on inside of curves) to allow adequate swept paths for transport by longer vehicles.

10 RMS counting station 99.342 (2005)

- Approximately 3.7 km west of Turondale Road, the carriageway narrows slightly adjacent to safety barriers.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along over-size transport routes.

3.3 Wind Farm Site Access Locations

There are proposed to be two major site access points serving all the wind turbine locations and the majority of the other ancillary facilities – refer to *Figures 3.2* and *3.3* above and *Appendix A: Proposed Wind Farm Layout*. An internal site road network would allow access across the entire wind farm site, providing the flexibility of external transportation to either of the site access locations.

The two major site accesses are proposed to be located as follows:

- Northern site access off the southern side of Aarons Pass Road approximately 2.5 km east of Pyramul Road.
- Southern site access of the northern (eastern) side of Hill End Road approximately 4.9 km west of Turondale Road.

In addition to the above two major site access locations, there would be minor and limited construction access required to the switching station site (off Castlereagh Highway via Bombandi Road) and the external transmission line route (potentially off Crudine Road via the transmission line easement).

With respect to each major site access, the following pertinent issues have been identified.

Northern site access

- There is a slight crest on the western approach to the proposed site access location, which partially restricts sight distance towards light vehicles (cars) to approximately 150 m. Larger (taller) vehicles would be able to be sighted over 200 m away. While this restriction in sight distance is less than what would normally be required for a paved road with a 100 km/h speed limit, it is not considered to be critical for the following reasons:
  - Construction traffic movements would be right-turn in and left-turn out, thus should have minimal affect on traffic to the west;
  - The road at this location is unsealed and traffic speeds are likely to be well below 100 km/h due to pavement conditions and the general road environment; and
  - Traffic volumes are very low (< 100 vpd) and consist predominantly of local rural traffic familiar with the conditions and likely to be familiar with the proposed wind farm construction activities.

Southern site access

- There is an uphill grade and crest on the western (northern) approach to the proposed site access location, which restricts sight distance to less than 120 m. For the eastern (southern) approach, sight distance is also restricted to approximately 150 m although it is not as severe due to the gentler crest alignment. These restrictions in sight distance are less than the minimum 225 m required for a paved road with a 100 km/h speed limit.