Flyers Creek Wind Farm Pty Ltd

Flyers Creek WIND FARM

Environmental Assessment

CHAPTER 3
Project Description

3. Project Description

This chapter describes the works proposed for the construction and operation phases of the Flyers Creek Wind Farm development.

The project design has been developed based on a number of considerations including energy resource analyses, access to suitable lands, likely equipment specifications, environmental studies and feasibility studies as well as issues raised during the community consultation program. A turbine layout of 46 wind turbines was considered during project planning but only 44 wind turbines form the basis for the Project Application and this Environmental Assessment. Two turbine sites were removed from the project and one was relocated to increase the setback in response to suggestions and comments received primarily during the community information days in November 2010.

In the event that the Project Approval is granted, the project to be implemented would relate to the proposed development as described in this Environmental Assessment and any variations proposed by the proponent in response to submissions (preferred project) or as directed by the Minister for Planning as part of the Project Approval. Minor variations may also be associated with the implementation stage as the design is refined following completion of any further site investigations (i.e. geotechnical studies), planning reviews and/or to address the conditions of approval and specific construction methods to be employed by the appointed contractors.

Any significant proposed variations may require further assessment, followed by a request for approval to modify the project. The final sites and selected equipment will be in accordance with the planning approval.

3.1 Wind farm layout

The wind farm spans about 11 kilometres from north to south and about 10 kilometres from east to west with the 44 wind turbine sites located as shown in Figure 1.4. It addresses the following main technical and environmental objectives:

- maximise the wind farm electrical output
- maintain spacing of turbines to minimise turbulence and airflow interactions between turbines
- avoid locations with unacceptable impacts on the flora and fauna and Aboriginal heritage values of the site
- maintain acceptable noise levels and visual impact at neighbouring residences
- enable accessibility in relation to delivery and construction of large turbine components
- achieve a wind farm scale required for project economic viability

The proposed layout provides the optimum arrangement for addressing the above factors.

Table 3.1 indicates the main component parts of the wind farm. Turbines are predominantly grouped by location on a common topographic feature or where they have common access routes. Ancillary components of the wind farm include the substation, access tracks, electrical collections circuits and the grid connection arrangement.

Table 3.1 - Wind farm component elements

Wind farm component	Number of Turbines	Turbine numbers	General Location
1. Turbine Groups			
Calvert Group (Northern)	10	3 – 12	Northern end of the project area southwest of Beneree. Sites 1 & 2 omitted following community consultation.
Fern Hill Group (Central Eastern)	8	13 – 20	Small group of turbines about 1 - 2 kilometers west of Beneree Road and north and west of Fern Hill
Hopkins Group (Southwestern)	17	21 – 37	Southern group located on ridges and hilltops south-west of Errowanbang – Carcoar Road
Halls Gap Group (southeastern)	9	38 – 46	Southeastern group located on ridges and hilltops east of Errowanbang – Carcoar Road and southeast of Halls Road
Total	**44**	**3 – 46**	
2. Ancillary items			
Ancillary item	Description of ancillary items and general location		
Access tracks	38 kilometers of access tracks to turbine sites and the substation		
Collection circuits	31 kilometers of 33 kV underground cables and approximately 11 kilometers of 33 kV overhead transmission line between substation and southern turbine groups		
Substation	33 kV and 132 kV switch yards, two transformers and associated buildings. North-western side of wind farm site in Slatterys Creek Valley		
132 kV transmission line	Up to 15 kilometers of 132 kV transmission line from the substation to the point of grid connection on Cadia Mine site with a new switchyard at grid connection point		

The estimated footprint of the areas required for the component parts of the wind farm development including temporary construction facilities are shown in Table 3.2.

Table 3.2 – Footprint of the project components and approximate area of disturbance

Project component		Approximate Dimensions	Estimated Area (hectare)	
			Long Term	Temporary
Turbine footings (44)		Each 12 by 12 metres	1	<0.6
Turbine assembly hard-stand areas		Each up to 50 by 40 metres	8.8	0
38 kilometers access tracks 8 to 10 metres wide	Upgraded	26 kilometers of upgraded track	10.4	5.2
	New	12 kilometers of new access track	9.6	2.4
33 kV underground cables		1 to 2m wide by 31 kilometres	0	5
33 kV overhead line		1 to 2m wide by 10.5 kilometres	<0.5	3
33 kV/132 kV Substation		120 by 80 metres	1	0.5
Facilities and auxiliary services buildings		15 by 20 metres	Included with substation	
132 kV overhead line		Up to 15 kilometres	1	5
Temporary construction site office		70 by 100 metres	0	0.7
Optional batch plant (if used)		50 by 60 metres	0	0.3
Optional quarry and crushing facility		70 by 80 metres	0	0.6
Totals			**32.3**	**23.3**

While the total extent of the installed wind farm site will be dispersed over an area of about 61 km^2 the actual area occupied by wind turbine footings and associated hardstands required for the turbine construction is about 10 hectares (0.1 km^2) (Table 3.2). At the landowner's request, some of these areas can be re-seeded and returned to agricultural production. The substation will require an additional one hectare. The new access tracks for the project will require about 20 hectares. The total project area is 6,082 hectares, so the 32 hectares required for the project footprint represents only about 0.5% of the total area of the wind farm properties.

The area associated with the underground cables amounting to up to 5 hectares is a temporary impact and once rehabilitated will enable the current pastoral activities to continue. All temporary construction facilities will be removed and the land restored and rehabilitated once construction has been completed.

The details of each of the component parts of the development are described in the following sections and in the associated figures. An outline of the construction and operational phases of the development is also provided in Section 3.7. The expected time frame for the construction through to commencement of commissioning of the wind farm is approximately 18 months.

3.2 Wind turbines

Each wind turbine will comprise several main component parts as described below. A schematic illustration of the proposed wind turbine proportions is shown in Figure 1.3.

- **Tower:** The supporting structure will be a tapered steel tower fitted with an internal ladder or lift. Its height will be about 80 to 100 metres and its approximate diameter will be five metres at the base and 2.5 metres at the top. The option for a tower height up to 100 metres has been considered in this assessment as an option that would enable access to increased wind energy for the same number of installed turbines. To facilitate production and transport the towers will be manufactured in three or (more likely) four sections which will be assembled on site. The tower will be installed on a stub section embedded in the concrete footing.

- **Footing**: The tower will be located on a reinforced concrete footing with a diameter of up 12 metres and approximately two to three metres thick, requiring about 110 m^3 of concrete. The base of the footing will be about two to three metres below ground level and the footing may either be backfilled with soil or have the top of the footing being above ground. The concrete footings are likely to be steel reinforced, tensioned and have rock anchors to bolt the footing to the underlying rock. Conduits for power and control cables will be incorporated in the concrete footings.

- **Turbine**: Each turbine will be of the three-bladed type with a rotor diameter of between 88 to 112 metres and a swept area of 6,082 – 9,852 m^2. The rotation of the turbines will be variable speed within a fairly tight range with a maximum rotation from about 14 to 18 revolutions per minute (rpm). The blades will typically be constructed of fibreglass and will be attached to a steel hub and shaft. Metallic conductors will be incorporated within the blades to conduct lightning strikes to earth. The turbine hub height will be 80 to 100 metres above the ground. No matter which tower height and turbine model is selected for the project, the maximum height of the overall structure will be 150 metres. The coordinates and elevations of the turbines proposed for the Flyers Creek project are provided in Attachment 1.

- **Nacelle**: The nacelle is the housing mounted on top of the tower that encloses a gearbox, generator, motors, brakes, electronic components, wiring and hydraulic and lubricating oil systems. The nacelle will be constructed of steel and fibreglass and will have dimensions of up to 10 metres long, three metres wide and about three metres in height.

The turbines will be of the "upwind" design which means that they will have a, control system that faces the rotor into the wind. Motors within the nacelle are used to turn the turbine and to adjust the pitch of the turbine blades. Weather monitoring equipment located on the top of the nacelle will provide data on wind speed and direction, for the automatic operation of the turbine. The generators typically generate electricity at 690 – 1,000 volts (0.69 to 1 kV), which is raised to 33 kV by the generator transformer located either within the nacelle or adjacent to the base of the tower on a concrete pad (Plate 3.1).

It is proposed to finish the turbines and supporting structures with a matte off-white colour.

Plate 3.1 – Turbine footing and external padmount 'kiosk' generator transformer adjacent to the hardstand. Depending on the turbine selected, the generator transformer may be located in the nacelle.

3.2.1 Wind turbine operation

A wind turbine converts wind energy into electrical energy. Wind blowing across the blades causes rotation of the turbine rotor that is connected via a gearbox to a generator that produces the electrical output. The gearbox increases the rotation speed for the generator to about 1,550 rpm. The output is generated at 0.69 – 1 kV which is then stepped up to 33 kV by the generator transformer located at each turbine site.

The wind turbines will be designed to operate automatically whenever wind speeds are between about four and 25 metres per second (Table 3.3). When wind speeds exceed the wind turbine cut-out speed (25 metres per second) the turbines will stop generating, so as to prevent turbine damage. Additionally, no generation occurs below the start–up wind speed of 3.5 to four metres per second. The typical wind speeds for operation of the wind turbines that could be selected for the Flyers Creek Wind Farm are shown in the Table 3.3.

The wind turbines will have a maximum rotation speed of between 14 and 18 rpm. At 14 rpm each blade will rotate through 360 degrees about every 4.2 seconds; therefore, the turbines appear to be turning relatively slowly.

Table 3.3 – Indicative wind speeds for typical turbine operational mode

Turbine operating regime	Wind speed at hub height	
	metres/second	kilometres/hour
No generation	less than 3	less than 10.8
Start-up wind speed	More than 3	10.8
Rated wind speed	14	50.4
Cut-out wind speed	25	90
No generation	greater than 25	greater than 90
Survival wind speed	60 to 70	216 to 252

While the wind farm is set for automatic operation, its size requires a small number of permanent operations staff to be located on site. These staff may be assisted from time to time by inspection and maintenance specialists.

3.3 Electrical works

The project's main electrical works (external to the turbine) will include underground cables, switchgear, earthing systems and a substation as indicated below:

- a generator transformer at each turbine, either within the nacelle or near the base of the tower
- about 31 kilometres of 33 kV underground cables
- about 31 kilometres of control cables in the same trenches as the power cables
- approximately 11 kilometres of 33 kV overhead transmission line
- a 33 kV/132 kV substation including two transformers each rated at about 50 to 80 MVA
- 33 kV/132 kV switchgear
- control and communications equipment to be located in the substation facilities building and a communications mast at a nearby elevated location
- up to 15 kilometres of 132 kV overhead line for grid connection (electrical works for the grid connection are outlined in Section 3.7)
- a 132 kV switching station located at the point of grid connection

The output from each of the turbine generator transformers will be directed to 33 kV primarily underground cables that are used to link the turbines to the substation. A schematic arrangement of the underground cables is shown on Figure 3.1. An 11 kilometre section of 33 kV overhead line is also proposed, to collect the generated output from the southern turbine collector groups.

The component electrical works are described in the following sections.

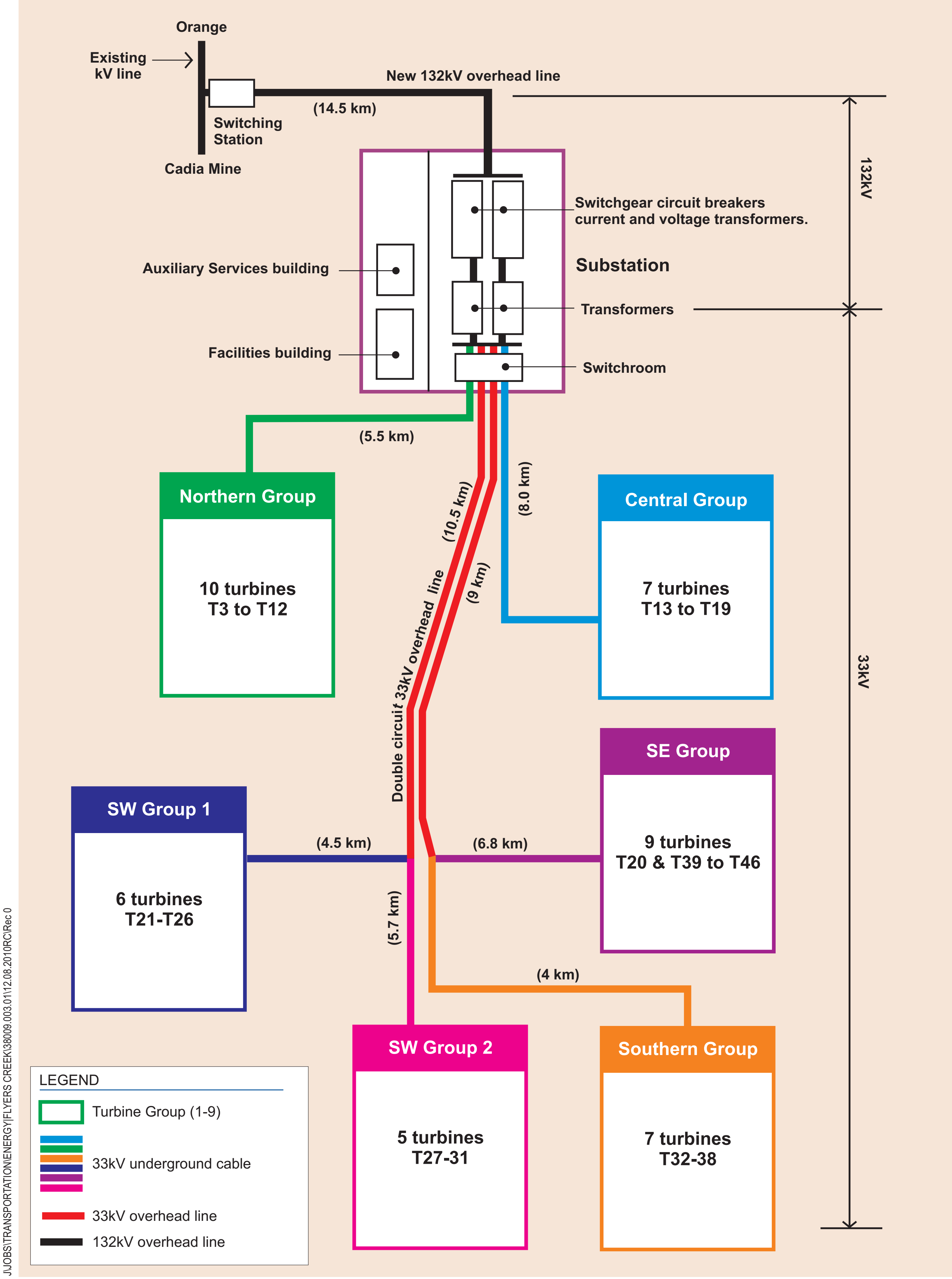


Figure 3.1: Schematic Arrangement - Electrical Cables and Grid Connection

3.3.1 Generator transformers

The generator transformers at each turbine will be located either near the base of the towers on a small concrete slab (padmount) (Plate 3.1) or within the turbine nacelle. The dimensions of any padmount transformer housings will be dependent on the supplier but will be in the order of 3.5 metres long by 2.5 metres wide and 2.5 metres high. The colour of the padmount transformer housing will be a low visibility shade of green due to their low height and position in the generally grassed paddocks. The transformers may be oil-filled or a dry type, depending on the turbine equipment supplier. If oil-filled transformers are used and the volume of oil used for generator transformers is likely to be in the order of about 2,000 litres. Containment measures will be incorporated to prevent any oil loss reaching the surrounding land.

3.3.2 Collection system – 33 kV underground cables

Underground power cables and an overhead power line will generally be used to connect each of the turbines and to transmit the generated output to the substation. The turbines will be subdivided into about six groups (6 to 11 turbines per group) of electrically connected turbines, each group having its own feeder cable to the substation (Figure 3.1) or connected to the 33 kV overhead transmission line.

The cable routes will be generally between turbines and where possible would be located alongside access tracks to minimise site disturbance (Plates 3.2 and 3.3). In practical terms this can be difficult to achieve in all cases. It is most economic for cables to be routed by the most direct route, while tracks are required to be designed to suit local grades and provide sufficient curvature and width for vehicles of lengths up to 55 metres. This could require a less direct route for access tracks due to topographic variations and to achieve a practical alignment. In some cases, two or more power cables may be placed side by side along the same route where the cables from two or more groups of turbines share the same route. Control cables that enable monitoring and control of turbine operation will be co-located in trenches excavated for the power cables.

Cable routes will mostly take a direct route between the turbines and the substation. The routes will be developed based on a range of considerations such as minimising route length, the terrain to be crossed, the ease of excavation, ground slope and stability and environmental sensitivities such as flora and fauna or heritage considerations.

In some places it can be beneficial to use a section of 33 kV overhead line for collection to facilitate connection and reduce environmental disturbance. This would be particularly beneficial for connecting turbines in the southern half of the project area to the substation. Use of an overhead line is proposed to cross the APA high pressure gas pipeline easement. Several other locations may also be suitable for use of short sections of overhead line rather than underground cable where there would be low visual impact for surrounding public view points and reduced environmental disturbance. Sections of overhead line are also proposed for several creek crossings to reduce environmental disturbance, as indicated in Section 7.6.2.

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

	
Plate 3.2 – Typical trenching machine	**Plate 3.3 – Cable trench being excavated**

3.3.3 Collections system – 33 kV overhead line

Up to 11 kilometres of 33 kV overhead transmission line have been proposed to connect turbines in the southern half of the project area to the substation at the north-western part of the wind farm site. This is considered a preferable means of collecting the power generated from a significant part of the wind farm avoiding extensive trenching for cable installation (reduction of about 11 kilometres for several collector groups). It is regarded as a lower impact and more cost effective component of the collection system than the comparable collection system using underground cables. A typical double circuit 33 kV overhead transmission line is shown in Plate 3.4.

	
Plate 3.4 – Typical double circuit 33 kV overhead line pole and conductor arrangement	**Plate 3.5 – View of 132 kV Substation for the 46 turbine Lake Bonney Stage 1 Wind Farm**

3.3.4 Substation

The proposed location of the substation is at the north-western side of the wind farm site (Figure 1.4) to facilitate connection to the existing 132 kV line from Orange to Cadia Mine. The general location has been chosen after consideration of the potential intra wind farm collection arrangements, proximity to the existing Country Energy 132 kV overhead line, the property available, environmental issues and visibility considerations for surrounding public viewpoints. Plate 3.5 shows a 33 kV/132 kV substation at a South Australian wind farm site that is similar to the facility that could be installed at the Flyers Creek Wind Farm site.

The substation site is located in an area of exotic pasture and avoids existing remnant woodland (Plate 3.6). The substation site is also located such that it will have limited visibility from neighbouring residences due to the distance involved, the low profile of the substation, the local variations in ground level and the position of nearby trees. Following construction, additional screening will be provided by trees planted to the northwest of the substation site to limit the substation's visibility from the Beneree to Errowanbang Road.

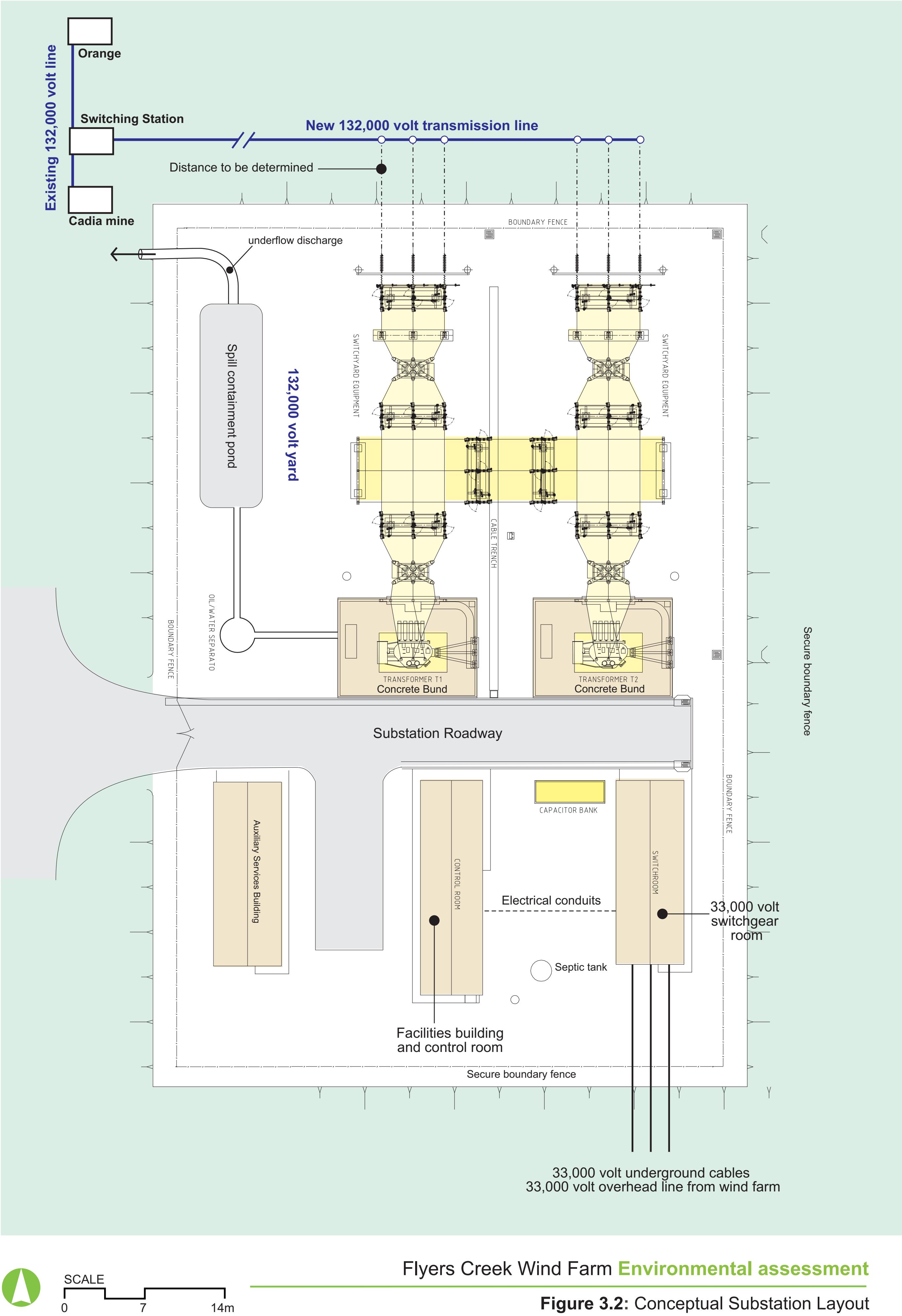
The substation will occupy an area approximately 120 metres by 80 metres. The substation arrangement will include two large 33 kV/132 kV transformers, an array of busbars, circuit breakers, isolators, various voltage and current transformers and a static compensator-capacitor bank, as agreed with Country Energy. The two transformers will nominally have a combined capacity of 100 to 160 MVA (50 to 80 MVA each), together with ancillary equipment and will increase the voltage of the generated power from 33 kV to 132 kV

A buried earth grid will be installed within the substation area. The ground surface within the substation enclosure will be covered with crushed rock. The substation will likely include two or three small buildings including a switchroom, wind farm control room and an auxiliary services building. A conceptual layout is shown in Figure 3.2.

As the two transformers may contain a total combined volume of oil in the order of 30,000 litres, provision will be made in the design for primary and secondary containment of any oil that may leak or spill from the transformers or the associated components. This will involve constructed concrete bunds around each transformer and a spill oil retention basin or oil/water separator external to the concrete transformer bunds and possibly outside the substation compound. Design of any fire deluge system will also include consideration of the risk of flushing oil from the substation site and incorporate suitable containment.

	
Plate 3.6 – Substation general location – cleared exotic pasture	**Plate 3.7 – Typical 33 kV switchyard within a secure compound at a South Australian wind farm site**

The operational substation contains a range of high voltage equipment and accordingly will be surrounded by a two metre high security fence or as required for the facility. Such facilities also normally have security lighting that may be operated at night in the event of work occurring at night or if security sensors are triggered. The flood lights used for security purposes do not need to stay on at night but may be activated by security sensors to allow operators to monitor the substation compound either when based at the substation or when undertaking surveillance remotely. The security lighting for the substation site will be designed to minimise impact for surrounding areas and directed inward and down toward the substation equipment and the surrounding compound.



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Flyers Creek Wind Farm **Environmental assessment**

Figure 3.2: Conceptual Substation Layout

Delivery of the transformers during the construction phase will involve restricted access vehicles based on the likely weight of the transformers and potential length of the load based on multiple axles to spread the loading on the local roads. Due to the location of the substation, delivery of the large transformers is likely to be from the Errowanbang to Beneree Road with an approach from the north. The proposed access to the substation site will require the entry point from Errowanbang to Beneree Road to be upgraded particularly to allow for delivery of the two large transformers and to ensure road safety for users of Beneree to Errowanbang Road.

A small temporary site office and amenities facility may also be located at the substation site during the construction period due to the range of construction activities associated with the substation.

Access from the substation direct to the nearby Calvert wind turbine group is required but the terrain between the substation and the Calvert Group is such that this access route is not proposed for the delivery of large items during construction phase and is likely to be designed for light vehicle traffic only.

3.3.5 Substation buildings

The substation will include two or three small buildings to house equipment and facilities for the operation of the wind farm. One of these buildings would also be used by the operators of the wind farm and include an office area for monitoring and reporting the wind farm performance, arranging maintenance and for meetings as required.

A facilities building will be constructed adjacent to the substation structures to house wind farm control instrumentation, electrical and communications equipment, routine maintenance equipment and stores, a small work area and staff amenities. The dimensions of this building will be in the order of 10 to 20 square metres.

An auxiliary services building is also proposed at the substation site. It will contain 132 kV switchyard control equipment and batteries and be used by the wind farm operator or Country Energy depending on the arrangements for maintenance of the 132 kV switchyard and transmission line. The dimensions of this building are expected to be about 15 metres by five metres.

The building structures are likely to be slab on ground constructions with steel frames, metal or brick walls and a sheet steel roof. Alternatively, they could be a transportable type building constructed on piers similar to that shown in Plate 3.5. In either case, the buildings will be of sturdy construction, suitable for the weather conditions they will be exposed to and will be compatible with the rural environment. Roof drainage will be collected to rainwater tanks for domestic use but at times these may be required to be topped up with water from outside sources. A septic system or composting toilet system that complies with the local Council requirements will be installed to treat the small amount of waste water produced once the wind farm is operational.

The substation compound will also include a switchroom containing 33 kV wind farm switchgear (Plate 3.7) and overhead busbars. The design of the substation, electrical installations and buildings will need to be developed in consultation with Country Energy and comply with relevant electrical standards.

3.3.6 Grid connection components

Flyers Creek Wind Farm Pty Ltd has identified the existing Country Energy 132 kV transmission line from Orange to Cadia Mine as the most feasible option for grid connection for the proposed wind farm. The proposed connection point to this line is on the Cadia Mine Site to the northwest of the wind farm site. It is the closest point to which the wind farm could connect to an existing 132 kV transmission line and the route between the substation has been assessed as having much lower environmental and neighbouring amenity impact compared to alternative routes considered. The proposed 132 kV power line route does not pass near one residence not involved in the proposed wind farm project.

A section of 132 kV overhead transmission line (up to 15 kilometres long) and a 132 kV switching station are proposed for the grid connection of the proposed wind farm. The new 132 kV transmission line would be routed from the substation along the southern side of Panuara Road and to the west of the Cadia Mine tailings Dams and Operations Centre.

The precise location of the connection point and the final route of the 132 kV transmission line will need to be determined in consultation with Country Energy and Cadia Valley Operations, but is envisioned to primarily follow existing 11 kV/33 kV lines to minimise amenity and logistical impacts. The 132 kV line will most likely involve a single circuit transmission line supported on poles with similar form to that shown in Plates 3.8 and 3.9.

Meetings have been undertaken with Country Energy to determine the requirements for connecting to the existing 132 kV line. Preliminary grid connection studies have indicated that the existing 132 kV line has sufficient capacity to accept the output of the wind farm with minor modifications to the Orange substation. The initial discussions involved a wind farm of up to about 125 MW installed capacity. If all 44 turbine sites are developed then the wind farm's maximum output would be 88 MW for 2 MW turbines, 110 MW for 2.5 MW turbines and 132 MW for 3 MW turbines. The actual output will depend on both the number of turbines installed and the model of the selected turbine.

A connection enquiry has been submitted to Country Energy in accordance with National Electricity Code requirements for connection and a number of associated technical studies are being carried out.

Plate 3.8 – Photo of section of 132 kV line north of Cadia Mine including change in direction

Plate 3.9 – Photo of pole structure for 132 kV line with conductors on alternating sides of pole

The current planning outlined in this Environment Assessment envisions a wind farm of up to 132 MW installed capacity; however, it is possible that a higher electrical capacity might be achieved should a wind turbine larger than 3 MW be selected.

A switching station will be required at the point of grid connection to Country Energy's 132 kV line. The site for the switching station and grid connection arrangement together with any protection equipment will be developed in consultation with Country Energy and Cadia Valley Operations. The connection arrangement is likely to include busbars, circuit breakers, isolators, switching and protection devices and other necessary equipment.

Works for connection of the Flyers Creek Wind Farm to the grid are considered here as an integral part of the development activities and are assessed in conjunction with the Wind Farm Project Application under Part 3A of the EP&A Act 1979. Country Energy may also choose to undertake a separate assessment of any necessary transmission line works undertaken by Country Energy under Part 5 of the EP&A Act, 1979.

3.4 Site access works

This section provides an overview of access works for the development. A comprehensive assessment of traffic and transport issues for the project is provided in Chapter 13.

3.4.1 Site entry

The project locality can be accessed via the Mid Western Highway and local roads within the Blayney Shire. A number of local roads surrounding the site are suitable for gaining access to the site. Preliminary reviews indicate they are well constructed with drainage on either side and suitable curvatures that will permit use by long vehicles. The feasible route options will be further discussed between Blayney Council and the contractor to confirm the final routes but at this stage the access via Errowanbang and Gap Roads appears to be the most suitable for movements of RAVs.

Preliminary discussions on the locations for entrances have been undertaken with the Blayney Shire Council and further consultation will be undertaken with Council to confirm the final design and any measures required to address safety issues for local traffic.

Aspects considered for safe access are further discussed in Chapter 13 and include sight distances for entry points from local roads, provision of signage and where necessary, use of escort vehicles to warn approaching vehicles of oversize and overmass construction vehicle movements. Once the wind farm is operational each access point from public roads will include a lockable gate, set back from the public road.

3.4.2 On-site access tracks

The on-site access tracks required for construction and ongoing operation and maintenance of the wind farm will be unsealed formations generally five to six metres wide but in the order of eight to ten metres wide during the construction phase. The proposed arrangement of tracks is shown in Figure 1.4, which distinguishes existing tracks and new tracks. Wherever practicable the existing tracks will be used as the access routes. Parts of the existing tracks will require upgrades including widening, improvements to track formation and provision of suitable drainage.

Construction of the access tracks will involve clearing of pasture, minor clearing of trees and be based on designs that ensure that grades and curvatures are suitable for the required vehicles accessing the site and that drainage works are adequate.

In general, the proposed access tracks are of low to moderate grades and follow the ridge lines. In some areas of the site, tracks may descend onto saddles to access other elevated ridge-tops and in some places these will require several short steep sections of track. All grades and associated drainage will be designed to suit the proposed traffic and site conditions. The final locations of tracks will be determined based on design considerations, including grades, slope stability, erosion hazard, visibility and environmental constraints. Some upgraded and new access tracks will improve access for the landowners around their properties. Landowner preferences for the routes of access tracks have been taken into account for the layout development.

The review of access options has identified routes which minimise clearing and that use the existing tracks where possible. In a few locations, the final access track routes will be determined in conjunction with an ecologist and the project civil works contractor to ensure that the access routes are practical and that any impact on remnant scattered trees and associated vegetation is minimised.

Some additional temporary tracks may also be required for construction of the cable routes and for access to any pre-existing sites of erosion in proximity to works where improvements may be affected in conjunction with the construction works. The erosion control sites will enable the beneficial utilisation of any excess rock excavated from turbine footings and will be chosen based on consultation with the landowner, availability of excess material, the need for erosion repair and minimising the distance for material transport.

In the few locations where steeper grades are present (eg between Turbine 33 and Turbine 34) there may be a need for the access track to be benched into the sides of the slope and track construction would include suitable batters with stabilisation to prevent erosion. The use of 'cut and fill' may also be required at a few locations to produce an even grade for the oversize vehicles delivering the longer items to the turbine sites. The access tracks between such turbine sites will also provide additional access routes for the landowners of the properties where the wind farm will be located. In such cases these may replace other existing property access tracks.

Overall, the routing of access tracks will take into account the following considerations:

- minimising the length of tracks
- taking advantage of existing tracks where possible
- located where clearing of native vegetation including scattered trees is minimised
- constructed with due regard to safety, erosion, sediment control and drainage
- position and design, as far as practical, to reduce visual impacts
- if not required for the ongoing operation and maintenance of the works, removal and revegetation on completion of the construction phase

3.5 Utility services

The project will require access to existing utilities and will place some additional demands on these services. The utility services can include electricity, water and telecommunications.

The design of the proposed development has been based on connection to Country Energy's existing 132 kV transmission system between Orange and Cadia Mine. This connection provides for both exporting of the generated electricity and for the wind farm to draw electricity to maintain its monitoring, control and power systems during the periods when the wind farm is not generating. Overall the net output will be up to 132 MW while power consumed when not generating will be a very small proportion of this amount.

A telephone connection at the substation site involving multiple telephone lines will be provided to enable remote monitoring and control of the wind farm. Mobile phone coverage is available on most of the ridges but can be limited in some of the valleys. While the wind farm operators and construction teams will not necessarily rely on this form of communication, it is expected that they will use both mobile phones and radio communication.

A radio link is also likely to be installed at the substation for communications relating to network controls. This could involve the installation of a small communications tower on an elevated ridgeline in proximity to the substation site. The facility will need to be registered with ACMA.

Water will be required for construction particularly for dust control and site restoration and to a lesser extent for domestic uses by site staff. Once operational, water will be provided to the proposed facilities building from a storage tank that will collect roof drainage. An approved septic system or composting system will be installed to treat the minor quantities of waste water. The proponent will be responsible for removal of all other wastes from the site.

3.6 Ongoing wind monitoring

Flyers Creek Wind Farm Pty Ltd has three existing 80 metre high guyed wind monitoring masts on site, located as indicated in Table 3.4, northern, central and southern sites. The locations of the existing on-site monitoring masts are also shown on Figure 1.4.

The three existing guyed monitoring masts could potentially be used for turbine performance proving tests required after wind farm commissioning and also to comply with future wind forecasting and dispatch requirements. However, additional monitoring masts similar to the existing masts may also be required. If so, mast construction will involve constructing four small footings, erecting the monitoring mast and installing instruments.

Table 3.4 – Wind monitoring mast locations

Meteorological mast	Approx. Coordinates (MGA)		Approx Elevation (m)	Height (m)
	Easting	Northing		
Wallaby (northern)	693,029	6,291,037	974	80
Fern Hill (central)	692,359	6,286,585	896	80
Hopkins (southern)	692,314	6,281,510	921	80

Temporary wind monitoring masts at proposed turbine sites may need to be established for site calibration purposes. If required, they would be installed at least three months prior to construction of the turbines at the same sites. Once sufficient data is obtained for correlation of wind data with nearby permanent masts they can be removed to enable turbine construction to commence at these sites. The locations of the temporary wind monitoring masts will be confirmed by the contractor at least three months prior to turbine construction.

It is understood that separate development applications are not required for the additional temporary meteorological masts as they qualify for exemption under Clause 39 (2a) of the SEPP (Infrastructure) 2007. This is discussed further in Chapter 5 (Section 5.3.3).

3.7 Wind farm development phases

Provided the Project Approval and any other required approvals are obtained, the phases for development and construction of the project will be as indicated in Table 3.5.

Table 3.5 – Wind farm development phases – planning approval through to operation

EA Section	Phase	Description	Approximate Duration
3.7.1	Pre-construction Project planning and Construction Certificate Approval	• Review of contract arrangements for civil works, equipment supply and electrical works • Certification of engineering designs • Construction Certificate Application & Approval, if required • Review and certification • Preparation and approval of Construction Environmental Management Plan (CEMP) • Pre-construction compliance report to Dept. of Planning	3 months
3.7.2	Construction	• Establishment, site office and signage installed, access works, foundation works, equipment delivery and ancillary aspects such as fencing and drainage works • Erection of any new monitoring masts at least three months prior to turbine construction at the same sites • Erection of turbines and installation of underground cabling and 33 kV overhead line • Construction of substation and associated buildings and electrical connections • Wind farm grid connection works including 132 kV line and switching station • Site restoration works	Approximately 18 months
3.7.3	Commissioning (partly overlapping construction)	• Performance assessment of equipment to ensure compliance with specification and project approval conditions	3 months
3.7.4	Operation	• Generation and supply of electricity to the grid	About 25 years
3.7.4	Maintenance	• Monitoring of equipment, lubrication, cleaning, repairs, replacement of worn or broken parts, maintenance of access tracks	Periodic and as required
3.7.5	Decommissioning or replacement at the end of life (after about 20 to 25 yrs)	• Removal of equipment and restoration of site, or • Replacement with newer equipment subject to any approvals required	At completion of operating life of wind farm

3.7.1 Pre-Construction arrangements and Construction Certificate

Once approvals have been obtained, the final design and construction arrangements will, if necessary, be updated to address the approval conditions and any other design related information obtained after preparation of this Environmental Assessment. This stage would also take account of geotechnical investigations, additional wind resource monitoring and updated energy modelling. However, any changes at this stage would be expected to be minor. Any significant change to the project to be implemented may require assessment by the proponent and review by Department of Planning to assess whether a modification to the project approval is required.

The Construction Environmental Management Plan (CEMP) will be developed in accordance with the Department of Planning's *Guideline for Preparation of Environmental Management Plans* and will be finalised prior to construction. It will address the proponent's Statement of Commitments (Chapter 19) and the Minister's Project Approval conditions. The CEMP will be referenced by the Contractor for the required construction works and equipment supply to ensure compliance and achieve the project environmental objectives. All subcontractors will also be required to address the aspects of the CEMP relevant to their component of the project construction works. Any modifications to the project during the implementation phase will require review and, as necessary, the CEMP will be updated.

A Construction Certificate application will be lodged with the Approval Authority and this phase is likely to involve some aspects of project design being subject to review by approved certifiers.

3.7.2 Construction activities

The construction of the wind farm will occur over a period of up to 18 months. It will include activities such as site establishment, earthworks for access tracks and footings, erection of 44 turbines, three to four meteorological masts, construction of the substation and switching station and installation of underground cables and a single or double circuit 33 kV overhead transmission line. Construction will also involve connection of the wind farm to the Orange to Cadia Mine 132 kV transmission line via the wind farm's substation. Restoration of the project site will follow the construction works.

The construction works are likely to progress sequentially through the different turbine groups over at least a twelve month period. Section 3.8 describes the process and potential impacts of the construction activities and Section 3.9 addresses the management of potential environmental impacts of construction.

3.7.3 Wind farm commissioning

Pre-commissioning checks will be carried out on the high voltage electrical equipment prior to connection to the Country Energy transmission network. When the wind farm's electrical system has been "back energised", the wind turbines will be progressively commissioned. The wind turbine array will be broken up into about six collector groups each of up to six to eleven turbines and with commissioning of each group being undertaken consecutively. The wind farm's generating capacity will therefore progressively come 'on-stream' as each group of turbines is commissioned.

The commissioning process will include assessment of performance and compliance with the equipment specifications and project approval conditions. The operation of the various components will be tested to ensure the wind farm's safe and reliable operation and equipment compliance with contract specifications and environmental requirements. Commissioning of the wind farm will commence after the substation and connection works have been completed and energised.

Due to progressive commissioning of the turbine groups, some turbines may be commissioned and operational while the construction of others is still being completed.

3.7.4 Operation and maintenance of the wind farm

Once commissioned, the wind farm will operate with a small on-site work force of around six staff. Additional visits by other technical staff will be made where assistance is required for supplementary inspection and maintenance. Staffing will be managed to ensure continued safe and reliable operation. An Operational Environmental Management Plan will be implemented as outlined in Chapter 19 and monitoring of performance routinely undertaken.

3.7.5 Decommissioning or replacement of wind turbine equipment

At the end of its economic life the wind turbine equipment will either be replaced with comparable new equipment or the wind farm will be decommissioned. Replacement of the wind turbines, or repowering, would be the subject of entirely new planning process. Decommissioning would involve dismantling and removal of the above-ground equipment and site rehabilitation. Turbine footings will remain buried at a level below the ground surface acceptable to the landowner. Access tracks may be retained depending on the landowners' wishes. Any overhead lines no longer required will be removed.

3.8 Construction impacts

This section of the Environmental Assessment describes the works to be undertaken during the construction stage of the project, a brief introduction to their potential impacts and the management measures to be incorporated to mitigate them. Additional details of the management of the construction process are provided in the following sections dealing with the respective environmental issues.

3.8.1 Construction activities

Construction activities will only commence once pre-construction activities have been fully completed, a project contractor has been engaged, construction environmental and safety management plans have been prepared and approved and the final design has been confirmed. Once works commence, the proponent and contractor will efficiently implement the construction activities in a socially and environmentally responsible manner including ensuring compliance with all approval conditions and statutory requirements.

The duration of construction works may vary depending upon the scheduling of activities such as site access and any delays that may be encountered due to factors such as unfavourable weather conditions or supply of equipment or materials. A minimum of twelve months is expected and 18 months more likely depending on the contractor's preferred scheduling and resourcing arrangements.

The principal activities involved in the construction phase will include the following:

- initiation of community notification/awareness program prior to commencement of construction activities
- site establishment (temporary facilities including site office, amenities and equipment storage areas)
- if required and subject to approval, establishment of a temporary concrete batch plant
- if required and subject to approval, access to one or more quarries and establishment of crushing facilities
- daily movement of people, equipment and materials to the site via local roads
- earthworks for:
  - access track construction including suitable surfacing and drainage
  - turbine and substation footing construction
  - excavation of cable trenches prior to cable installation
- formation of concrete footings for turbines and the substation
- erection of temporary and permanent wind monitoring towers

- erection of 44 turbines and supporting structures
- installation of underground cables and generator transformers at each turbine site
- substation and facilities building construction and electrical testing
- grid connection works, 132 kV transmission line and switching station
- energisation of the substation and commissioning of the wind farm
- removal of temporary facilities and restoration of the site

The above activities are described in the following sections.

3.8.2 Community construction awareness program

Prior to the commencement of the site construction activities, a program of community awareness initiatives will be implemented. Information will be disseminated to the local community by local newspapers and direct mail out to advise them of the nature of the construction activities, their timing and potential impacts. Contact details will be provided for individuals to gain further information or if required to express concerns or complaints.

Updates on the progress of construction works and relevant impacts will be provided during the construction period via web site notices and newsletters.

3.8.3 Site establishment

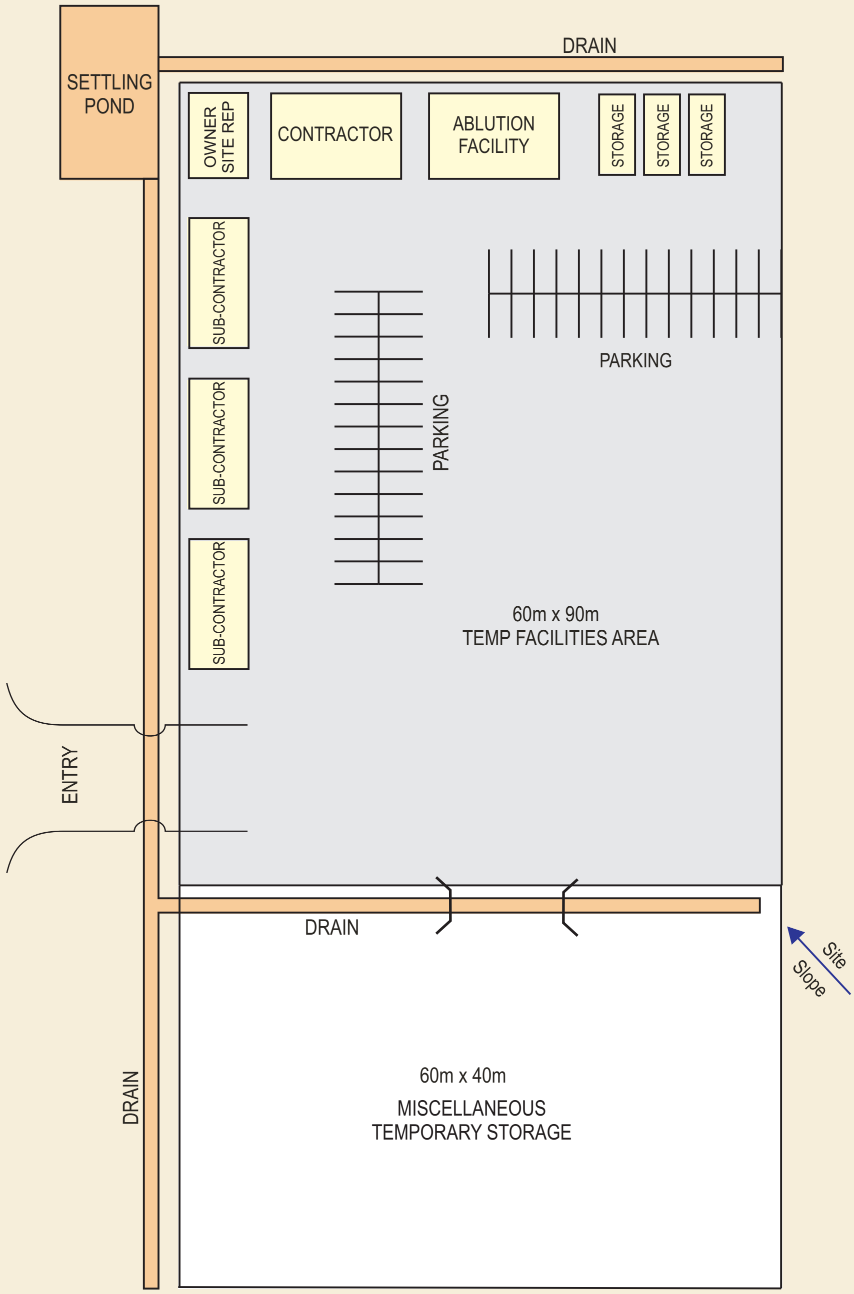
The construction phase will involve up to about 70-80 staff working on the site at any time. Much of the work will take place outdoors at various locations on the site and the contractor will also require temporary site office and storage facilities.

Site Office and laydown area: The site office may include several demountable buildings, an amenities block and portable pump-out toilet facilities which will be temporarily located on the site for the duration of construction work. A typical wind farm construction site office is shown in Plate 3.10 and a typical layout is shown in Figure 3.3. Arrangements will be made for power and communications at the main site office. Sufficient parking will be provided to allow for the expected usage. A cleared flat area is also generally required for storage of various items needed during construction, cables, grids, gates, pipes, etc.

Options that have been considered for the location of the contractor's temporary site office are shown in Figure 1.4 and include:

- an area of cleared land at the northeast of the project area beside the proposed access group to the Calvert Group of turbines
- a site adjacent the proposed substation site accessed from the Errowanbang to Beneree Road
- a location toward the central eastern part of the wind farm
- an area at the southern part of the wind farm

Each of the site office location options is regarded as being suitable for the purpose as described above and have been selected as avoiding areas that are regarded as having environmental constraints.



Notes: 1. Generalised layout only
2. May be modified for selected site
3. Sediment trap provided by drainage to settling pond

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SCALE
0 15 30m

Flyers Creek Wind Farm **Environmental assessment**

Figure 3.3: Construction Site Office -Typical Layout

	
Plate 3.10 – Typical Site Office and Storage Area	**Plate 3.11 – Typical Portable Concrete Batch Plant**

One or more additional smaller temporary office facilities may also be constructed at locations distant from the main construction site office facility to provide temporary shelter for workers and temporary storage areas at these locations, if required. It is likely that a separate temporary construction site office would be installed at the substation site.

Construction staff will be accommodated away from the construction site and camping on site will not be permitted. Off site accommodation is available at Orange, Blayney, Millthorpe and Carcoar.

Mobile Concrete Batching Plant: A mobile concrete batching plant could be used to produce the concrete required for the project, however at this stage it is considered more likely that concrete would be delivered from Orange rather than an on site batch plant. The bulk of the traffic for delivery of concrete to the site would occur on about 50 days associated with the turbine and substation footings. The decision to install an onsite batch plant or to deliver concrete from Orange or Blayney will be determined by the contractor and, if required, approvals will be sought for the proposed activities.

If an on-site batching plant was utilised it would occupy an area of approximately 50 by 60 metres and be likely to consist of a trailer mounted concrete mixer, cement bins, sand and aggregate stockpiles together with a storage container for various equipment and tools. Sufficient area will be required to allow use of front end loaders, delivery of materials and entry and exit of concrete agitator trucks. A typical mobile concrete batch plant is shown in Plate 3.7 above.

A batch plant would be powered by diesel generator and have a production capacity of approximately 50 m^3/hour. A single location for the batching plant would be sufficient for supply to all 44 turbine sites and substation footings during the construction period. Such a plant may only operate up to 50 days over a period of 4 to 6 months of the construction phase and its establishment on site may not be warranted. As the transport time for delivery of concrete from an off-site batch plant to the location where it is to be used increases the option of having an on site batch plant may be more feasible or necessary. Also the total amount to be used on site can affect the decision regarding sourcing of concrete. The contractor will need to review the practicality and commercial aspects to determine if an on-site batch plant is warranted and if the on-site batch plant is favoured, then suitable sites will need to be identified, assessed and any approvals obtained.

Quarrying and Crushing Facility: A supply of road base material will be required for construction of access tracks to turbine sites and the substation. Aspects such as sub-grade and surfacing for access tracks may require over 30,000m^3 of gravel some of which may be obtained on site and some imported. Various types of material are required including suitable sub-grade and surfacing materials. Part of the road base requirement may be sourced from material extracted from turbine footings but the bulk of material is expected to be imported to the wind farm site from a source having suitable geotechnical characteristics.

During site investigations, two potential sites for obtaining road base material were identified within the southern part of the project area. While the rock material at the quarry sites may be suitable and the locations are close to where the gravel could be used, the quantities available and the qualities would need to be determined. One of the landowners has also indicated that there is a good source of road gravel at an existing quarry site on Cadia Road to the northwest of the project area and discussions with other community members has indicated a number of potential local gravel suppliers.

The contractor will review options for sourcing gravel for track construction and if any extraction of gravel is proposed from an on-site location then the contractor will seek approval of the relevant landowner and regulators for that activity. Any material brought on to site will need to be reviewed to ensure that it does not give potential for introduction of weeds to the site and this aspect will be addressed by the project construction environmental management plan.

3.8.4 Earthworks and formation of access tracks

As discussed in Section 3.4, the principal access from the Mid Western Highway to the wind farm for construction vehicles will be via one of several possible route options. In addition, there could be light vehicle access to the wind farm via various local roads. The site entrances from public roads will be designed to enable safe access and minimise disruption to local traffic.

On-site access track construction will involve limited clearing, grading and removal of topsoil as required, to provide a formation of up to ten metres width. This will be followed by placing and compacting of suitable gravel road base and the provision of drainage works.

Due to the nature of the loads being delivered to the site, special consideration will be given to access track gradients and layout geometry to ensure safe access in and around the site for long and/or heavy vehicles. The maximum access track grade required for the type of vehicles involved is typically around 14% and most, if not all, access tracks will be much less than the maximum.

However, it is possible that access to a number of turbine sites will require sections of steeper access track which may necessitate additional construction measures. This could include assistance by towing and/or pushing the heavy equipment with one or more bulldozers up a short section of steep track to reach the turbine sites with the steepest access.

In designing the access tracks, particular attention will be given to the management of stormwater drainage to minimise erosion and sediment transport. The site works contractor will be required to formulate a Soil and Water Management Plan and site specific Erosion and Sediment Control Plans prior to any works commencing on site.

Excavated topsoil will be stockpiled during the construction of the access tracks and later used in the rehabilitation of the site. The stockpiles will be stabilised to prevent dust generation and loss of material. If necessary, the stockpiles will be situated in a sheltered location. Weed control measures will be incorporated in all earthworks and rehabilitation of disturbed areas.

At the conclusion of the construction phase, any tracks not required for subsequent operation and maintenance of the wind farm will be restored and revegetated. It will be an objective of the post construction site restoration to return as much disturbed land as possible to its former grazing use.

3.8.5 Earthworks for footing construction and hardstands

Whilst the detailed footing design is yet to be finalised, it is estimated that the excavation for each turbine footing will be approximately 12 metres in diameter and up to two to three metres deep. Excavation for the turbine footings will be carried out by mechanical equipment. If the geology of some sites includes strong rocks unsuited to excavation by mechanical excavators, it may be necessary to use controlled low level blasting. Should controlled blasting be required, it will be carried out by qualified practitioners in accordance with all relevant statutory requirements and project approval conditions. In addition, the ANZECC guidelines for controlled blasting will be followed to limit impacts at residences, should controlled blasting be required. It may also be possible to avoid blasting by using a shallower excavation and a raised footing together with installation of rock bolts into strata deep below the footing. The detailed assessment of individual sites will be undertaken once planning approval has been obtained for the project and a project contractor has been appointed.

A level hardstand area will be prepared adjacent each footing location. The hardstand is required for the large cranes used for erection of the turbine and for laydown of the component turbine parts and inspection and assembly prior to erection. The hardstand areas may vary in size as indicated in Figure 3.4. However, the unconstrained arrangement will be used wherever conditions permit this (see section 3.8.8). Hardstand areas at the turbine sites will be retained to enable a crane to be brought back to site and for laying down turbine components, should maintenance of the wind turbine generator be required.

Topsoil from the excavation of the footing and hardstand will be stockpiled separately adjacent to the excavation. It will be used for backfilling over the constructed footing and/or being evenly spread around the disturbed turbine site to assist its restoration once construction at the turbine site is complete. Excess excavated material, if available, may be utilised elsewhere on the property (in consultation with the landowner) to rehabilitate any existing areas of erosion. Rehabilitation of the disturbed areas will be undertaken at the completion of construction to prevent site erosion and sedimentation in surrounding watercourses.

3.8.6 Formation of reinforced concrete turbine footings

Each footing will be a reinforced concrete block poured against natural ground, a 'blinding' layer and formwork. Typically a thin layer of concrete is poured in the base of the excavation to form a 'blinding' layer that provides a level base for construction of the reinforced concrete footing. The concrete footing will be about two to three metres thick and involve up to 110 m^3 of concrete per footing. It is likely that the footing will be tensioned and that rock anchors will be installed to secure the footing.

The footing will also include conduits for power and control cables that provide for auxiliary power to the wind turbine generator when not generating, to export the power when it is operating and for various controls and monitoring functions. Earthing cables for the turbine structure will also be installed in association with the footing construction.

The completed footing may be covered by soil and grass or slightly raised above ground level. It is expected that the concrete will be produced off-site and transported from Orange or Blayney to each footing in conventional agitator trucks. Any agitator trucks movements from Orange are likely to enter via the local roads through Forest Reefs and Beneree while any concrete sourced from Blayney could be delivered via Browns Creek Road or alternative routes to the north or south.

3.8.7 Earthworks for underground power and control cables

Underground cables will be buried in trenches generally about one metre in depth to give a minimum cover of 0.75 metres. The width of the trenches for individual cables will be about 0.5 to 0.75 metres with power cables and control cables being installed in the same trench. In some cases two or more cables may be placed side by side, requiring a wider trench. A temporary access track may also be constructed alongside the trenches for temporary access by trenching and cable installation vehicles.

The excavation methods will vary based on the ground conditions encountered. At this stage it is expected that the bulk of the trenching will be undertaken either using a mobile trenching machine or a hydraulic rock breaker and an excavator. The trenching activity will progress along the cable routes and at any point on the route will only occur for a short period of time. The time that trenches are open will be minimised and they will be backfilled with sand over the cables and excavated material and the fill compacted.

Marker tape will be placed above the buried cables at about 20 centimetres below ground level in accordance with the relevant standards to indicate the presence of cables if the areas were ever subject to excavation in the future. Marker posts may also be installed on the surface at regular intervals to indicate the presence of buried cables below.

Any surplus excavated material will be distributed over the surrounding area to blend in with the natural landform and will be revegetated. All trenches will be installed and backfilled with due consideration to the site erosion and sediment control plan. In particular, where trenches are oriented down slopes, measures will be incorporated to slow stormwater flows and prevent scouring of the open trench or disturbed ground prior to re-establishment of grass cover. The installation of underground cables at the wind farm sites can generally be completed with effective restoration of the surface such that within about 12 months the disturbance zone may no longer be evident or difficult to identify visually.

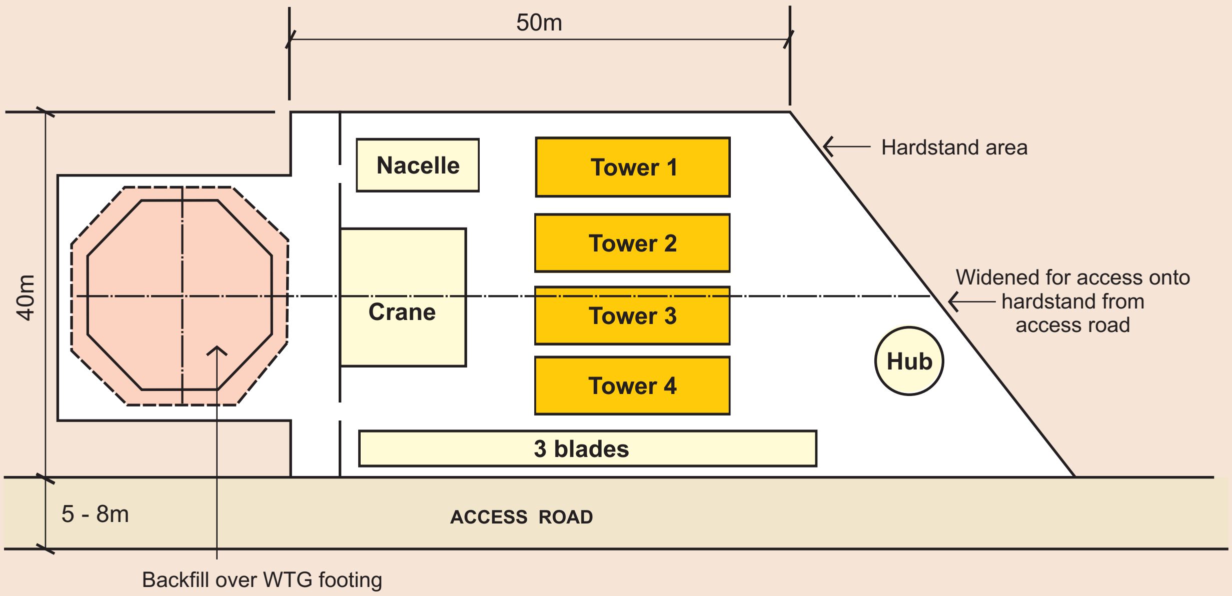
3.8.8 Turbine erection

Following completion of the footings, the erection of each tower, nacelle and rotor using one or two large cranes may be completed over a relatively short time involving from one week to several weeks depending on suitable weather conditions occurring. For efficiency of construction it is desirable to deliver all turbine components to each turbine site after formation of the footing and hardstand and prior to the lifting of the turbine components. Sequential completion of the lifting operations for each turbine minimises the transit of the large crane between sites. In many cases it is possible to walk the large cranes between turbine sites. However, where long distances between turbines are involved or the route is difficult for the crane to negotiate it may be taken apart, transported and reassembled at the new location.

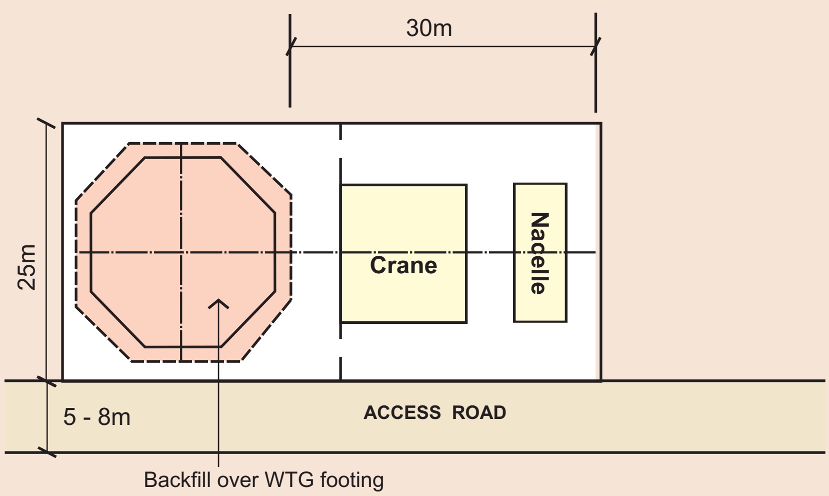
The transport of large equipment components to the site in advance of turbine erection will be subject to an approved traffic management plan. The component parts will be temporarily stored on assembly hardstands at the turbine sites (Figure 3.4). Details of typical component parts required for assembly of the wind turbines are listed in Table 3.6.

Table 3.6 – Details of typical turbine components

Item	No. of parts per turbine	Total number of parts (44 turbines)	Approximate weight of each part (tonnes)	Approximate length of each part (metres)
Tower	4 sections	156	35 to 45	12 to 30
Nacelle	1 part	44	67	6
Turbine blades	3 blades	132	7	Up to 55 metres
Hub	1 part	44	10	2



A: TYPICAL TURBINE CONSTRUCTION HARDSTAND - UNCONSTRAINED LAYOUT



B: TURBINE CONSTRUCTION HARDSTAND - CONSTRAINED LAYOUT

Figure 3.4: Typical Turbine Site Construction Layouts

Most of the turbine sites for the Flyers Creek Wind Farm have relatively flat cleared areas with sufficient space for the construction operations. Several sites may be constrained due to ground slope variations or proximity of sensitive vegetation or other aspects and may require special erection procedures where component parts are transported to the turbine site and lifted directly from the transport vehicle to the turbine structure under construction. Figure 3.4 shows hardstand arrangements for constrained and unconstrained situations. The unconstrained arrangement provides the most efficient arrangement and will be used in all situations except those where site constraints limit the available area for the hardstand. Turbine site 33 has been identified as requiring a reduced hardstand area due to site constraints. The contractor will need to review procedures to be used at the site given the constraints of the adjacent trees and steep slopes.

The tower is erected first with the initial tower section bolted to a stub section embedded within the concrete footings that will be constructed in advance of tower erection. Each subsequent section will be progressively raised into place by a large crane and bolted to the section below. The nacelle is then lifted onto the top of the tower and secured. The rotor is fitted to the nacelle last and due to the size of the rotors, height of the work and variation in conditions this operation must be carefully managed.

The turbine blades can be up to 55 metres in length and weigh about seven tonnes each. Rotor assembly may be carried out “in the air” with the hub and each blade lifted into place individually. Alternatively where there is sufficient space at the turbine site, the rotor can be assembled on the ground and lifted into place in a single operation. All lifting operations are dependent on favourable wind conditions and extended periods of unfavourable weather can extend construction times. Lifting of an assembled rotor using a large crane could require wind speeds (including gusts) of less than 10 metres/second or as determined by the erection specialists. Due to the need to conduct the lifting of the upper components at times of low wind speeds it is desirable to have some flexibility in operating hours for this activity.

Once the turbine has been constructed it will need to be checked prior to energising and commissioning. The commissioning phase will take place some time after the turbine construction depending on the status of the substation construction, grid connection and substation energisation.

	
Plate 3.12 – Turbine components and crane on hardstand prior to turbine erection phase	**Plate 3.13 – Raising nacelle to install on tower as part of turbine erection.**

3.8.9 Substation

Construction of the 33 kV/132 kV substation will include:

- clearing and levelling of an area of about 120 by 80 metres either as a single bench or separate benches for the 33 kV and 132 kV switchyards
- construction of footings for the transformer(s), buildings and structures, concrete containment bund(s) for the two large transformers
- installation of the necessary structures and component parts.

The bund(s) will be sized to enable capture of the full amount of oil that could be lost from the main transformers. Secondary oil containment capability will also be provided (Figure 3.2). Other aspects of the construction will include a surface layer of crushed rock approximately 120 millimetres thick and a buried “earth grid”. Lightning protection masts will also be installed.

A facilities building and an auxiliary services building will be constructed at the substation site. A septic system or composting system will be installed to treat the small amount of waste water produced within the building. An area will also be included for the storage of spare parts. The construction of the buildings will have relatively minor impacts that will be managed in conjunction with the substation construction.

The transport of the substation equipment from the local roads requires a relatively short length of upgraded access track and will also require upgrading of the entry point or formation of a new entry point nearby.

A section of 132 kV overhead line (up to 15 kilometres) and a switching station will be constructed for the grid connection with the arrangement subject to the Country Energy requirements and Cadia Valley Operations confirmation of facility locations.

3.8.10 Switching Station

A small 132 kV switching station will need to be constructed on the Cadia Valley Operations property to enable connection of new 132 kV line from the Wind Farm Substation to the existing Orange to Cadia Mine 132 kV transmission line.

3.8.11 Removal of temporary facilities and restoration of the site

Following construction and commissioning of the wind farm, the site will be restored by removal of contractor’s facilities and any wastes or surplus materials, removal and restoration of any temporary construction tracks and ongoing maintenance of any land stabilisation until adequate ground cover is established. Revegetation of disturbed areas will be undertaken in consultation with landowners to return the land to the condition prior to construction, in most cases involving exotic pasture. Management of weeds in the disturbed areas will be integrated with the site restoration.

3.9 Environmental management of construction impacts

Best practice environmental management requires that the environmental issues associated with construction projects are identified and managed in accordance with an Environmental Management Plan (EMP). A Construction EMP (CEMP) will be developed for the construction phase that addresses the Department of Planning’s Guideline for preparation of EMPs. The issues to be addressed for construction environmental management are described in the Statement of Environmental Commitments and, as relevant, the Project Approval Conditions.

The principal environmental issues typically associated with construction works for wind farm developments include:

- construction traffic management
- constraints on the location and extent of site earthworks
- soil and water management

- dust control for road construction and soil stockpiles
- management of construction noise
- fuel storage and handling
- waste storage, handling and disposal
- bush fire prevention
- coordination with property owners and affects on stock
- weed control and site restoration
- and if relevant;
  - management of any quarrying activities and associated crushing plant
  - management of issues associated with any concrete batch plant

Specific aspects of these issues are outlined in the following sections and the process for their management is outlined in Statement of Commitments included in this Environmental Assessment.

3.9.1 Construction traffic management

The proposed access for the wind farm project is outlined in Section 3.4. A comprehensive review of traffic issues is also provided in Chapter 13 of this Environmental Assessment. Key points for traffic management during the construction phase are outlined here.

During construction, traffic will be generated by the delivery of materials and equipment as well as by the construction workforce of up to 70-80 persons travelling to and from the site on a daily basis. Table 13.3 provides a list of the types of vehicles involved in the construction stage. As shown in the table there will be approximately 4,100 one-way trips by trucks and about 5,000 one-way trips by cars over the construction period.

Some of the required equipment and materials will be delivered on trucks that are typically classified as 'Over-mass', 'Over-size' or both. Such vehicles are referred to as Restricted Access Vehicles (RAVs) and will require special permits and/or escorts to travel on public roads. Given the nature of such vehicles (up to 55m in length for transport of turbine blades) some disruption to local traffic flows could be experienced on some sections of the roads in the locality especially where manoeuvrability is restrictive. The proposed movement of the larger vehicles avoids less suitable roads and will be timed to minimise the impact on local traffic.

On a regular daily basis, the majority of extra traffic movements will be due to employee traffic and involve cars and small commercial vehicles.

To minimise disruption to local traffic and ensure community safety, a Traffic Management Plan for the use of the public roads by construction vehicles will be prepared in consultation with the local Traffic Management Committee and implemented as part of project management.

The construction traffic generated by the project also has the potential to impact on the physical condition of the lesser standard local roads. It is possible that damage to local roads may result from the increased passage of heavy vehicles and that maintenance by Flyers Creek Wind Farm Pty Ltd will be required during the construction period in these instances. The final site access arrangements using local roads will be developed through consultation between Blayney Shire Council and Flyers Creek Wind Farm Pty Ltd.

Tracks within the wind farm site will be constructed and maintained to suit the type of vehicular traffic and the intensity of use during the construction stage. The construction will also aim to provide tracks that have a sustainable structure over the life of the wind farm. Erosion and sedimentation measures will be incorporated in the design of the tracks and if necessary the detail will be refined during construction. Clearing of vegetation will be minimised and, where necessary, an ecologist will be engaged to confirm the suitability of the final location of access tracks in sensitive parts of the site.

3.9.2 Constraints on the location and extent of site earthworks

The extent of the site works will be constrained to prevent excessive clearing and site disturbance and to ensure that identified areas of environmental or heritage sensitivity are not impacted. These constraints will be shown on construction plans and where warranted identified on the ground, by flagging, fencing or similar effective means. The CEMP will describe the method for monitoring compliance with these requirements and where necessary implementing corrective action.

3.9.3 Soil and water management including dust control

A Soil and Water Management Plan (SWMP) will be prepared for the project. Requirements of the SWMP will form part of the Construction Environmental Management Plan and earthworks will be undertaken in accordance with the SWMP. Detailed plans for erosion and sediment control at specific locations will be prepared by the relevant contractor(s) relative to their works. They will also be required to implement and maintain the necessary procedures and measures to prevent and control any adverse effects. Approval of the contractors' detailed erosion and sediment control plans by the project owner or its representative will be a prerequisite to the commencement of specific contract works.

In general terms, the work will be designed to minimise land degradation and the contractors will be required to carry out the whole of the work to avoid erosion and sedimentation within the site, surrounding areas, watercourses and streams. Procedures for management of wind or rain erosion of soil stockpiles, batters and bare soil and prevention of dust generation and sediment discharge will also be incorporated in the SWMP. An outline of the soils at the site and erosion and sediment control measures is provided in Section 7.5.

3.9.4 Management of construction noise

Construction noise is addressed in Chapter 12 of the Environmental Assessment and Appendix G. Potential noise sources during construction will be associated with traffic movements, use of mobile plant and cranes on site, excavation of footings and trenches, and if relevant, operation of the concrete batch plant and quarrying and crushing activities. The construction noise at any location will be temporary and, in most cases, distant from surrounding residences. The impact of much of the construction on surrounding neighbours is therefore likely to be low and times of working will be limited to avoid noisy operations occurring outside day-time hours. However, there may be a need to undertake some activities outside normal daylight working hours due to practicalities and safety aspects for specific tasks such as:

- Need for erection of towers and turbine structures to occur during favourable low wind conditions in early morning or late evening
- Need to complete a concrete pour in a single day, but potentially extending beyond normal working hours
- Emergency activities
- Works directed by Police to occur outside approved hours due to off-site considerations

Where there is a requirement to work outside normal hours, consideration will be given to the distance from neighbouring residences and potential noise impact, and as necessary, mitigation measures developed. Approval will be sought for such operations.

Consideration of vehicle noise impacts will also be addressed during the development of the Traffic Management Plan.

Excavation of rock will be undertaken by earthmoving equipment or rock breakers which represent some of the higher noise levels for the various construction activities. This activity will only be undertaken during approved working hours. Should any controlled low level blasting be required it will be undertaken in accordance with all relevant statutory requirements.

3.9.5 Fuel and oil storage and handling

In the event of the contractor storing diesel fuel and/or oil on site it will be stored in a suitably bunded area. Handling procedures will be defined in the project CEMP.

3.9.6 Waste, storage, handling and disposal

The principal wastes to be disposed of will consist of surplus topsoil, surplus excavated material, packaging material, general construction debris and relatively minor amounts of domestic wastes.

- Surplus topsoil will be spread on the site to blend in with the natural landform and will be revegetated
- Surplus excavated material will be disposed of on the relevant property at one or more locations as agreed with the property owner. Disposal sites will be finished with topsoil and revegetated. Where feasible, existing erosion areas will be selected for backfill and treatment.
- Subject to the Council's agreement, it is proposed to dispose of packaging material, general construction debris and all other waste at the Blayney waste disposal area. Where feasible, recyclable items such as metals, glass or timber will be separated and directed to the nearest appropriate recycling facility. Any putrescible general waste material will be stored in sealed containers until it is removed from site.
- Disposal of sullage from any of the contractor's pump out toilet facilities will be to the local Blayney treatment plant or other suitable facility as agreed with Council.
- Any waste oil arising from equipment servicing will be stored in sealed containers in a covered and bunded area until it can be removed off site to a suitable waste oil facility.

3.9.7 Bush fire prevention

Measures to mitigate the risk of initiating bush fires will include the exclusive use of diesel fuel by construction vehicles, implementation of procedures for hot-work activities and adoption of response measures to control any incident. The Rural Fire Services will be consulted in regard to the adequacy of the bushfire prevention measures to be incorporated in the CEMP. The management of the bush fire risk is addressed in Section 15.5 of this Environmental Assessment.

3.9.8 Coordination with property owners and effects on stock

Flyers Creek Wind Farm Pty Ltd will consult with the respective landowners regarding the on-site impacts of the construction stage of the project. Some changes to normal grazing activities and temporary fencing to keep stock from areas of active construction work are expected but these are only likely to affect a relatively small part of the land at any one time and be a temporary impact.

3.9.9 Weed control and site restoration

Construction activities will be managed to minimise the potential for weeds to be introduced to the site or spread within the site. Earthworks vehicles will be washed down before entry to the project area. Imported soil and gravel shall be assessed for potential for introducing weeds to the site. Post disturbance monitoring and where necessary weed control will be undertaken to avoid exacerbating existing weeds or allowing new weeds to establish at the site. Site restoration works will include control of weeds on disturbed areas. Weed management will be addressed by the CEMP and Operational EMP (OEMP).

3.9.10 Site safety during construction

The safety issues for the project are addressed in Chapter 16. In respect of construction, the main issues relate to the movement of oversize vehicles around the site, staff working at heights, the use of mobile plant and work in proximity to steep slopes. The safety of the workforce will be managed by the implementation of strict work procedures, good design of site tracks (particularly in relation to grade and curvature) and regular maintenance. Access tracks will include adequate area for turning vehicles and areas to allow vehicles to pass safely.

At the commencement of construction liaison will be carried out with local ambulance and emergency services to establish specific procedures for medical and emergency events on site should they occur. Such procedures would include the establishment of specified meeting points at which site staff would meet emergency service personnel and direct them to the required site location. In the event of accident, communication to ambulance or medical services will be by phone and/or radio.

Attachment 1 – Details of proposed turbine locations and elevations

Wind Turbine	MGA coordinates		Latitude and longitude		Ground surface level (1)	Max height of turbine (2)
Ref Number	Easting (m)	Northing (m)	Latitude	Longitude	m AHD	m AHD
3	692738	6290953	33° 30' 13"	149° 4' 30"	914	1064
4	693188	6290906	33° 30' 14"	149° 4' 48"	945	1095
5	692610	6290375	33° 30' 32"	149° 4' 26"	886	1036
6	692438	6289879	33° 30' 48"	149° 4' 19"	851	1001
7	692375	6289621	33° 30' 57"	149° 4' 16"	843	993
8	691922	6289293	33° 31' 7"	149° 3' 58"	851	1001
9	691710	6288716	33° 31' 26"	149° 3' 50"	837	987
10	690463	6289008	33° 31' 18"	149° 3' 4"	814	964
11	690764	6288686	33° 31' 28"	149° 3' 14"	822	972
12	690638	6288139	33° 31' 46"	149° 3' 11"	779	929
13	693146	6288195	33° 31' 42"	149° 4' 48"	837	987
14	693850	6287994	33° 31' 48"	149° 5' 17"	855	1005
15	694720	6287294	33° 32' 10"	149° 5' 49"	895	1045
16	693932	6287163	33° 32' 15"	149° 5' 20"	880	1030
17	692356	6286368	33° 32' 42"	149° 4' 19"	808	958
18	693315	6284663	33° 33' 37"	149° 4' 55"	899	1049
19	693106	6284262	33° 33' 50"	149° 4' 48"	908	1058
20	693633	6283962	33° 33' 59"	149° 5' 10"	942	1092
21	691091	6283878	33° 34' 4"	149° 3' 32"	845	995
22	691440	6283635	33° 34' 11"	149° 3' 47"	862	1012
23	691436	6283205	33° 34' 25"	149° 3' 47"	851	1001
24	690258	6283778	33° 34' 7"	149° 3' 0"	807	957
25	690357	6283178	33° 34' 27"	149° 3' 4"	846	996
26	690381	6282714	33° 34' 42"	149° 3' 4"	828	978
27	689933	6282625	33° 34' 45"	149° 2' 49"	830	980
28	689635	6282686	33° 34' 43"	149° 2' 35"	810	960
29	689403	6282413	33° 34' 52"	149° 2' 28"	785	935
30	689820	6282149	33° 35' 1"	149° 2' 42"	809	959
31	690231	6282050	33° 35' 3"	149° 3' 0"	831	981
32	692382	6282353	33° 34' 52"	149° 4' 23"	868	1018
33	692173	6281920	33° 35' 6"	149° 4' 16"	903	1053
34	692320	6281639	33° 35' 15"	149° 4' 19"	881	1031
35	692379	6281358	33° 35' 25"	149° 4' 23"	889	1039
36	692852	6280328	33° 35' 58"	149° 4' 41"	883	1033
37	692897	6279893	33° 36' 12"	149° 4' 44"	820	970
38	694007	6282678	33° 34' 41"	149° 5' 24"	868	1018
39	695178	6283099	33° 34' 26"	149° 6' 11"	904	1054
40	695285	6282880	33° 34' 33"	149° 6' 14"	908	1058
41	695383	6282655	33° 34' 40"	149° 6' 18"	898	1048
42	695229	6282331	33° 34' 51"	149° 6' 14"	889	1039
43	696494	6283966	33° 33' 57"	149° 7' 1"	933	1083
44	696745	6283761	33° 34' 4"	149° 7' 12"	911	1061
45	696940	6283488	33° 34' 12"	149° 7' 19"	891	1041
46	697221	6283308	33° 34' 18"	149° 7' 30"	873	1023

NOTE: (1) Elevations are approximate as they are derived from GIS

(2) Maximum height of turbine is based on 150m structure