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Proposed Development of the Silverton Wind Farm, Silverton New South Wales

Concept Approval Application and Project Application for Stage 1

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1 EXECUTIVE SUMMARY

The Silverton Wind Farm proposal would be located on semi arid grazing land approximately 25 kilometres north-west of Broken Hill, in western New South Wales.

The Silverton Wind Farm would involve the construction and operation of up to 500 wind turbines on ridge crests and plateaus. Each wind turbine will have three blades up to 53 metres long mounted on a tubular steel tower up to 105 metres high. The wind turbines are likely to have a rated output of between 1.75MW and 3MW each. Accordingly, the wind farm could generate in excess of 1000 Megawatts of clean, renewable energy.

Underground and overhead cabling would be used to connect the turbines. Based on the current grid connection concept, between one and four substations would be installed on site to facilitate the most effective grid connection. This application includes those substations and also the necessary off-site powerlines to connect this wind farm to the national electricity grid.

This Concept Approval Application and Stage One Project Application outlines the scope of the construction, operation and decommissioning/recommissioning phases of the Silverton Wind Farm proposal, north of Silverton. It identifies and prioritises the associated potential environmental impacts. The Concept Approval Application and Stage 1 Project Application has been prepared by nghenvironmental on behalf of the proponent Silverton Wind Farm Developments Pty Ltd.

The proposal would be assessed under Part 3A of the Environmental Planning and Assessment Act 1979 which provides a consolidated assessment and approval regime for Major Projects. Following the submission of the Concept Approval Application and Stage 1 Project Application and issuing of the Department of Planning Director-General's requirements, a detailed Environmental Assessment Report would be prepared.

The Project is being prepared based on three broad stages of construction. This Concept Approval Application covers all three stages, and will include a completed Project Application in relation to Stage 1. Project Application for stages 2 and 3 will follow. The Environmental Assessment Report to be lodged with the Concept Approval Application will address issues relating to all stages of the proposal, with a full and detailed assessment of Stage 1. With the exception of heritage and biodiversity assessment, the detailed impacts of stages 2 & 3 will also be assessed in this Concept Approval Environmental Assessment Report.

The Environmental Assessment Report would draw upon the input of local and state government agencies, as directed by the Department of Planning. A Planning Focus Meeting involving government representatives was held on 14 and 15 November 2007 to identify the key issues of involved government agencies.

Moderate to high priority issues associated with the proposal and identified by the preliminary assessment include visual, noise, archaeological, biodiversity, traffic and roads and community impacts. These issues are being investigated by way of specialist reports, liaison with relevant stakeholders and for the latter, a community consultation program.

Issues where impacts are expected to be readily manageable using a range of mitigation measures include land use, aircraft and telecommunication (including defence), services and infrastructure, bushfire, construction noise, safety and impacts on local hydrology, soils, air and climate. These issues would be investigated primarily through desktop assessment and liaison with stakeholders and relevant agencies.

2 INTRODUCTION

2.1 Purpose of this document

This document has been prepared to enable the Department of Planning to determine their requirements for the Concept Approval and Stage One Project Application for the Silverton Wind Farm. The proponent is Silverton Wind Farm Developments Pty Ltd (SWFD),

SWFD proposes to develop the Silverton Wind Farm on the Barrier Ranges, approximately 3 kilometres north of Silverton, near Broken Hill, New South Wales. The wind farm site is in the unincorporated area of the Western Lands Division, administered by the NSW Department of Lands. Some parts of the proposal including the construction of transmission lines would be located within the Broken Hill Local Government Area (LGA), the Wentworth LGA and the Mildura LGA, Victoria.

The proposal has been separated into three distinct stages of proposed development. SWFD is now seeking concept approval for the entire project and project approval for stage 1 works. A second Project Application will address the Director General's requirements relevant to stages 2 & 3 following further detailed investigations that would specifically target biodiversity and archaeology relevant to those stages.

A detailed description of the works associated with the application is presented in Section 5.1.

This Concept Approval Application and Stage One Project Application will detail the scope of the construction, operation and decommissioning / recommissioning phases of the proposal and will undertake a preliminary prioritisation of potential environmental impacts. Potential environmental impacts associated with the proposal have been categorised into **moderate to high** and **lesser** priority issues. Issues identified as moderate to high priority would be comprehensively investigated and assessed via specialist studies in the Environmental Assessment report, as directed by the Director General's Requirements. Lesser priority issues are anticipated to generate impacts which are readily manageable, requiring less intensive investigation.

It is anticipated that the turbines would be maintained as required until the decision is made to decommission the wind farm. As part of the decommissioning stage, all above ground infrastructure would be removed and the disturbed areas rehabilitated.

2.2 Statutory context

Part 3A of the *Environmental Planning and Assessment Act 1979* consolidates the assessment and approval regime for all Major Projects that require the approval of the NSW Minister for Planning. Part 3A applies to wind power developments with a capital cost of $30 million dollars or greater, defining these developments as Major Projects.

The proposed Silverton Wind Farm would have a capital cost in excess of $30 million dollars and in the Minister's opinion is considered to be a Major Project, under Part 3A of the Act (Minister's opinion dated 24/10/2007, included in Appendix A). In addition, an application was made to the Minister of Planning to seek permission to lodge this concept approval application on 20 November 2007. The Department of Planning requested the proponent to prepare this document and categorise the potential impacts of the proposal in terms of moderate to high and lesser priority issues.

SWFD now seeks the Director General's Requirements for the required Environmental Assessment Report of those issues assessed by the Minister to be of moderate to high priority. It is understood that upon validation of this document, the Department of Planning will issue the Director General Requirements within 28 days.

2.2.1 Planning Focus Meeting

The Planning Focus Meeting for this proposal was held on 14 and 15 November, 2007. Representatives from the Department of Planning, Department of Environment and Climate Change (DECC), Department of Primary Industries (Minerals), Department of Primary Industries (Agriculture), Department of Lands, Western Catchment Management Authority (CMA), Lower Murray Darling CMA, Country Energy, Transgrid, Broken Hill Shire Council, Department of State and Regional Development and the Roads and Traffic Authority were invited to attend. The Department of Defence and the Civil Aviation Safety Authority were unable to attend but requested that they be kept informed.

Key issues identified by these agencies to date have been considered in the assignment of priority to potential impact areas in relation to this proposal.

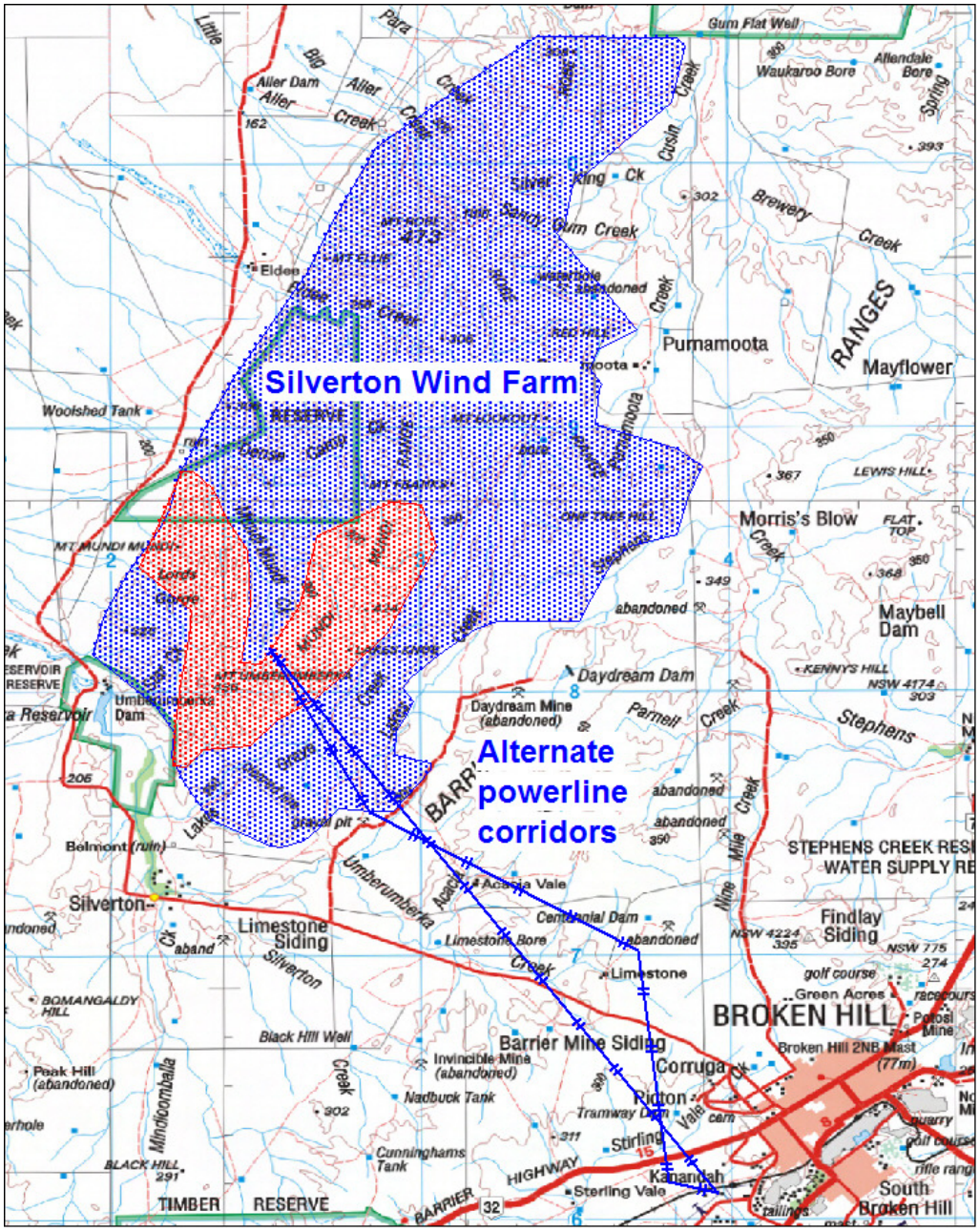

Figure 2.1 Location of the proposed Silverton Wind Farm

3 SITE CONTEXT

The proposed site is located on the Barrier Ranges, approximately 25 kilometres north-west of Broken Hill, New South Wales (Figure 1.1). In addition, the proposed corridor for associated transmission lines extends approximately 25 kilometres to Broken Hill and an additional 300 kilometres south to the Buronga and Red Cliffs substations.

The wind farm site is located within unincorporated land administered by the NSW Department of Lands (DOL). The wind farm site falls within the boundaries of the Western Catchment Management Authority (CMA). The associated transmission lines would be located within the unincorporated land, Broken Hill Shire Local Government Area (LGA), Wentworth Shire LGA and Mildura Rural City Council area (Victoria). In addition, this transmission line route would also be located within the boundaries of the Western CMA north of Broken Hill and the Lower Murray Darling CMA, south of Broken Hill.

The landforms and vegetation, land use and density of settlement and wind resource relating to the sites are described below.

3.1 Land use and density of settlement

There are a small number of dwellings located in the vicinity of the site, with the town of Silverton approximately 3 kilometres south. One adjacent and involved property, Eldee Station, is a commercial tourist operation. In general, the density of residences and development is sparse, although there is a clustered settlement at Silverton and a larger township at Broken Hill.

The tenure of land at the subject site is Crown Land offered as leasehold under the authority of the *Western Lands Act 1901.* The land is currently used for grazing purposes (sheep and feral goats) with a small number of residences at lower elevations. The Stage 1 wind farm would directly involve two properties, with the powerline traversing an additional five properties closer to Broken Hill. The Stage 2 and 3 sections of the wind farm would involve two additional properties.

The proposed route for the powerline that would be associated with Stages 2 and 3 of the development and which is the subject of the concept approval application is generally isolated from towns and communities between Broken Hill and the NSW border near Wentworth. The route passes close to built up areas within the Wentworth shire Local Government Area. From there the power line crosses into Victoria where it would terminate at Red Cliffs.

3.2 Landforms and vegetation

The Barrier Ranges form a series of north-east and north-west trending ridges rising up to 300m above the surrounding plain. The geology of the area includes schist and gneiss, intrusive granites, amphibolites and very coarse pegmatites (Morgan & Terrey 1992). [1]

There are no major watercourses present; however, several ephemeral watercourses exist. These include Umberumberka Creek, Lakes Grave Creek, Lakes Creek, Eldee Creek and Mundi Mundi Creek. The first three creeks drain into Umberumberka Dam, which provides part of the water requirements for Broken Hill and Silverton. In some areas, the creeks have formed steep-sided gorges, such as Lords Gorge, where sheltered waterholes exist when water is present. Beyond the Barrier Ranges, the creeks expand as alluvial fans, distributing sediment onto the Mundi Mundi Plain.

[1] Morgan, G & Terrey, J (1992) Nature Conservation in western New South Wales. National Parks Association, Sydney.

Diverse vegetation communities occur across the Broken Hill Complex Bioregion, varying according to topography, soils and micro-climate. Mulga (*Acacia aneura*) communities and chenopod shrubland communities dominate the vegetation of the bioregion (Morgan & Terrey 1992).

Although 95 per cent of the Western Division of NSW is uncleared, the composition and structure of vegetation communities with the bioregion has been modified as a result of grazing by stock and feral animals such as goats, and altered fire regimes (DNR 2005).

Over 300 flora species occur in the region. There are 9 threatened plant species known to, or predicted to occur in the Barrier Range CMA subregion; 5 are listed as endangered, 4 are listed as vulnerable (DECC 2007). Two endangered ecological communities are also known to, or are predicted to, occur in the subregion. These are Neila Woodland and the Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River (DECC 2007).

It is currently proposed that the additional transmission lines from Broken Hill, south to Buronga and on to Red Cliffs in Victoria would run parallel to the existing 220kV transmission line. The approximate length of the proposed works is 300 kilometres of which approximately 1.2 kilometres is south of the Murray River in Victoria. The current transmission line runs mainly in a north south direction, generally adjacent to the Silver City Highway. The proposed new transmission line route, like the existing power line crosses a number of drainage lines between Broken Hill and Red Cliffs as well as crossing the Darling and Murray Rivers. Generally, the existing transmission line easement is not in close proximity to residences, however, the powerline route crosses the road at three different locations and certain sections of the easement are located within the vicinity of towns.

4 PROJECT JUSTIFICATION

4.1 Project viability

In Australia, wind farms are viable because of legislation putting into practice the renewable energy policies of the Federal and State Governments which require electricity retailers to source a certain percentage of electricity from renewable sources. The NSW State Government's newly introduced legislation, called the Renewable Energy (NSW) Bill, will create a renewable energy market of 7,500GWh/an. The increase in the Federal renewable energy target announced by the Government will create a renewable energy market of 45,000GWh/an.

Both the MRET and the NRET are market based mechanisms designed to encourage investment in renewable technologies that will provide the lowest cost generation of renewable electricity in the National Electricity Market. Projects like the Silverton Wind Farm will encourage renewable investment in NSW.

Commercial viability of an infrastructure project such as this is a complex product of the capital costs (and finance costs) of the project and the revenue it would generate over its operational life. In the case of this project, the commercial viability is considered to be good, and is supported by the number of proposed turbines combined with good wind speeds.

SWFD, through CSIRO, has been monitoring the wind regime at the site since May 2007. This data has been analysed together with long term data from surrounding sites to confirm that wind speeds are high at the site and more than sufficient for a viable wind farm.

4.2 Project benefits

In a typical year the Silverton Wind Farm could produce over 3,000 GWh of clean, renewable energy in each year it is operating. In terms of scale, this represents approximately:

- 4-5% of the average annual NSW electricity demand;
- 40-50% of the proposed NSW Renewable Energy Target of 7500GWh/an
- 6 – 10% of the proposed increase in the federal Mandatory Renewable Energy Target of 45,000GWh/an
- 20-30% of the requirements of NSW under this federal target.

The Silverton Wind Farm offers several benefits to the environment and local community:

- This project would directly inject funds into the local economy (both during construction and during the operational phase);
- The project, would provide an opportunity for regional investment in the Broken Hill area as the renewable energy sector grows;
- The wind farm would provide electricity into the NSW and Victorian grid that would assist in meeting ongoing load growth in NSW and Victoria;
- The project would reduce greenhouse gas emissions, helping to move towards sustainable electricity generation and reduce the impact of climate change ;
- The project would supply renewable energy that would assist electricity retailers fulfil their obligations under state and federal renewable energy targets;

The proposal would provide for community projects including environmental measures both on and off-site. The Silverton Wind Farm proposal is fully self-funding, with each stage being viable in its own right. The project maximises use of existing resources (wind, power line, road access) while being remote from high population centres, thereby reducing social impacts. Opportunities exist to improve the management of the land at the wind farm site. The development would provide an additional income stream to assist with this.

5 PROJECT DESCRIPTION

5.1 General description

The proposal would involve the construction, operation, and decommissioning of a wind farm with capacity of approximately 1000MW for all three stages. The project would involve:

- up to 500 modern wind turbines constructed for all three stages. Each turbine would have three blades likely to be up to 53m long mounted on a tubular steel tower likely to be 80-105 metres high.
- electrical connections between wind turbines and on-site substations would be a combination of underground cable and overhead power lines.
- up to four on-site substations on site together with associated control builds and related infrastructure
- for Stage 1, a new high voltage (likely 220kV) powerline approximately 25km long from the proposed wind farm site to Broken Hill.
- For Stages 2 & 3, a new high voltage (likely 220kV) powerline approximately 250-300km long from the proposed wind farm site via Broken Hill to Buronga and on to Red Cliffs. This would be constructed as part of the Stage 2 works.
- There would be onsite control buildings and equipment storage facilities.
- Access roads around the site in addition to minor upgrades of the Silverton Road and the Daydream Mine Road, and possibly the Nine Mile Road for installation and maintenance of wind turbines.
- There will be a number of freestanding permanent monitoring masts for wind speed verification and monitoring.

In addition to the permanent infrastructure associated with the project, there is also a requirement for temporary construction infrastructure during the construction and decommissioning phases (discussed below).

At this stage of investigations, optimal turbine and easement locations have not been determined. These would be determined prior to submission of the Environmental Assessment report, after a full investigation of site specific constraints.

This project description is based on the current and initial wind farm design concept. In particular, any site layouts are based on the current proposal, which may change due to the outcomes of further investigation and transmission connection design amendments.

5.2 Wind farm infrastructure

5.2.1 Wind turbines

Wind turbines

Each wind turbine would be a three bladed up-wind machine. A variety of wind turbines are under consideration, broadly falling into three groups:

- Option A – 80-82m blade diameter
- Option B – 88-95m blade diameter
- Option C – 100-105m blade diameter

The specific turbine selection would be carried out through a competitive tender process after development approval has been received.

Nacelle

The nacelle, or housing at the top of the tower, contains the generator, gearbox, and control gear including motors, pumps, brakes and electrical components. This control gear ensures that the wind turbine always faces into the wind, and adjusts blade angles to maximise power output and minimise blade noise. The nacelle also houses a winch or winches to assist in maintenance equipment or smaller replacement parts to the nacelle.

The nacelle design takes into account acoustic considerations to minimise noise emissions from mechanical components.

Tower

The tower is a tubular steel tower 80 to 105 metres high. The final dimensions would depend on the wind turbine design selected. The tower would be constructed in up to four sections, each section bolted together via an internal flange. Within the tower are the power and control cables, and access ladder to the nacelle (with safety climb system).

Footings

The tower would be secured in a reinforced concrete footing. Various designs of footings are under consideration, based around a gravity footing (where subsoil geology is less stable) and a rock-bolted footing (where subsoil geology provides adequate bedrock). A combination of these footing designs may be used on the site to best match the subsurface geology at each turbine location.

Transformer

Each wind turbine generator would produce power at typically 690V, up to 1,000V. This power is then transformed at each wind turbine to a higher voltage (typically 22-33kV) for reticulation around the site. The transformer for each wind turbine would be located either within the base of the tower or in the nacelle, depending on the specific wind turbine model selected. The transformer would be either dry-type or suitably bunded.

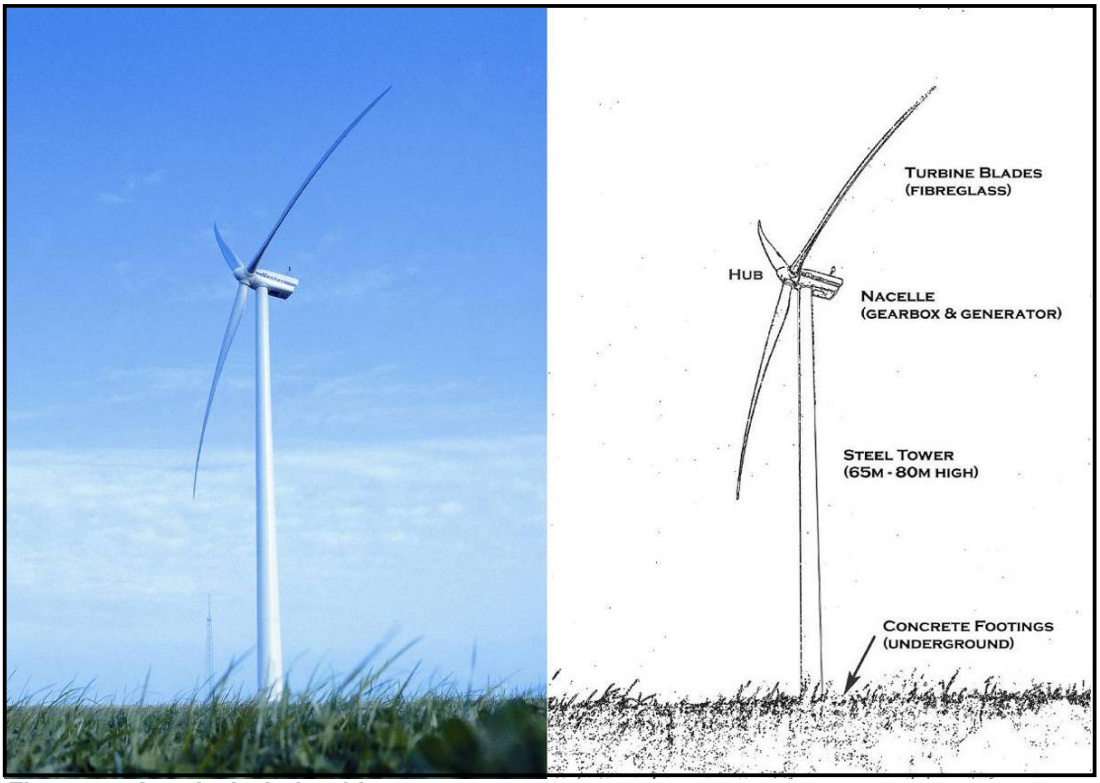

Figure 5.1 A typical wind turbine.

Lightning protection

Each wind turbine would have a lightning protection system installed. This system includes lightning rods through each wind turbine blade, an earth mat built into the foundations of the wind turbine, and lightning protection around the various electronic components within the wind turbine.

Obstacle Lighting

The turbines may have aircraft warning lighting which would comprise a red flashing beacon on the top of the nacelle to meet the requirements of the Civil Aviation Safety Authority (CASA). CASA guidelines for aviation warning lighting for a group of wind turbines require that sufficient wind turbines should have red obstacle beacons to indicate the extent of the group.

Fixed or variable speed machines

Wind turbines can be fixed speed or variable speed machines, that is, the turbine blades would either rotate at a constant speed (when operating) or a variable speed depending on wind speeds. Variable speed machines have better performance over a wider range of wind speeds, provide higher quality power to the electricity grid, and help reduce wind turbine noise levels at low speeds. Variable speed machines are more expensive to install than fixed speed machines.

It is likely that variable speed machines would be used in this wind farm, with a rotational speed in the range of 5 to 25 revolutions per minute (RPM) depending on wind conditions. This rotational speed is slower than the existing New South Wales wind farms at Blayney and Crookwell which operate at a fixed speed of 25-30 RPM.

5.2.2 Wind turbine operation

Each wind turbine would have its own individual control system, and would be fully automated. Start-up and shutdown (including safety shutdowns) are fully automated, with manual interruption available via onsite control systems and remote computer.

Generally, wind turbines would commence operation at an approximate wind speed of 3–5 metres per second (11–18 kilometres per hour) and gradually increase in production to their maximum capacity, usually at an approximate wind speed of 12–15 metres per second (44–54 kilometres per hour). Once at this maximum capacity, the wind turbine would control its output by altering the pitch of the wind turbine blades. Under high wind conditions in excess of 25 metres per second (90 kilometres per hour) the wind turbine would automatically shut down to prevent damage. The wind turbine would continue measuring the wind speeds during this state via an anemometer mounted on the nacelle, and would restart once wind speeds drop to a suitable level.

Various operating constraints are able to be programmed into the control system to prevent operation of the turbine under certain operational conditions. For example, if operational issues such as excess noise or shadow flicker are noted under certain conditions, these conditions can be pre-programmed into the control system enabling individual wind turbines to automatically shut down whenever these conditions are present. For instance, the noise control systems can be programmed such that if the wind is blowing from a certain direction at a certain wind speed, the wind turbines can be switched off. Similarly, wind turbines can be switched off at a certain time of day during a period of the year when the sun angles may cause shadow flicker on nearby properties.

It should be noted that noise and shadow flicker are not expected to be an issue, as these impacts can be minimised in the design process. However, this capability within the control system would allow adjustment of wind turbine operation modes for unforeseen outcomes.

5.2.3 Ongoing wind monitoring equipment

SWFD has established a 65m high lattice tower wind monitoring mast to assess wind speeds at the site. It is proposed to continue operation of this mast to allow ongoing performance monitoring of the site. Data from this mast is also used for the noise assessment.

Three additional masts are in the process of being installed at the site. These include two 62m masts and one 71m mast. Additional masts will be required for stages 2 & 3.

5.2.4 Wind Turbine Layouts

SWFD is reviewing a number of wind farm layouts for the various wind turbines under consideration. Proposed layouts have undergone a preliminary review to determine constructability. Further studies will provide greater information in determining the optimised locations for each turbine model and final geotechnical investigations at each turbine location will further refine the process. Detailed geotechnical investigations can only be carried out once consent conditions are known and a turbine supplier has been selected.

SWFD requires flexibility in relation to the final turbine locations to allow for movement of up to 250m from individual proposed turbine locations. This provides flexibility to take into account specific site conditions including geology, biodiversity and archaeology constraints identified. This distance is consistent with the outcomes of the Land and Environment Court case with respect to the proposed Taralga Wind Farm.

5.3 Electrical connections

To export power from the wind farm to the electricity grid at connection points in NSW and Victoria, electrical works would include:

- electrical connections between wind turbines and on-site substations. These would be a combination of underground cable and overhead power lines;
- up to four on-site substations on site together with associated control builds and related infrastructure;
- for Stage 1, a new high voltage (likely 220kV) powerline approximately 25km long from the proposed wind farm site to Broken Hill;
- for Stages 2 & 3, a new high voltage (likely 220kV) powerline approximately 300km long from the proposed wind farm site via Broken Hill to Buronga and on to Red Cliffs. This would be constructed as part of the Stage 2 works;
- onsite control buildings and equipment storage facilities; and,
- substation upgrades within the existing Broken Hill, Buronga and Red Cliffs substations for each of the stages and other parts of the national electricity grid as required.

Site substation

A new on-site transmission substation is required on site to convert power from on-site reticulation voltage to a transmission voltage of 220kV-50kV suitable to connect into the national electricity grid. It would also include all necessary ancillary equipment such as control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation.

The substation area would be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. The ground would be covered partly by crushed rock and partly by concrete pads for equipment, walkways and cable covers, and would have an earth grid extending outside of the boundary of the security fence.

The Stage one substation would be located on-site in the inner lowland region of the site. This location has been selected to minimise environmental disturbance of the Stage one site; reduce cabling lengths and therefore reduce costs and environmental impacts; and reduce visual and archaeological impacts and ground disturbance of the site.

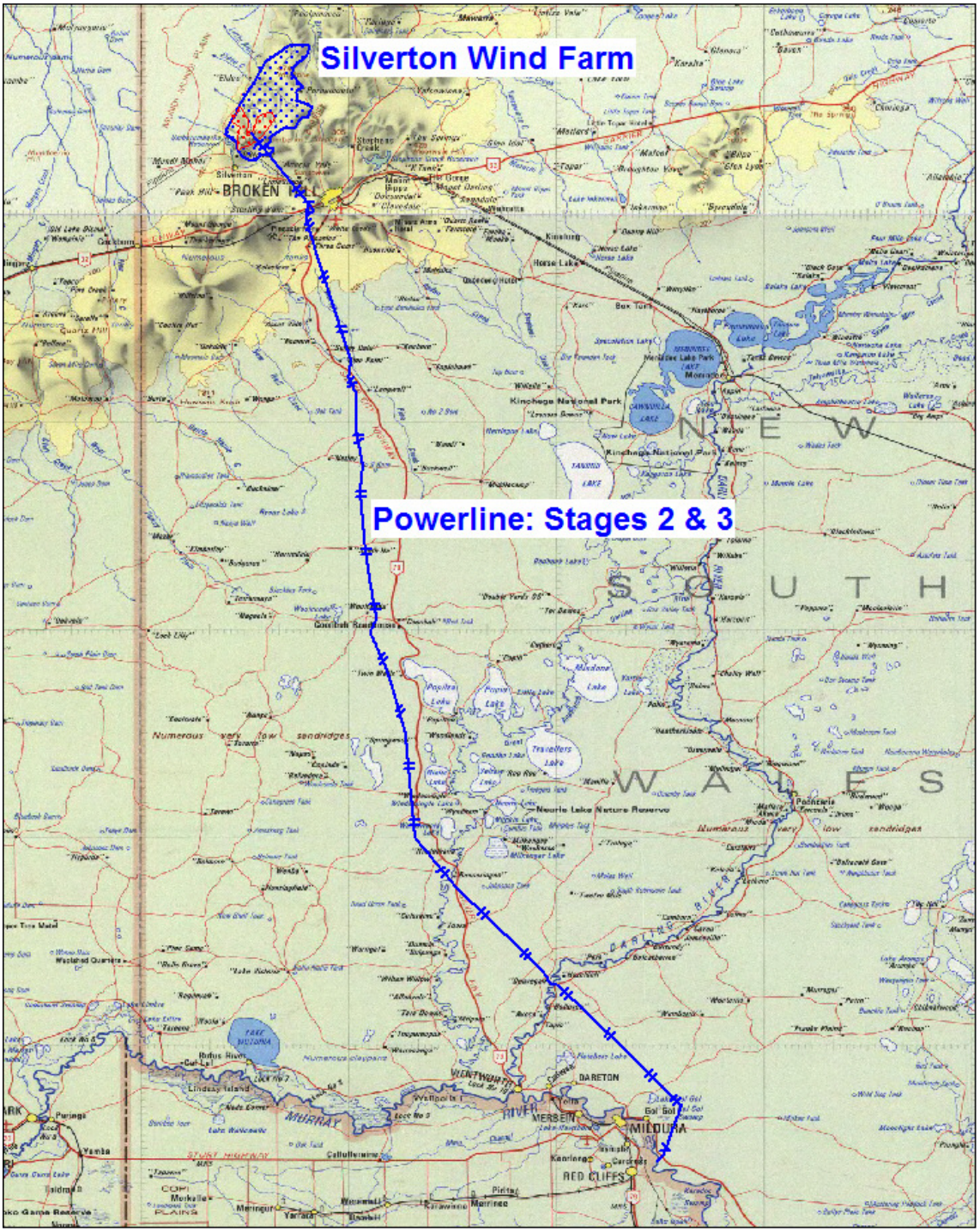

Figure 5.2 Proposed Powerline Corridor, Stages 2 & 3

Onsite electrical reticulation

Each wind turbine must be connected by electrical reticulation which cables turbines together in groups and then into the Site Substation. These connections would be made using both underground and possibly overhead cabling. Cable trenches would, where possible, be dug alongside the onsite roads to minimise any related ground disturbance.

Short spur connections would come off a main cable run which would, where possible, approximately follow the main access tracks on site.

The routes for power reticulation would be finalised taking into account the ease of excavation of cable trenches, and with an effort to minimise impacts on areas with sensitive biodiversity or heritage; to minimise clearing of vegetation and trees; and to minimise erosion issues resulting from construction.

Control cabling

In addition to the power reticulation cabling, control and communications cabling is required from the control building to each wind turbine, and to the Site Substation. This control cabling would be installed using the same method and route as the power cabling described above, that is, strung from the same poles as overhead lines, or dug in the same cable trench as underground cables.

Control cables would consist of twisted pair cables, multi-core cables or optical fibres, and would be used for central and remote control of individual wind turbines, substation controls, monitoring of weather data and equipment and communications to offsite control centres where required.

Interaction with grid operators

The proponent intends to seek a Grid Connection Agreement with Transgrid on the basis of the proposed connection arrangements and in accordance with the National Electricity Code. This Grid Connection Agreement would include all technical requirements for safe connection of the wind farm to the NSW electricity grid. Construction of the project would not commence until this Grid Connection Agreement has been entered into by both parties.

Stages 2 and 3 will require a connection agreement with SPAusnet and VenCorp in Victoria.

Relevant stakeholders including National Electricity Market Management Company (NEMMCO) would be consulted in preparation of the related Grid Connection Application.

5.4 Site Civil Works, Roads and Access

At the Planning Focus Meeting, Site Civil Works, Roads and Access were noted as areas of interest for some stakeholders. A high level constructability assessment is being undertaken to quantify these issues and review approaches to them. This assessment will review desktop geology, slope, drainage management, construction techniques, supply of aggregates and other construction aspects.

Access route

Access routes to the site are expected to use the Silverton Road from Broken Hill, the Daydream Mine Road and the track across Nine Mile Station crossing Lakes Creek to the south of Lakes Knob. It is expected that turbines would be delivered from a port in South Australia and would be delivered by road into Broken Hill from the Barrier Highway, then follow Rakow Street, Brookfield Avenue, Horsington Drive which becomes South Broken Hill and then Silverton Road. Other equipment would come from towns in eastern NSW and would follow the Barrier Hwy into Broken Hill from the east and then follow a similar route to site.

Vehicle management

A Traffic Management Plan (TMP) would be prepared to properly manage traffic impacts. The TMP would incorporate measures such as a signposting plan, interim information bays, clearing of sight lines, line marking, upgrades to pavement and drainage structures, sealing a junction, shoulder widening, reduced speed limits for the period of construction, scheduling of high traffic flows and implementation of dust suppression. The TMP would be developed in consultation with the RTA to ensure that these measures are adequate to address the potential for safety and asset degradation issues.

Access tracks

Onsite access tracks for construction and operation would be designed to balance the requirement to enable large parts to be delivered to turbine locations and the substations and to minimise impacts.

At each wind turbine base, a firm hardstand area would be required to provide a level and stable base for cranes necessary for construction.

Every effort would be made to:

- minimise the number and length of necessary access tracks;
- locate access tracks along the route of existing farm tracks, in areas where clearing of existing native vegetation would be minimised, and where impact on sensitive biodiversity or heritage areas would be avoided or minimised; and
- construct access tracks with due regard to erosion, sediment control and drainage.

Control Building

A control building would be built onsite to house instrumentation, control equipment and communications equipment. This building would also house routine maintenance stores, a small work area, and amenities for staff.

The control building would likely be constructed from a concrete slab on ground construction with a steel frame, metal or brick walls, a non-reflective sheet steel (colourbond) roof, and would include rainwater collection and storage for domestic use. A composting or septic toilet system would be installed for staff use. It is likely that the control building would be air-conditioned. The internal layout of the control room would be finalised after the Grid Connection Agreement has been completed.

A telephone connection to the control building would be required to allow remote monitoring and control of the wind farm. The control building would be located adjacent to the site substation, and is expected to be a joint facility for control of the substation as well as the wind farm.

Other Site Services

Operating staff would be responsible for removal of all other wastes at the site; no waste management services would be required.

5.5 Construction Facilities and Works Staging

5.5.1 Phase 1: Construction of the wind farm

The construction phase of the wind farm would include such activities as:

- Transport of people, materials and equipment to site
- Civil works for access track construction, footings and trenching for cables
- Establishment, operation and removal of concrete batching plant
- Potential use of rock crushing equipment onsite, if required
- Installation of wind turbines using large mobile cranes
- Construction of substation and onsite power reticulation lines and cables
- Temporary site offices and facilities
- Restoration and revegetation of site on completion

Construction would commence with the upgrading and construction of new roads and all other site civil works, including preparation of hardstand areas, and laying of cables. This would be followed by preparation of concrete footings, which must be cured prior to construction of wind turbines.

Wind turbine construction can be relatively fast once the footings are prepared, if weather conditions permit, with wind turbines installed at a rate of approximately 4 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub.

The necessary substation construction and grid connection works would be carried out in parallel.

The commissioning phase would include pre-commissioning checks on all high-voltage equipment prior to connection to the transmission system. Once the wind farm electrical connections have been commissioned and energised, each wind turbine is then separately commissioned and connected and put into service.

On completion of construction, the site would be rehabilitated and all waste materials removed from the site. Any temporary road realignments would be restored and rehabilitated.

Wind turbine construction and installation

Installation of the wind turbine blades would require establishment of a level (<1% gradient) and stable hardstand area at the base of each wind turbine. This hardstand area would support cranes used for the major component lifts. It is also necessary to have a delivery area for the various components adjacent to the hardstand area, in most cases it is expected that the access road could be used in part as this delivery area.

The wind turbines would be anchored using large concrete gravity footings or smaller concrete footings bolted to rock, as determined by geological parameters. Some blasting of rock may be required to excavate footings, dependent on the geological properties of the rock and design of the footing. Should controlled blasting be required, it would be carried out in accordance with all relevant statutory requirements.

Rock crusher

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades, and construction of the hard stand area required at each turbine. For this purpose, it is possible that a mobile rock crusher would be used onsite.

Concrete Batch Plant

It is expected that portable concrete batch plant would be required to supply concrete onsite. The batch plant would be located on an existing clear and level area of the site, situated in the central area of the wind farm site. SWFD is currently in discussion with Country Water regarding sourcing water needed for the batching plant. Initial correspondence with Country Water indicates that Country Water is confident that they will have the necessary resources to meet the construction water demand.

5.5.2 Phase 2: Wind farm operation

Once installed, the wind farm would operate for an economic life in the order of twenty to thirty years. The economic life would depend on various considerations including the increasing costs of maintenance; requirements for major repair work; and cost and efficiencies of possible replacement wind turbines.

During the operation phase the wind turbines and other equipment would require regular maintenance, and it is possible that at some stage some equipment may require major repair or replacement. In addition, during the initial operating years, operator attendance may be more regular while the wind farm operation is being fine-tuned and optimised.

Routine maintenance

To ensure the wind farm operates in a safe and reliable manner, regular maintenance, and inspection checks are scheduled. This would generally require only standard vehicles. As a guide, each turbine can require around 7 days of maintenance per year.

Major repairs

It is possible that major unexpected equipment failures could take place during the life of the wind farm. While wind turbines and electricity connections are designed for a 20 - 30 year life, failures can occur due to a number of factors including lightning strike (either onsite on the wind turbines or offsite on the transmission line) and damage to key components (such as transformers or gearboxes).

Most repairs can be carried out in a similar manner to routine maintenance, with some exceptions which may require the temporary reinstatement of wider construction tracks.

5.5.3 Phase 3: Wind farm decommissioning and recommissioning

The life of the wind turbines is 30 years at which point if the turbines are no longer viable they may be replaced, overhauled or removed from the site.

Decommissioning and recommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines. All underground footings and cable trenches would remain in situ, all other equipment would be removed from site. It should be noted that the scrap value of turbines and other equipment is expected to be sufficient to cover the majority of the costs of their dismantling and site rehabilitation.

6 MODERATE TO HIGH PRIORITY ISSUES

6.1 Summary of issues identified

The following issues are considered potentially able to generate moderate to high level impacts and would therefore be given greater priority in terms of investigation and mitigation of impacts. These are impacts which may be, for example:

- Highly contentious within the community (impact on visual values and noise in the locality);
- Non reversible (impact on Aboriginal heritage features);
- Have potential to cause population level impacts to threatened species.

Moderate to high priority issues will require additional investigation/consultation and will be dealt with more fully in the **Environmental Assessment Report** in order to enable impacts to be managed and kept to acceptable levels. Table 6.1 summarises the sources of impact and proposed strategies for investigation for each issue of moderate to high priority.

Table 6.1 Issues of moderate to high priority.

Issue	Sources of impact	Risk Priority	Investigation strategy
Visual	• Loss of visual amenity • Impact on scenic character • Cumulative visual impacts.	High	Further investigation via visual assessment and community consultation.
Noise	• Operational noise may impact residences nearby.	Potentially Moderate	Further investigation via acoustic assessment including modelling and mapping.
Archaeology	• Potential to impact Aboriginal heritage values and items.	Moderate to high	Further investigation via archaeological assessment including desktop literature review and onsite field work. Subsurface work would only be undertaken if required.
Biodiversity	• Clearing of vegetation during construction and maintenance. • Loss or modification of habitat. • Potential for spread of weeds through soil disturbance during the creation of access tracks, footings and underground cable routes. • Impact on threatened species or endangered ecological communities.	Moderate to high	Further investigation via biodiversity assessment including desktop literature review and onsite field work.
Soils and landforms	• Soil disturbance from vegetation clearing. • Erosion from excavation works. • Soil compaction from the transport of heavy equipment.	Moderate	Further works including the preparation of a detailed Erosion and Sediment Control Plan.

Issue	Sources of impact	Risk Priority	Investigation strategy
Traffic and roads	• Turbines may distract drivers (either by their movement or as other motorists pullover to view the development). • Increased traffic may be a safety risk in the local area. • Construction traffic may contribute to road pavement deterioration.	Moderate	Further investigation via traffic assessment RTA.
Community	• Potentially divisive development.	Moderate to high	Further investigation via community consultation. Implementation of a community consultation plan.

6.2 Specialist reports

Further investigation is proposed to include specialist reports for a number of priority issues identified above. These include visual, acoustic, archaeology, biodiversity and road and traffic impacts. A summary of the proposed approach to each of these areas is provided below. A community consultation plan will be developed and implemented to identify and respond to community impacts.

6.2.1 Visual Assessment

A visual and landscape assessment report will be prepared to document and present the results of the assessment process and mitigation measures together with figures and illustrative material provided by others. A description of the likely methodology for this assessment is as follows.

1 Desktop Study and Analysis

Desk-top analysis to identify a series of Landscape Units and to determine and plot the likely extent of visibility of the proposed wind farm, and associated infrastructure, within distance bands.

2 Detailed Site Investigations

Carry out a detailed site inspection to confirm the boundaries of the Landscape Units and review and confirm the visual catchment of the proposed wind farm and route for the 220kV transmission line to Broken Hill. Review and confirm potential view locations and record photographs toward the proposed wind farm site and route for this 220kV transmission line from view locations.

3 Landscape and Visual Impact Assessment

Classify the potential view locations and viewers in terms of view context, view distance, number of potential viewers, and period of view and record the results in a matrix.

Record the likely magnitude of visibility of the development from the view locations, and define the level of sensitivity of the various categories of viewers to change that would result from the wind farm development.

4 Glint and shadow flicker assessment

Review and incorporate glint and shadow flicker assessment into the visual assessment report.

5 Potential Mitigation Options

Identify potential mitigation measures to be considered as part of a strategy to minimise potential visual impacts.

6 Illustrative Material

Prepare figures, where appropriate, to illustrate the results of fieldwork and to demonstrate issues of distance and relative scale between selected view locations and the wind farm site.

7 Visual Simulations

Prepare a series of visual simulations to illustrate the development of the wind farm from a number of selected view locations.

8 Reporting

6.2.2 Archaeology

The Aboriginal Heritage project would be conducted in accordance with the requirements of the NSW DECC Aboriginal Cultural Heritage Standards and Guidelines Kit (NPWS draft 1997). In addition the study will be undertaken following the new requirements for Community Consultation – Interim Guidelines for Aboriginal Community Consultation-Requirements for Applicants. Accordingly, the study would include:

- consultation requirements including Notification and Registration of Interests (written notification to five nominated groups, any groups or individual who elect to register and via an advertisement in the local paper) and Preparation of Assessment (submission to any registered stakeholders of the proposed methodology):The consultation process will need to be initiated 6 weeks prior to fieldwork.
- consultation with relevant Aboriginal organizations: Two reps from the local Aboriginal community will assist in fieldwork.
- a review of heritage listings and relevant literature;
- a synthesis of local and regional archaeology;
- an historical review and outline of relevant historical themes;
- the construction of a predictive model of Aboriginal site location;
- a comprehensive field survey of the zones of proposed impact conducted in accordance with the NSW DEC Aboriginal Cultural Heritage Standards and Guidelines Kit (NPWS draft 1997)
- an analysis of the survey and results;
- a significance assessment of cultural heritage sites located within the study area;
- an assessment of whether or not further archaeological investigations are required i.e. subsurface test excavation;
- recommendations for the mitigation and management of cultural heritage based of the results of the investigation, significance assessment and a consideration of the impacts of the proposed activities;
- provision of a draft document to registered Aboriginal stakeholders; and
- compilation of a heritage report in accordance with the relevant standards and guidelines.

The archaeological assessment would focus on Stage 1 works. In relation to the Stage 2 and 3 works investigations would be carried out to identify how these are likely to affect the development.

6.2.3 Acoustic Assessment

The Acoustic Assessment would detail the noise criteria, background noise measurements and the predicted noise level at all potentially impacted receivers from the operation of the proposed wind farm. The acoustic assessment will include:

- construct a noise model and create a colour contour map for the reference wind speed (typically 8 m/s).
- using the SA EPA Guideline for Wind Farm Noise Assessment indicate the potential zone of noise affectation.
- undertake baseline noise monitoring near sensitive receivers
- undertake noise modelling of proposed wind farm noise
- Predict received sound level at all surrounding noise sensitive locations for the wind speed range from cut-in to rated
- Produce a noise contour map for the reference condition of 8 m/s
- determine if the wind farm is likely to be compliant.

The study will include an assessment of construction noise and develop potential mitigation measures that may be required for the construction phase of the proposal.

6.2.4 Biodiversity Assessment

The biodiversity assessment will target mammals, birds (woodland and wetland species), amphibians and reptiles by direct searches and habitat assessment and flora via the 'random meander' method and vegetation mapping. The study area is located in the Barrier Range sub-region of the Western Catchment Management Area. This sub-region is characterised by 44 threatened species and two endangered ecological communities.

The fauna survey techniques will include:

- Bird censusing: targeted bird surveys at 72 sites across the study area for a period of 20 person minutes each including at the nearby Umberumberka Dam. Opportunistic sightings of threatened species will also be recorded while travelling across the study area.
- Habitat assessment, including searches for species signs (scats, runways, feeding signs etc), for a total of 9 person hours to identify food and shelter resources, limiting or specialised habitat features such as hollows and other features known to be used by the threatened fauna that are known to, or predicted to occur in the study area;
- Pitfall and Funnel Trapping targeting small mammals and reptiles consisting of 150mm PVC tubes or where rock or shallow precluded the installation of these tubes, funnel traps would be substituted. At each site, two traps would be connected by 20 metres of drift fence to divert animals into the traps, with each being open for a minimum of three days. A total of 32 trap nights will be undertaken.
- Reptile hand searches will be undertaken at 33 sites for a period of 20-person minutes at each site, giving a total survey effort of 11 hours. Additional target searches for threatened reptiles will be undertaken after the first survey period by four persons over 5 days for a mininum of 96 person hours.
- Elliot trapping will also be used to target small mammals and reptiles where the rocky ground does not allow the installation of drift fences between pitfall or funnel traps. This will be undertaken at four sites across the study area using 25 traps at each site for three nights at each site. A total of 300 trap nights will be undertaken. These traps were baited with rolled oats, peanut butter and cat food as an attractant to small mammals and reptiles.

- Bat trapping will be undertaken using 'harp traps' at 7 sites across the study area. At each site, one harp trap will be erected for a total of two nights, giving a total of 14 trap nights.
- Bats will be targeted using 'Anabat' ultrasonic call detection recording equipment. This will be undertaken at 5 sites across the study area for a period of one night at each site, giving a total survey effort of 5 nights. With an absence of drinking sources across the site which microbats tend to visit regularly, one of these nights will be at the nearby Umberumberka Dam to acquire additional data for the locality.
- Nocturnal surveys will be undertaken at six locations in the study area. These surveys will include nocturnal call playback for the threatened Masked and Barking owls, listening for calling frogs and spotlighting for fossorial and aboreal fauna (both on foot and in vehicle). Each of the six sites will be surveyed for a minimum of 20 person minutes, giving a minimum survey effort of 120 minutes.

The flora survey will be undertaken by stratifying the study area into vegetation communities by a series of air photo interpretation and on-ground validation. Areas carrying native vegetation will be surveyed using the 'random meander' method (Cropper 1993), rather than quadrats, to maximise opportunities for detecting significant or sparsely distributed plant species to compensate for greater vegetation heterogeneity in western NSW. Further, additional species will also opportunistically recorded whilst traveling through these communities.

The identification of vegetation types will be based on vegetation communities as detailed by Benson (2006) and Benson et al. (2006).

6.2.5 Traffic and transport

A Traffic and Transport assessment will be undertaken to identify:

- traffic volumes and vehicle types;
- Preferred access options and routes; and,
- Access requirements including assessment of technical upgrades required to existing access and roads

6.2.6 Community consultation

A community consultation plan incorporating face to face meetings, phone contact, newsletters, an Open House session and focussed presentations as required, is being carried out in parallel to the design and assessment of the proposal. The aim of the consultation process is to establish two-way channels of communications between the public, the proponents and the environmental assessment personnel whereby information can be distributed and feedback incorporated into the design and assessment of the proposal.

7 LOWER PRIORITY ISSUES

This section outlines issues considered to be of lesser priority. These are issues which pose environmental risks which are considered to be readily identifiable and manageable. It is anticipated that these issues will be the subject of desktop investigation. Liaison with relevant agencies and stakeholders would occur where appropriate.

Table 7.1 Issues of lesser priority

Issue	Sources of impact and potential risks	Risk Priority
Land use and land value	• Permissibility of the development on the site selected, under local government legislation and planning instruments. • Impact on onsite and adjacent land uses, including mineral leases.	Low to moderate
Aircraft and tele-communication impacts.	• Television, radio and telecommunications may be impacted. • Turbines may cause a collision hazard.	Low to moderate
Defence	• Television, radio and telecommunications may be impacted. • Turbines may cause a collision hazard.	Low
Bushfire Risk	• Potential for wind turbines to start or influence the pattern of bushfire. • Potential to impact bushfire-fighter access.	Low
Services and Infrastructure	• Potential to affect transport routes and telecommunications (such as mobile, TV and radio). • Access to the site may be improved as a result of the development. Provision of new substation may allow future electricity network improvements for properties in the area.	Low to moderate (Positive)
Construction noise	• Operation of equipment. • Transportation of equipment and materials to and from the site.	Low
Safety	• Potential to generate electromagnetic fields. • Potential to cause injury.	Low to moderate
Climate and air impacts	• Dust and emissions generated during excavation, road works, transport of machinery. • Greenhouse gas emissions. The proposal would make a positive contribution to the reduction in greenhouse gas emissions by providing alternative electricity sourced from fossil fuels.	Low to moderate (Positive)
Hydrology (water quality and water-table impacts)	• Mobilisation of sediment and pollutants generated during excavation, road works, transport of machinery. • Risk of oil leaks during operation and maintenance.	Low to moderate

Issue	Sources of impact and potential risks	Risk Priority
Economic impact	• Property prices may be impacted by the infrastructure. • Local employment would be created during construction - net economic gain to the local community.	Low to moderate (Positive)
Tourism	• Potential to affect the number and type of visitors to the area.	Low
Removal of infrastructure	• Ability to finance removal of infrastructure. • Potential to Environmental rehabilitation of site.	Low to moderate

8 CONCLUSION

This Concept Approval Application and associated Project Application for Stage 1 summarises the scope and receiving environment of the Silverton Wind Farm proposal, as of December 2007. This proposal is to be assessed under Part 3A (Major Projects) of the *Environmental Planning and Assessment Act 1979*.

This document is intended to give a preliminary prioritisation of potential impacts, in order to guide the full investigation of issues in the Environmental Assessment. The Proponent now seeks the Director General's Requirements, identifying the key issues and any required methods of inquiry in order to complete the Environmental Assessment for this proposal.

9 AUTHORS

Authors	Experience
Nicholas Graham-Higgs *Bachelor of Applied Science*	Nicholas has worked as an environmental planning consultant since 1992, specialising in environmental impact assessment and natural resource management. His work demands an in-depth knowledge of current planning and environmental legislation coupled with a comprehensive understanding of development-related impacts, especially those relating to the provision of recreational facilities. Nicholas has acquired his knowledge in this field over the last 18 years, during which he has worked with a number of land management organisations within and outside Australia. Much of the work undertaken has been within sensitive areas, including major works for infrastructure development; the augmentation of water supplies at Perisher Range and Adaminaby, environmental assessment for a wind farm on the Snowy Plains, near Kosciuszko National Park.
Tim Browne *Bachelor of Earth and Environmental Science* *Masters of Environmental Management (ongoing)*	Tim is a Project Officer with **ngh**environmental and has prepared impact assessment reports for a range of proposals including road construction, industrial upgrades and public infrastructure. These reports have included threatened species assessments requiring research, fieldwork and GIS components. Some of this work has been completed in sensitive alpine environments.
Madeline Cowley *Master of Science* and Andrew Durran *Bachelor of Engineering (Elec), Masters of Business Administration (Technology Management)*	Research and report writing, Sections 4 & 5.

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10 APPENDIX 1 MINISTERS OPINION OF PART 3A PROJECT