

Final
TRAFFIC AND TRANSPORT IMPACT STUDY



PROPOSED SILVERTON WIND FARM
Barrier Ranges, West of Broken Hill

Prepared for Silverton Wind Farm Developments

March 2008

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EXECUTIVE SUMMARY

Silverton Wind Farm Developments (SWFD) is proposing to construct a wind-generating facility of up to 500 turbines and associated infrastructure in western NSW. The proposal site is located approximately five kilometres north of Silverton and would occupy a section of the Barrier Ranges extending for approximately 30 kilometres. The site is located approximately 25 kilometres west of Broken Hill

The turbine site and the majority of the associated transmission line infrastructure are located within the unincorporated area of western NSW, administered by the NSW Department of Lands. The land is held under lease by three separate lessees.

The roads in the unincorporated areas can be considered to be in three groups as described below.

1. Classified roads maintained by the Roads and Traffic Authority (RTA): These roads are generally sealed and in good condition. Classified roads include Silverton Road (M.R. 81), Silver City Highway (S.H. 22) and Barrier Highway (S.H. 8).
2. Unclassified roads maintained by the Roads and Traffic Authority (RTA): These roads are generally unsealed roads in public use and include the road through Eldee Station, Daydream Mine Road, Part of Purnamoota Rd and Stephens Creek Road.
3. Property access roads, which are the responsibility of the lessee.

The Traffic and Transport Impact Study considers the general impact of increased traffic including heavy and oversized vehicles on the public road network from Broken Hill to the wind farm site north of Silverton and does not include property access roads.

The report focuses on the key issues associated with an increase in traffic primarily during the construction phase of the proposal which is likely to generate the maximum traffic impact. General safeguards are proposed as well as site-specific measures on particular routes.

Traffic safety is dependent on many variables including driver behaviour and weather conditions. The report examines the physical constraints which may have an impact on traffic safety as observed on an inspection of the roads undertaken in November 2007.

The size of the current wind farm proposal would likely result in the need for access at several locations, one for the majority of the southern section via the Silverton Route and another for the northern section via the Purnamoota Route. These routes would not share any common roads from Broken Hill. Additional access points will be required from the western route through Silverton towards Eldee Station.

Once operational, the wind farm would be managed and operated by several crews of technicians based at Broken Hill. The sites would be accessed regularly for operational and maintenance activities. It is estimated that the operational phase will generate up to 24 trips per day on each route.

Calculations indicate that the maximum daily rate of traffic at any point in the project's road network during the construction phase would likely be in the order of 250 vehicles per day. The maximum vehicles per day figure is added to the existing traffic volumes for the estimation of road capacity and the report shows that all the roads involved have sufficient capacity to accommodate the increased volumes.

Potential impacts of traffic on the sealed roads are expected to be minimal, however road closure on the gravel roads due to damage by heavy vehicles can have a major economic impact on the residents and property owners. The gravel road surfaces will likely deteriorate and potholes will form under the increased traffic loads particularly during wet weather when water ponds or floods

across the road. It is understood that the NSW Roads & Traffic Authority would close the unincorporated roads if traffic is likely to damage the gravel surface during rain periods.

Dust would be generated on the unsealed roads affecting visibility and resulting in the loss of pavement materials and structural damage may occur to some of the culverts, concrete causeway crossings and stock grids.

Road closure on the gravel roads due to damage by heavy vehicles can have a major economic impact on residents and property owners. Road damage which occurs during major agricultural activities such as sheep shearing can disrupt the management of rural properties. Transport of children to school and the purchase of supplies in Broken Hill are dependent on the condition of the road network.

The impacts of travel on the unsealed roads can be minimised by construction of an internal access road system, which will minimise length of travel on the unsealed public system.

Potential routes through Broken Hill could impact on local residents particularly during the passage of heavy vehicles along designated heavy vehicle routes towards Silverton, which do not normally carry large volumes of heavy vehicles. Increased noise and traffic delays could occur during the passage of heavy vehicle convoys. Any increase of traffic in school zones has the potential impact on pedestrian safety.

A number of intersections have inadequate pavement width to safely accommodate the turning manoeuvres of oversize vehicles. These impacts would only be temporary, as the equipment haulage is not a continuous program. It is understood that most of the heavy haulage will be in the form of convoys and would be managed through a number of specific mitigation measures developed and implemented in conjunction with both RTA and local Councils.

The area proposed for the Silverton Wind Farm is sparsely populated and the introduction of an additional 250 vehicles per day for approximately five years will likely have a significant impact on the existing road users adjacent to the site, particularly on the unsealed roads. The impacts on the road users and residents in and around Broken Hill on the sealed roads will be minimal

Safeguards for the impacts on the roads in general as well as safeguards at specific locations have been presented. Adoption of safeguards for minimising traffic impacts outlined in this study should reduce community disruption and the risk of traffic accidents to an acceptable level and minimise structural and environmental damage.

1 INTRODUCTION

1.1 Scope of this assessment

Bega Duo Designs was commissioned by **ngh**environmental to complete a Traffic and Transport Impact Study for inclusion in the Environmental Assessment of the proposed wind farm at Silverton. Silverton Wind Farm Developments (SWFD) is proposing to construct a wind-generating facility of up to 500 turbines and associated infrastructure in western NSW. This report conforms to the *Guide to Traffic Generating Developments* as recommended by the NSW Roads and Traffic Authority and provides a technical appraisal of the traffic and safety implications arising from the proposal. The report also develops measures and provides recommendations for the minimisation of traffic impacts during the construction and operation of the proposed wind farm.

This report focuses primarily on the construction phase of the project which is likely to generate the maximum traffic impact.

This report considers the general impact of all the heavy and oversized vehicles on the public road network and immediate surrounds. It does not include a detailed route assessment for the transportation of the over-mass and over-dimension turbine and transformer components along the routes from the major manufacturing centres and ports to Broken Hill. This assessment would be required to be produced by the haulage contractor prior to the commencement of the construction phase and approved by the appropriate road authorities. This report examines the various routes through Broken Hill which may be considered in the detailed route assessment. Broken Hill is linked to the State Highway network and the surrounding highways are approved for use by road trains.

It is proposed to construct the wind farm over a five-year period commencing in 2010 and planning has commenced for stage 1 at the southern end of the proposed development area. Stage 1 would involve the construction of 120 turbines.

This assessment examines the potential traffic impacts for the construction of up to 500 wind turbines over the whole of the proposed wind farm development area.

A draft constructability study (ARRUP 2008) has been completed which classified potential access routes within the wind farm according to gradient. The final location of the access roads on to the public road system has not been determined at this stage of the planning and therefore assumptions have been made regarding the most likely access points based on the ARRUP study, existing road condition, and cooperation with the relevant property managers. Changes to the locations of the access points should not significantly affect the conclusions of this report.

1.2 Proposal overview

The proposed development would occupy a section of the Barrier Ranges extending for approximately 30 kilometres north from Silverton. Silverton is approximately 25 kilometres west of Broken Hill (see plan in appendix A).

The entire wind farm proposal falls within the unincorporated area of western NSW and is administered by the NSW Department of Lands, Western Region. The land is held under lease by three separate lessees.

The roads in the unincorporated areas can be considered to be in three groups:

1/ Classified roads maintained by the Roads and Traffic Authority (RTA): These roads are generally sealed and in good condition. Classified roads include Silverton Road (M.R. 81), Silver City Highway (S.H. 22) and Barrier Highway (S.H. 8).

2/ Unclassified roads maintained by the Roads and Traffic Authority (RTA): These roads are generally unsealed roads in public use and include the road through Eldee Station, Daydream Mine Road, Part of Purnamoota Road and Stephens Creek Road.

3/ Property access roads, which are the responsibility of the lessee.

Broken Hill City Council administers the roads and road reserves within their local government area which includes part of the Purnamoota Road as far as the Living Desert Reserve. (Approximately ten kilometres west of Broken Hill)

Most of the roads in the unincorporated area do not have surveyed road reserves and the NSW Department of Lands has a program to formalise the reserves.

The proposed wind farm will require an overhead power line to connect to a substation in Broken Hill during stage 1 with a higher capacity line to be constructed to the south during stage 2 and 3.

The exact turbine locations have not been determined at this stage of the planning. The locations are not critical for the purposes of this report as all the towers are greater than five kilometres from any major roads and therefore driver distraction impacts are expected to be minimal.

1.3 Key issues and objectives

The issues outlined in Table 2.1 of the Roads and Traffic Authority's *Guide to Traffic Generating Developments* are included in the study. Additional issues have been included of the unique nature of the development. These include the structural condition of the existing road surfaces as observed at the site inspections.

Key issues

- Existing road hierarchy and proposals for improvement
- Impact on road safety
- Impact on traffic noise
- Traffic counts
- Traffic volumes and trends
- Traffic generation
- Safety and efficiency of internal roads
- Impact on intersections and surrounding developments
- Safety and efficiency of access routes (including capacity) between the site and adjacent road networks

1.4 Methodology

- Base project information was obtained from **ngh**environmental and SWFD
- Further information and feedback was received from key stakeholders at the 'Planning Focus Meeting' held at the site on 14 and 15 November 2007

- Existing mapping was used to identify features during the site inspection
- Planning documentation for other wind farm proposals was reviewed
- All roads were inspected, inventories prepared and photographs taken
- Approximate traffic count information was obtained from observations on the sites and RTA published data to establish the existing traffic volumes (vehicles per day)
- Road junction and intersections were inspected and photographed
- Discussions were held with representatives from **ngh**environmental, SWFD, Roads & Traffic Authority and Broken Hill City Council
- Methods of wind turbine construction and programming of the works was investigated to determine proposed vehicle trips

Note:

In accordance with the *Guide to Traffic Generating Developments*, a 'trip' is defined as a one-way vehicle movement from one point to another, excluding the return journey.

The general method of measuring traffic volume is 'vehicles per day'. This is the total of all trips made in either direction per day.

2 PROPOSED DEVELOPMENT

2.1 Site description

The site is typical of the Barrier Ranges with steep, low rocky ranges oriented to the bedrock structure in a generally north-easterly direction from Silverton. Fault scarps are evident and the eroded footslopes extend to outwash fans. The site is bordered on the west by the Mundi Mundi Plain and the Barrier Ranges extend towards Broken Hill in the east. The landform loses height and is less steep towards the east.

The vegetation is sparse consisting of mulga, dead finish and bluebush on the ridges. Denser shrubs including belah, whitewood, turpentine, prickly wattle, punty bush with bluebush grasses and forbs on the lower slopes. River Red gum, line the larger creeks.

Umberumberka Reservoir, which was the original water supply to Broken Hill and now a supplementary supply, is located at the southern end of the site.

Previous landuse has been mineral exploration and limited grazing.

2.2 Site access general

Existing access roads are shown in Appendix 1.

Access to the site would be via a number of access roads which will most likely be constructed along existing tracks within the leased properties. The commencement of these possible access tracks are shown on the plan. For the purposes of this study access on established roads up to the most likely access track locations were evaluated.

It is considered that the favoured access points will likely be from the eastern side of the Range where gradients are less and the distance to Broken Hill is reduced. The soils on the eastern side of the Range generally contain a higher percentage of coarse gravels and are therefore less likely

to be closed in wet weather. The adoption of access from the eastern side would likely reduce the number of vehicles travelling through the historic town of Silverton.

Access for the southern section would be via Main Road 81, (Silverton Route), which commences at the Barrier Highway in Broken Hill and gives access to the Eldee Station Road at Umberumberka Reservoir. There are several potential access points from the west along Eldee Station Road. Eldee Station Road connects with other routes providing access to other stations and ultimately Cameron Corner in the far north of NSW.

Daydream Mine Road junctions with Main Road 81, 20km west of Broken Hill. A potential access point, which has provided preliminary access for planning purposes, departs from the Daydream Mine Road at approximately 4km.

Access to the northern section would be via various routes within Purnamoota Station. Purnamoota Station has two alternatives for access from Broken Hill. The most direct route is via Nine Mile Road which adjoins Kaolin St in Broken Hill. Kaolin Street intersects the Barrier Highway. An alternative access via Stephens Creek Road, which junctions with the Silver City Highway 16km north of Broken Hill has also been identified. The Stephens Creek Road could become the preferred route for heavy and oversize vehicles.

Access through Broken Hill for road trains has resulted in routes being established which would result in minimum impacts on residents, road users and road structure. These routes should be adopted for heavy and oversize vehicles where possible. The routes are shown on the plan in Appendix A.

2.3 Future road proposals

The Roads and Traffic Authority and Broken Hill City Council have ongoing maintenance and improvement programs for the roads and bridges under their control.

There are no current proposals for road improvements on the access roads under consideration.

3 EXISTING TRAFFIC CONDITIONS

3.1 General

Traffic safety is dependent on many variables including driver behaviour and weather conditions. This section of the report examines the physical constraints which may have an impact on traffic safety as observed on an inspection of the roads undertaken in November 2007. This work included observations of traffic volumes.

The unsealed roads are closed by the Roads and Traffic Authority following rain periods. The rainfall is consistent throughout the year and planning in Broken Hill City Council is based on 32 rain days per year. The annual rainfall is approximately 250mm. The lengths of closure depend mostly on the quality of the road surface materials. Road condition information is readily available via telephone and roadside signage and is regularly updated.

3.2 Specific routes

Barrier Highway

The Barrier Highway provides access to Adelaide in the southwest and Wilcannia and Dubbo toward the east. The Barrier Highway crosses the Silver City Highway in Broken Hill and both routes share Iodide Street in Broken Hill. The highway is a sealed high-standard two-lane road with marked centreline and edge lines (see Plate 1, Appendix B).

There are four roundabouts on the route through Broken Hill (Plate 1 shows the roundabout at Galena Street). These roundabouts do not generally restrict the passage of oversize vehicles travelling straight through as mountable concrete aprons are provided around the central island to accommodate the wider turning paths. The access towards Silverton at the Galena Street roundabout, however, would require a left turn. This turn will be discussed further in the inventory of the Silverton Route.

Silver City Highway

The Silver City Highway is a sealed high-standard two-lane road with marked centreline and edge lines (Plate 3 shows the Silver City Highway at North Broken Hill). This Highway connects with Wentworth and Mildura in the south providing access to Melbourne and Sydney. The highway provides access to Tibooburra in the north. The junction with Stephens Creek Road is approximately 16km north of Broken Hill. Stephens Creek Road together with the Silver City Highway could provide a route for heavy vehicles from Broken Hill to Purnamoota Station and the northern section of the proposed wind farm.

There are four roundabouts on the Silver City Highway Route through Broken Hill. A right turn is required at the roundabout in Broken Hill South, however large vehicles would adopt the road train route along the Barrier Highway to avoid the centre of Broken Hill. (See plan in Appendix A).

Road train route

The road train route on the Barrier Highway from Wentworth is clearly signposted (Plate 5) and directs traffic through the industrial area along Kanandah Road, under the railway line (5.3m clearance) and on to a Junction at Creedon Street (Plate 6). Vehicles have the option of turning left to proceed to the Barrier Highway or turning right to travel through the City via Crystal Street. This route avoids two roundabouts and a railway overbridge at South Broken Hill. Vehicles are required to travel through the roundabout at Bromide Street in the City without making a right or left turn. There are two more turns to be negotiated to proceed along the Barrier or Silver City highways. These turns have been designed for road trains and are therefore suitable for most oversize vehicles.

Silverton and Eldee Station route

The distances quoted for this route are from the Barrier Highway. The distances shown on the plan in Appendix A are from the centre of Broken Hill (approximately 2.5km from the junction with Barrier Highway).

This route, which is Main Road 81, departs from the Barrier Highway at the Galena Street Roundabout (Plate 2). As discussed with the Barrier Highway route, the left turn into Brookfield Ave (Main Road 81 to Silverton) is at an acute angle. It is considered that this turn will provide difficulties for oversize vehicles due to the width available in the roundabout. Some signposts are located on the splitter islands on each roundabout approach which restrict the mounting of the islands by wide vehicles. A power pole and direction signs are located on the inside of the left turn (see Plate 20). Potential restrictions for oversize vehicles can be managed with adjustments to the layout of the junction, or the application of mitigation measures as discussed in Section 5.3.

The route west of the Barrier Highway through Broken Hill has a wide sealed pavement in good condition. The 50km/h speed restriction zone changes to 80km/h at 0.9km and 90km/h at 1.5km. The seal width is 7.0m or greater up to 3.7km. From 3.7km, the seal is approximately 6.0m minimum width with centreline marking and advisory speed signposting (Plate 8). The cross drainage is achieved by floodways at frequent intervals along the route which control the vertical alignment and vehicle speeds. The road is fenced on both sides up to 17.1km.

Daydream Mine Road junctions on the right at 17.15km (Plate 9). Additional seal width has been provided on the main road at the Junction. The road is generally unfenced for the remainder of this route. Silverton Creek Causeway is at 20.9km.

Silverton commences at approximately 22km from Barrier Highway (Plate 10) and the 50km/h speed restriction commences at 22.4km. The Black Hill Creek causeway is located at 22.9km. The road through the township has wide gravel shoulders (Plate 11). The 50km/h speed restriction zone ends at 23.9km/h. Stock grids cross the road at 28.1km and 33.0km.

A lookout (Mundi Mundi lookout), provides views across the Mundi Mundi Plain and back to the Barrier Ranges is located at 29.0km. The view to the west is presented in Plate 12. A large concrete culvert diverts a stream crossing at 33.3km. The right turn into Umberumberka Reservoir and the end of seal is at 34.0km from the Barrier Highway. This junction is also the termination of Main Road 81 and the commencement of UR4 which is also maintained by the Roads and Traffic Authority as an 'unclassified road'.

The gravel road from approximately 34km is approximately 8 metres wide with a graded surface consisting mostly of natural gravel and sands. There are no drainage structures and cross drainage flows across the road at depressions. Plates 15 and 16 at approximately 35.4km identify the typical conditions along this section of the route. Possible access routes depart from the road at 36.2km, 42.5km and at 45.5km. Plate 18 shows the possible access track at 45.5km

A stock grid 3.6m wide is located at 43.3km which marks the commencement of Eldee Station (Plate 17). Plate 19 shows a dip at a typical stream crossing. These streams are normally dry and road closures are frequent during wet weather.

The natural materials which compose the road surface on this section of the road consist of fine particles which produce dust and potentially reduce sight distance. This hazard usually increases with vehicle speed. Plate 19 demonstrates the dust generated by one vehicle travelling at approximately 100km/h. The road surface in many locations becomes slippery in wet weather and can be closed following relatively small rain events.

This route in general has excellent sight distance and light traffic (traffic volumes are described in Section 3.3). The major constraints are the layout of the roundabout at the Barrier Highway and the physical restrictions resulting from the gravel formation beyond Umberumberka Reservoir.

Daydream Mine Road

The road to Daydream Mine (unclassified road UR19) is maintained by the Roads and Traffic Authority as an unclassified road. This road departs from Silverton Road at approximately 20km from Broken Hill (Plate 21). The road has a gravel surface approximately 8.0m wide except for a short length of seal across the floodway at 2.45km. (See Plates 33 and 34). A fence and cattle grid cross the road at 2.7km and there is a junction with an existing a track to the left at 2.8km.

A track that has been used as access for preliminary planning of the wind farm is located on the left-hand side at 4.20km (Plate 35). This access is located slightly to the west of a crest and curve in Daydream Mine Road and sight distance towards Daydream Mine in the east is restricted. Plate 36 shows the curve looking back towards Silverton Road.

This road is considered to provide an adequate access route subject to the high maintenance required for the gravel surface if subject to high traffic volumes and the lack of site distance at the junction with the existing access track. Local information suggests that the road is closed due to wet weather for two to three days per year.

Nine Mile Road route to Purnamoota Station

This route to Purnamoota Station commences at the intersection of Kaolin Street and Barrier Highway. This roundabout is shown in plate 21. The left turn from Barrier Highway into Kaolin

Street West may be difficult to negotiate for oversize vehicles. Oversize vehicles may need to mount the splitter islands on the roundabout approaches. Similar to the Galena Street roundabout, warning signs are located on the islands (see Plate 22).

The route along Kaolin Street has a sealed surface in good condition at a minimum of 7.0m wide. A school zone from 0.6km to 0.8km contains a centre of road pedestrian refuge (Plate 23). The speed zone restriction increases to 100km/h at 1.55km and the curves are advisory speed posted. The pavement is provided with edge and centre lines (Plate 23).

The Sculpture Park access is at 6.3km and the Living Desert access is located at 7.5km. The seal ends at a stock grid at 8.2km which marks the boundary between Broken Hill City Council and the unincorporated area. This is also the commencement of Unincorporated Road 3. (See Plates 24 & 25)

The unsealed section of the road is approximately 7.0m wide (Plates 24 & 25 show the road in both directions). There is open stream crossing at 4.85km. The road continues to the junction with Stephens Creek Road on the right-hand side at 15.55km (Plate 26). The Unincorporated Road (UR3) classification follows Stephens Creek Road.

The road to Purnamoota narrows to approximately 6.0m at 15.6km (see Plate 27) and there is a stream crossing at 16.0km. The road passes under a power line at 17.4km. Plates 28 and 29 show the road conditions in both directions at 17.7km. There is a stream crossing at 18.9km and a grid 3.6m wide is located at the entry to Purnamoota Station at 19.0km.

Stephens Creek Road

This section of Unincorporated Road 3 links the Purnamoota Road route with the Silver City Highway. The distances shown in this section are measured from the Purnamoota end of the Road.

The road has a natural gravel surface and is approximately 8.0m wide with a relatively flat, straight alignment. There are stream crossings at 3.25km and 5.20km. There is a gate on the road at 3.55km and plates 30 and 31 show the road in both directions from the gate.

Stephens Creek Road meets with the Silver City Highway at 8.15km (Plate 32). The distance to Broken Hill from this junction is approximately 16km.

3.3 Existing traffic volumes

Traffic observations were made during morning and afternoon on 13 and 14 November 2007.

Volumes obtained from RTA counts are average, annual, daily traffic (AADT) counts and represent axle pairs. The AADT volumes were based on counts collected in 2005. To obtain a more accurate estimation an adjustment is required to allow for vehicles with more than two axles. For the purposes of this study the count of axle pairs is considered to be acceptable. The figures can be adjusted if required assuming that the peak hour represents 10% of the AADT volumes.

Table 3.1 AADTs for roads in the study area

Road	AADT	Information source
Barrier Highway 12.8km west of Broken Hill	999	AADT obtained from RTA records
Barrier Highway 32km east of SH22	819	AADT obtained from RTA records
Barrier Highway in Williams St west of Chloride St Broken Hill	9697	AADT obtained from RTA records
Silver City Highway 26km north of SH8	90	AADT obtained from RTA records
Silver City Highway 13km south of Eyre St	388	AADT obtained from RTA records
Main Rd 81 Silverton Rd 8km west of SH8	210	AADT obtained from RTA records
Nine Mile Rd (Purnamoota Rd route) at Sculpture Park	60	Adjusted from counts taken
Nine Mile Rd (Purnamoota Rd route) on gravel section	Less than 50	Adjusted from counts taken
Unincorporated Road 4 west of Umberumberka Reservoir	Less than 50	Adjusted from counts taken
Silver City Highway 26km north of SH8	90	AADT obtained from RTA records
Stephens Creek Rd	Less than 50	Adjusted from counts taken

* AADTs represent the total traffic volume in both directions.

4 FACTORS RELATING TO TRAFFIC GENERATION AND TRAFFIC IMPACT

4.1 Traffic generation

Operation

The size of the current proposal will result in the need for access at least two locations, one for the southern section via the Silverton route and another for the northern section via the Purnamoota route. These routes will not share any common roads from Broken Hill and as such it is assumed for the purpose of traffic generation that 250 turbines will be serviced from each route.

Once operational, the wind farm will be managed and operated by several crews of technicians, based at Broken Hill. The sites would be accessed regularly for operational and maintenance activities. It is estimated that the operational phase will generate up to 24 trips per day on each route.

Construction

The maximum traffic volume is expected to occur during the civil construction phase which includes the pouring of concrete for the foundations. Each footing may contain up to 310 cubic metres of concrete to be poured over an eight-hour period. This would result in a rate of up to 12 mixer truck trips per hour. It is envisaged that a concrete batching plant would be located on or near the construction site in which case the number of vehicles carrying raw materials would be less. For the purpose of predicting maximum probable traffic generation, concrete trucks will be included in the number of vehicles generated however it is unlikely that concrete trucks would travel from Broken Hill.

For the purpose of this assessment it is assumed that the traffic for the northern section will access the site via:

- a/ Nine Mile Road from Broken Hill to Purnamoota Station or
- b/ Silver City Highway and Stephens Creek Road to Purnamoota Station

For the purpose of this assessment it is assumed that the traffic for the southern section will access the site via:

- a/ Silverton Road (Brookfield Avenue, Horslington Drive) and Daydream Mine Road or
- b/ Silverton Road (Brookfield Avenue, Horslington Drive) to Umberumberka Reservoir and UR4 towards Eldee Station.

4.2 Construction program

The project is planned to be constructed over a five-year period. The following activities are expected to be undertaken with the exception of the substation and associated power lines which will be constructed in the southern portion of the site (Stage 1) only.

- o Civil works for upgrading access roads and establishment of site office
- o Civil works for the construction of internal tracks, excavation for footings and trenching for cables
- o Establishment and operation of a concrete batching plant and pouring of footings

- Transportation to site, erection and commissioning of wind turbines
- Construction of substation and associated power lines

4.3 Working hours

Normal construction industry working hours are assumed for the purposes of this report, as specified in the EPA Environmental Noise Control Manual (7am–6pm Mon–Fri, 7am or 8am–1pm Sat). EPA Guidelines would apply for noise emissions from construction works.

4.4 Assumed design traffic volumes

The traffic volumes contained within this section would be used to design traffic management devices, such as junctions, required for the proposal. They are also used to quantify the potential traffic impact, for example, on residents living adjacent to the haulage routes and possible damage to the road pavements.

The daily rate of traffic movements, rather than total number of movements, is the critical factor in determining the level of impact. The hourly rate is derived from Table 4.1, which estimates the predicted maximum number of one way traffic movements (trips) per day for the various construction activities.

For the purposes of predicting traffic on each route the following table is based on the construction of 250 wind turbines at both the northern and southern portions of the site.

Table 4.1 Predicted daily rates of traffic (trips) for one site

Activities	Approximate duration (months)	Maximum number of trips per day	Comments
Construction and management staff	60	<u>54</u>	Assuming approx. 3 employees per vehicle.
Site set up	2	10	
Road construction	18	30	
Foundation construction	33	<u>102</u>	Includes reinforcing steel delivery
Dust suppression	60	<u>4</u>	
Substation & power line construction	6	<u>26</u>	Includes up to 4 overmass vehicle deliveries
Internal cabling	20	6	
Turbines erection	25	<u>58</u>	Includes up to 1500 oversize and overmass vehicle deliveries

Information in the table is generally based around continuous pouring one footing in a day and erection of approximately 2.5 towers per week to complete the whole project.

The underlined trips could be concurrent at the southern site resulting in **244** trips per day

Or **218** trips per day at the northern site (not including the substation)

Table 4.1 indicates that the maximum daily rate of traffic at any point in the project's road network would likely be in the order of 250 vehicles per day. The maximum vehicles per day figure (250) is added to the existing traffic volumes for the estimation of road capacity (see Section 4.7).

The estimated hourly rate during the peak hour (based on 15% of the daily volume) is approximately 40 vehicles per hour. This figure would be used in the design of new junctions and is applicable when estimating the impacts on residents adjacent to the proposed routes.

4.5 Design for heavy vehicles

The standard design vehicle for the construction of intersections and design of parking and turning areas generally would be the Austroads Single Unit Truck/Bus, which is 12.2 metres long. However provision would be made on site for the turning of semi trailers and oversize vehicles.

There is a requirement to transport turbine blades to the site, which are up to 50 metres long. These would be transported on purpose designed steerable trailers making approximately 750 deliveries (all sites). These vehicles would be capable of negotiating relatively small radius curves provided areas free of obstructions are available on the inside of curves.

The transport of tower sections up to 25 metres long and weighing up to 50 tonnes will require a total of 2000 oversize vehicle deliveries. It is expected that the tower sections will be delivered at a rate of four deliveries per day. It is understood that the nacelles will require 500 over-mass (up to 75 tonnes) vehicle deliveries.

The blades, nacelles and tower hubs are expected to be delivered in convoys of up to 15 trucks at a rate of three convoys per month. This results in a total of 45 convoys commencing month six of construction works.

The design of access roads and junctions would need to allow for widths of up to 4.2 metres and weights complying with NSW Roads and Traffic Authority maximum loading.

4.6 Traffic circulation

Level areas would be required around each turbine for the safe operation of large cranes. These areas would also provide turning opportunities for delivery vehicles. No vehicles would reverse on to the public road network.

4.7 Road capacity (level of service)

Road capacity is normally described as 'level of service' and based on Austroads' *Guide to Traffic Engineering Practice, Part 2 Roadway Capacity*. Capacity is expressed in total vehicles per day. The level of service descriptions are presented in Table 4.2.

Table 4.2 Level of service (LOS) descriptions

LOS A :	Free flow condition, high degree of freedom for drivers to select desired speed and manoeuvre within 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. Restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS D :	Approaching unstable flow condition. Severely restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.
LOS E :	Condition close to capacity. Virtually no freedom for drivers to select desired speed and manoeuvre within traffic stream. Small increases in flow would generally cause operational problems.

Tables contained in Austroads' *Guide to Traffic Engineering Practice, Section 3.4 Roadway Capacity* have been used for the following determinations based on the traffic volumes shown in Section 3.3.

- Silverton Road route, at approximately 210 vehicles per day (vpd), operates at LOS A and would not reach LOS B until the volume reaches 1800 vpd. The estimated maximum design volume (see Section 4.4) is 460 vpd.
- Nine Mile Road, at approximately 60 vehicles per day, operates at LOS A and would not reach LOS B until the volume reaches 1800 vpd. The estimated maximum design volume (see Section 4.4) is 520 vpd.
- The impact of an additional 290 vehicles per day on the highways and heavy vehicle routes through Broken Hill is considered to be minor.
- All other roads with lower traffic volumes (less than 100vpd) would operate at LOS A and would not reach a lower level of service until the volume reaches approximately 700 vpd. The estimated maximum design volume (see Section 4.4) is 360 vpd.

The above determinations are based on two-lane, two-way rural roads in rolling terrain and the whole of the predicated maximum design volume, which has been applied to each road separately to model the worst-case scenario.

4.8 Safety considerations

Traffic generation calculations indicate that the maximum hourly increase in traffic at any location would be approximately 40 vehicles per hour (equivalent to 250 vpd) during the construction phase of the project.

This increase would remain at the maximum during each working day for approximately five years for both the southern and northern routes. The traffic increase would then reduce to approximately 30 vehicles per day for continuing maintenance on both routes.

The following safety issues have been considered:

- Risk of collisions
- Traffic noise
- Dust from unsealed roads
- Driver distraction
- Obstruction by long loads
- Wet weather
- Road surface deterioration
- Structural failure of road structures

The impacts of these issues are discussed for the key locations.

5 IMPACT ASSESSMENT AND ASSOCIATED SAFEGUARDS

5.1 Traffic impacts on over-mass and over-dimensional haulage routes

All routes described previously have been considered in this section of the report. There are some alternative routes for the over-mass and over-dimensional vehicles. Decisions on the final routes for these vehicles will be the subject of negotiations between the Haulage Contractor and the Road Authorities.

Due to the potentially large increase in the number of vehicles using these routes, there are many impacts to be considered. The low standard of horizontal and vertical alignment would assist in controlling speed on many sections, however isolated curves between higher speed sections could increase the risk of vehicles losing control.

The larger vehicles would occupy most of the width of the roadway at many locations increasing the risk of collisions. There would be an increase in traffic noise and dust nuisance for property owners and a need to control stock from straying on the roads which are not fenced.

The gravel road surfaces will likely deteriorate and potholes will form under the increased traffic loads particularly during wet weather when water ponds or floods across the road. The Roads & Traffic Authority would close the unincorporated roads if traffic is likely to damage the gravel surface during rain periods.

Dust would be generated on the unsealed roads affecting visibility and resulting in the loss of pavement materials.

Structural damage may occur to some of the culverts, concrete causeway crossings, stock grids and traffic islands.

Road closure on the gravel roads due to damage by heavy vehicles can have a major economic impact on the residents and property owners. Road damage that occurs during major agricultural activities such as sheep shearing can disrupt the management of rural properties. Transport of children to school and the purchase of supplies in Broken Hill are dependent on the condition of the road network.

The location of trees and other roadside objects have the potential of obstructing the passage of long wide loads and high loads. Lack of roadside delineation in some locations may impact traffic safety during periods of poor visibility.

The routes through Broken Hill could impact on local residents particularly during the passage of heavy vehicles along designated heavy vehicle routes towards Silverton, which do not normally carry large volumes of heavy vehicles. Increased noise and traffic delays could occur during the passage of heavy vehicle convoys. Any increase of traffic in school zones has a potential impact on pedestrian safety.

Some intersections have inadequate pavement width to safely accommodate the turning manoeuvres of oversize vehicles. These impacts would only be temporary, as the equipment haulage is not a continuous program. Most of the heavy haulage will be in the form of convoys and would be managed through a number of specific mitigation measures developed and implemented in conjunction with both RTA and local councils.

Safeguards

- Use of a licensed haulage contractor with experience in transporting similar loads, responsible for obtaining all required approvals and permits from the RTA and Councils and for complying with conditions specified in the approvals.
- Development of a traffic management plan in conjunction with the haulage contractor to include scheduling of deliveries, managing timing of transport through Broken Hill to avoid peak hours (beginning/end of the school day), limiting the number of trips per day, undertaking community consultation before and during all haulage activities, designing and implementing temporary modifications to intersections and street furniture, restoring all changes to their original condition and managing the haulage process.
- Implementation of all aspects of the Traffic Management Plan in coordination with the Council and RTA.
- Providing a dedicated telephone contact list to enable any issues or concerns to be rapidly identified and addressed.
- Installing required signage to direct traffic flows appropriately during haulage through Broken Hill.
- Reinstating pre-existing conditions after temporary modifications to the roads and pavement along the route.
- Undertaking forward planning to ensure equipment transportation complies with requirements of the management plan, RTA and Council.
- The erection of warning signs and/or advisory speed posting prior to isolated curves.
- Reconstruction of gravel pavements. The decision to provide a seal needs to be balanced against the cost of maintenance on the gravel surface. Sealing would also help address dust suppression and sediment control. The environmental impacts of this work should also be considered.
- A speed limit could be placed on some of the roads to reduce speed and subsequent maintenance costs. Most of the unsealed roads have an existing 100km/h speed restriction.
- A Transport Code of Conduct be prepared and made available to all contractors and staff detailing traffic routes, behavioural requirements and speed limits. This code of conduct could be included in the Traffic Management Plan.
- A procedure should be established to monitor the traffic impacts during construction, such as noise, dust nuisance and travel times and work methods modified to reduce the impacts.
- The Proponent would prepare road dilapidation reports covering pavement and drainage structures in consultation with the RTA and Council for the route prior to the commencement of construction and after construction is complete. Any damage resulting from the construction traffic, except that resulting from normal wear and tear, would be repaired at the Proponent's cost. Alternatively, the Proponent may negotiate an alternative for road damage with the relevant roads authority.

5.2 Traffic impacts from increased visitation

The proposed wind farm development is likely to generate tourist traffic on the roads surrounding the site. Broken Hill is currently visited by approximately 300,000 tourists per annum. A large percentage of the tourists would visit Silverton as it is highly promoted in tourist information (Silverton Road has approximately 210 vehicles per day). It has been observed that many visitors

travel to the Mundi Mundi lookout, 5km west of Silverton for a view of the Mundi Mundi Plains. Some travel on to the Umberumberka Reservoir and very few visitors travel further on to the gravel road.

The Daydream Mine also attracts some visitors and this traffic could share the initial four kilometres of Daydream Mine Road with wind farm construction traffic.

The proposed wind farm will generate much interest as a visual feature in the Broken Hill area. It is considered that it will not significantly increase the number of tourists visiting Broken Hill and therefore the increase in traffic volumes and subsequent impacts on the Silverton Route will be slight.

It is possible that many visitors will wish to stop beside the roadside before arriving at Silverton to view the wind farm possibly causing a disruption to through traffic.

The number of tourists visiting the Mundi Mundi lookout west of Silverton may increase as the wind turbines along the Barrier Range will be highly visible.

Safeguards

- The initial section of Daydream Mine Road should be upgraded and sealed if it is to become a major access to the wind farm. A speed restriction should be placed on the road to be consistent with Silverton Road (90km/h)
- An information bay with deceleration and acceleration lanes should be constructed along Silverton Road where there are views of the wind farm. Visitors could be directed to the lookout west of Silverton.
- The Mundi Mundi lookout 5km west of Silverton should be upgraded and provided with information.

5.3 Traffic impacts at specific locations

Barrier Highway

The roundabout at Galena Street gives access to Main Road 81 (to Silverton). The left turn from the Barrier Highway is of insufficient width to be negotiated by oversize vehicles in safety. Convoys of oversize vehicles will generate noise and traffic delays. In addition to those safeguards described in Section 5.1, the following additional safeguards apply.

Safeguards

- A road train route making a left turn at O'Farrell Street (one street to the west) is available as an alternative route. Haulage contractors need to be informed to consider this route in their planning.
- Residents along the road train routes should be informed when convoys are expected via public information programme.

Silver City Highway

The roundabouts at South Broken Hill may restrict turns by oversize vehicles. In addition to those safeguards described in Section 5.1, the following additional safeguards apply.

Safeguards

- Haulage contractors need to be informed of the alternative road train routes to be considered in their route planning.

Silverton Road

Increased vehicle movements particularly by heavy vehicles increase the potential of vehicle conflicts. Visiting motorists may be distracted by the view of the proposed wind farm. In addition to those safeguards described in Section 5.1 and 5.2, the following additional safeguard applies.

Safeguards

- Visitor information facilities should be provided along Silverton Road between Broken Hill and Silverton and at the existing lookout site west of Silverton.

Eldee Station route west of Umberumberka Reservoir

The gravel road north from Umberumberka Reservoir is regularly closed by wet weather. At this stage in the planning for the proposed wind farm, access points have not been finalised. Existing road users could potentially experience very large, relative increases in traffic during the construction phase. Increased traffic can rapidly accelerate the road deterioration particularly during wet weather causing road closure. This road is the only vehicular access for a large area west of Broken Hill and additional closures can have significant economic and social impacts to residents. Increased traffic would require residents and regular users to be exposed to an increased dust hazard. As the road is not fenced potential hazards exist from straying stock and native animals. In addition to those safeguards described in Section 5.1, the following safeguards apply.

Safeguards

- The existing road should be reconstructed and sealed along the length which is required for access.
- Establish speed limits and erect warning signs for potential hazards along the route.

Daydream Mine Road from Silverton Road to proposed access point

The gravel road from Silverton Road to the access point (4.2km) is occasionally closed due to wet weather. At this stage in the planning for the proposed wind farm the access points have not been finalised. Existing road users to Daydream Mine could experience very large relative increases in traffic during the construction phase. Increased traffic can rapidly accelerate the road deterioration particularly during wet weather causing road closure. This road is the only access to the Daydream Mine which is a popular tourist destination and road closures can have an economic impact on their business. Increased traffic would require road users to be exposed to an increased dust hazard. The existing track junction point has insufficient sight distance towards the Daydream Mine Road. In addition to those safeguards described in Sections 5.1 and 5.2, the following safeguards apply.

Safeguards

- The existing road should be reconstructed and sealed along the length which is required for access.
- The road junction at the access requires reconstruction including relocation towards the east.
- Establish speed limits and erect warning signs for potential hazards along the route.

Purnamoota route junction with Barrier Highway at Kaolin Street

The roundabout at Kaolin Street could have insufficient width to be safely negotiated by some oversize vehicles. Convoys of oversize vehicles will generate noise and traffic delays. In addition to those safeguards described in Section 5.1, the following safeguards apply.

Safeguards

- A road train route turning into O'Farrell Street (four streets to the east) is available as an alternative route. Haulage contractors need to be informed to consider this route in their planning.
- Residents along the road train routes should be informed when convoys are expected via public information program.

Nine Mile Road from Broken Hill to the Living Desert Park

A school zone with a median pedestrian refuge is located at 0.7km. Heavy traffic will generate potential conflicts with pedestrians. In addition to those safeguards described in Section 5.1, the following safeguard applies.

Safeguards

- Residents and schools along the route should be informed when convoys are expected via public information program.

Nine Mile Road from Living Sculpture Park to Purnamoota Station

This gravel section of the road is occasionally closed due to wet weather. Existing road users could experience very large relative increases in traffic during the wind farm construction phase. Increased traffic can rapidly accelerate the road deterioration particularly during wet weather causing road closure. Increased traffic would require road users to be exposed to an increased dust hazard. In addition to those safeguards described in Section 5.1, the following safeguards apply.

Safeguards

- The existing gravel road should be reconstructed and sealed (approximately 11.5km).
- Establish speed limits and erect warning signs for potential hazards along the route.

Stephens Creek Road

This gravel road is frequently closed due to wet weather. Stephens Creek Road is suggested as an alternative to Nine Mile Creek Road for access to Purnamoota Station. If this route is adopted, existing road users could experience large relative increases in traffic during the construction phase of the wind farm. Increased traffic can rapidly accelerate the road deterioration particularly during wet weather causing road closure. Increased traffic would require road users to be exposed to an increased dust hazard. As the road is not fenced potential hazards exist from straying stock and native animals. In addition to those safeguards described in Sections 5.1 and 5.2, the following safeguards apply.

Safeguards

- The existing gravel road should be reconstructed and sealed if it is adopted as the major access route (approximately 11.6km).
- Establish speed limits and erect warning signs for potential hazards along the route.

5.4 General safeguards

Additional to the specific safeguards outlined above, it is recommended that a transport carpool be organised for construction workers. This would minimise the number of vehicles travelling to and from the site, with resultant safety and environmental benefits.

The aforementioned safeguards have not been discussed in any detail with road authorities or property owners and are presented for further discussion and assessment. The decision on the extent and standard of road improvements to be provided would be subjective and related to the economies of construction for short-term use.

6 CONCLUSION

It is considered that the introduction of an additional 250 vehicles per day for approximately five years will likely have a significant impact on the existing road users adjacent to the site, particularly on the unsealed roads. As the area in the vicinity of the proposed wind farm is sparsely populated with a relatively small number of potential road users, these impacts are considered manageable. Road closures will occur during rainfall events, which will impact on turbine construction schedules as well as on local traffic. The draft constructability study (ARRUP 2008) indicates that access may be required to turbine locations on the western side of the range north of Eldee Station. This would require travel on unsealed for up to 25km. The costs of sealing the road surface need to be compared with the benefits derived from having all weather access to the relevant turbine sites. The savings in reducing disruption to the existing road users also needs to be included. This economic and social analysis also applies to the Purnamoota route.

Due to the relatively long construction period for this project, it may be more cost effective to reconstruct and seal gravel roads prior to the introduction of construction traffic loads than to repair sections as they degrade.

The managers of the properties that rely on access via the routes being examined should be consulted at an early stage of the planning process to determine the social, economic and safety impacts of traffic on the unsealed routes prior to the adoption of access points. Preliminary discussions with some of the property managers and road users have revealed widely differing opinions on the frequency of rainfall events and road closures.

This document demonstrates the maximum impacts on the road system. As planning for the road access points proceeds the projected impacts on some routes will be reduced. Road access planning for stage 1 on the southern end of the site will attempt to minimise the number of turbine sites being accessed via the western route through Silverton.

It is considered that traffic impacts of the proposal to the sealed roads in and around Broken Hill would be minimal, however there is a potential for impacts to users of the unsealed roads in the vicinity of the turbine site. Adoption of safeguards for minimising traffic impacts outlined in this study should reduce community disruption and the risk of traffic accidents to an acceptable level and minimise structural and environmental damage.

These safeguards should be implemented in consultation with the Broken Hill City Council the Roads and Traffic Authority.

7 REFERENCES

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APPENDIX A:

LOCATION OF THE PROPOSAL AND RELEVANT ACCESS ROADS

APPENDIX B: PHOTOGRAPHIC PLATES



PLATE 1

Barrier Highway at Gypsum Street



PLATE 2

Roundabout at Galena Street



PLATE 3

Silver City Highway at North Broken Hill



PLATE 4

Start of road train route at South Broken Hill



PLATE 5

Silver City Highway south of Broken Hill



PLATE 6

Road train route in Ryan Street, Broken Hill



PLATE 7

Silverton Road in Broken Hill looking west



PLATE 8

Silverton Road looking towards Broken Hill



PLATE 9

Silverton Road, Daydream Road on right



PLATE 10

Entry to Silverton



PLATE 11

Road through Silverton looking west



PLATE 12

Looking west from lookout at 32km



PLATE 13

Large Culvert near Umberumberka Reservoir



PLATE 14

Road to Umberumberka Reservoir



PLATE 15

To Eldee Station looking back at 35.4km



PLATE 16

To Eldee Station looking north at 35.4km



PLATE 17

Stock grid at entry to Eldee Station



PLATE 18

To Eldee Station, possible access on right at 45.5km



PLATE 19
Dust hazard on Eldee Station Road



PLATE 20
Galena Street roundabout looking south



PLATE 21
Kaolin Street roundabout looking northeast



PLATE 22
Kaolin Street roundabout looking northwest.



PLATE 23
Pedestrian refuge in Kaolin Street



PLATE 24
Nine Mile Road (sealed section)



PLATE 25

Start of Unincorporated Road 3 (Nine Mile Road)



PLATE 26

Looking south along Nine Mile Road at junction with Stephens Creek Road



PLATE 27

Looking towards Purnamoota from 15.6km



PLATE 28

Purnamoota Road at 17.7km looking south



PLATE 29

Purnamoota Road at 17.7km looking north



PLATE 30

Stephens Creek Road looking west from 3.55km



PLATE 31

Stephens Creek Road looking east from 3.55km.



PLATE 32

Stephens Creek Road junction with Silver City Highway



PLATE 33

Daydream Mine Road looking north



PLATE 34

Floodway at 2.45km on Daydream Mine Road



PLATE 35

Access track off Daydream Mine Road



PLATE 36

Looking south along Daydream Mine Road showing the curve at 4.2 km

