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PALING YARDS WIND FARM

CHAPTER 5

THE PROPOSAL

5 The Proposal

This chapter details the project and all associated buildings and works that support the wind energy facility. It also details the major elements of the commissioning, operational and decommissioning phases.

5.1 Overview

The proponent, and its successors and assigns, is seeking project approval for the construction, operation and decommissioning of a wind energy facility known as the Paling Yards Wind Farm (the 'project'). The project is located on two land holdings over approximately 3,900 hectares known as 'Mingary Park' and 'Paling Yards' (refer to **Figure 11 – Indicative Site Plan**).

The project will comprise a number of elements, including:

- Up to 55 individual wind turbines with a capacity of up to 4.5MW;
- Up to 55 individual kiosks for the housing of transformers and switchgears and associated control systems, to be located in the vicinity of the wind turbine towers (in some turbine models the equipment is integrated within the tower or nacelle);
- Upgrades to local road infrastructure including up to six access points from Abercrombie Road;
- Internal unsealed tracks for vehicle access to turbines and infrastructure;
- An underground electrical and communication cable network linking turbines to each other and the proposed on-site substation;
- Up to three wind monitoring masts fitted with various instruments such as anemometers, wind vanes, temperature gauges and potentially other electrical equipment;
- A temporary batching plant to supply concrete for the foundations of the turbines and other associated structures;
- Obstacle lighting to selected turbines (if deemed necessary);
- Removal of native vegetation (if required);
- Vegetation planting to provide screening;
- Wind farm and substation control room and facilities buildings;
- An on-site electrical substation and approximately 9km of overhead powerline of up to 500kV;
- Grid connection achieved via an off-site 500kV electrical Terminal Station (including control room and other associated facilities) for the grid cut-in to the Mt Piper to Bannaby 500kV transmission line; and
- All associated and ancillary uses and activities.

Several options for connection to the electricity transmission grid were explored:

- Northern connection: an overhead powerline connection of approximately 9km to the Mt Piper to Bannaby 500kV transmission line, which bypasses the north-east and east of the site, or,
- Southern connection: a 55km overhead transmission line connection to the approved Crookwell 2 Wind Farm substation which connects to the Yass to Bannaby 330kV transmission line.

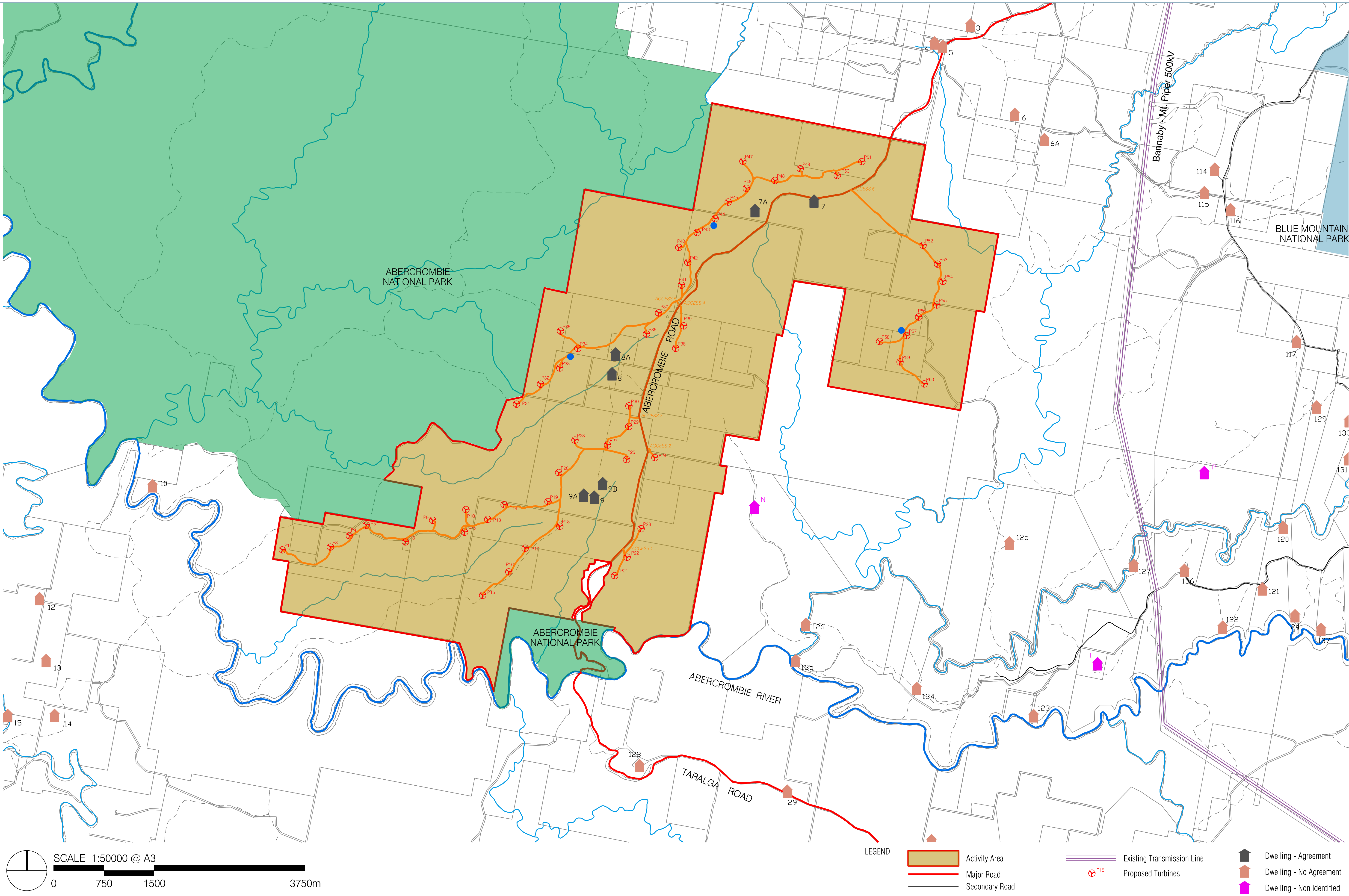

Figure 11 Indicative Site Plan

Source: *Tract Consultants*

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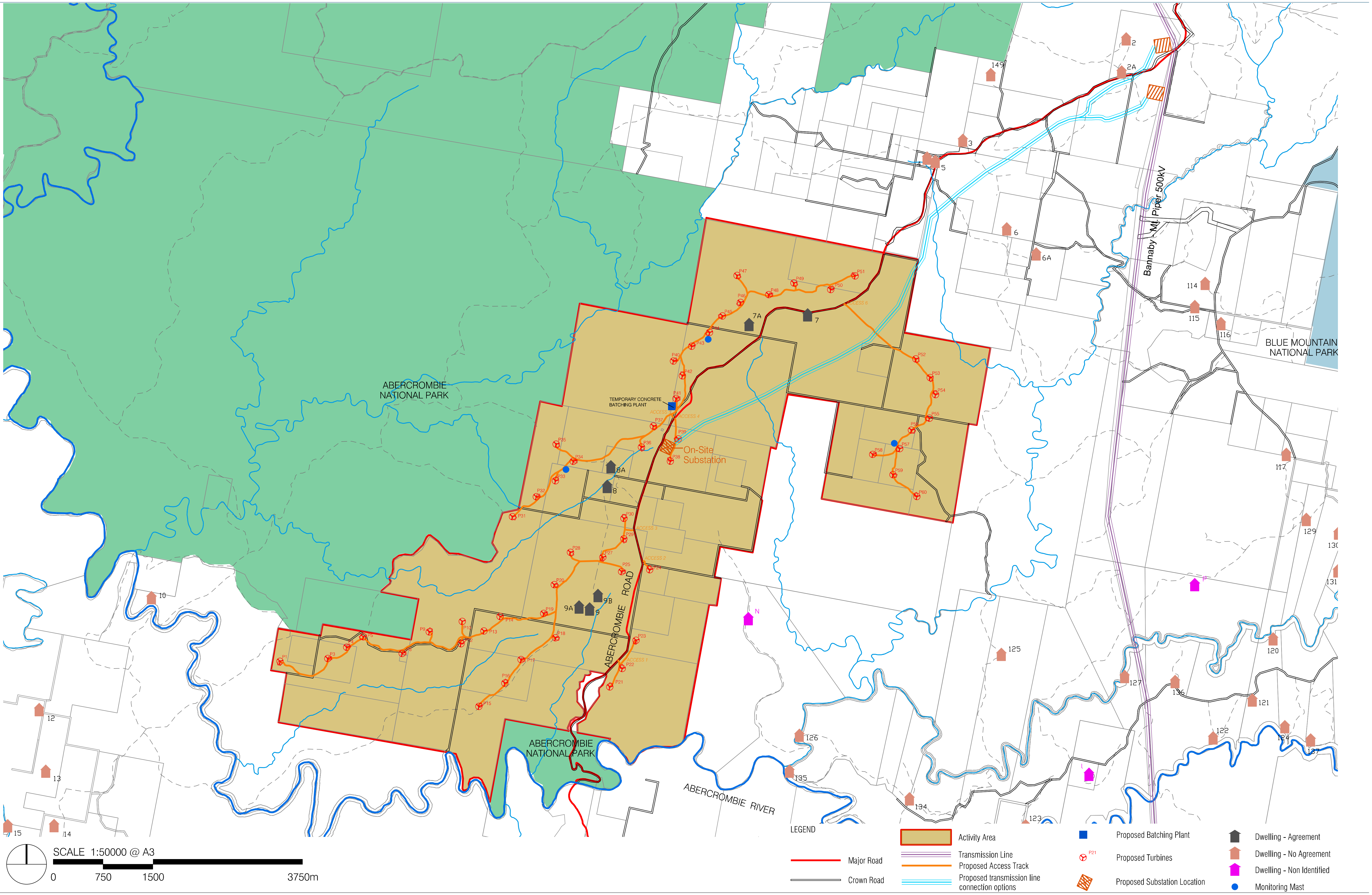
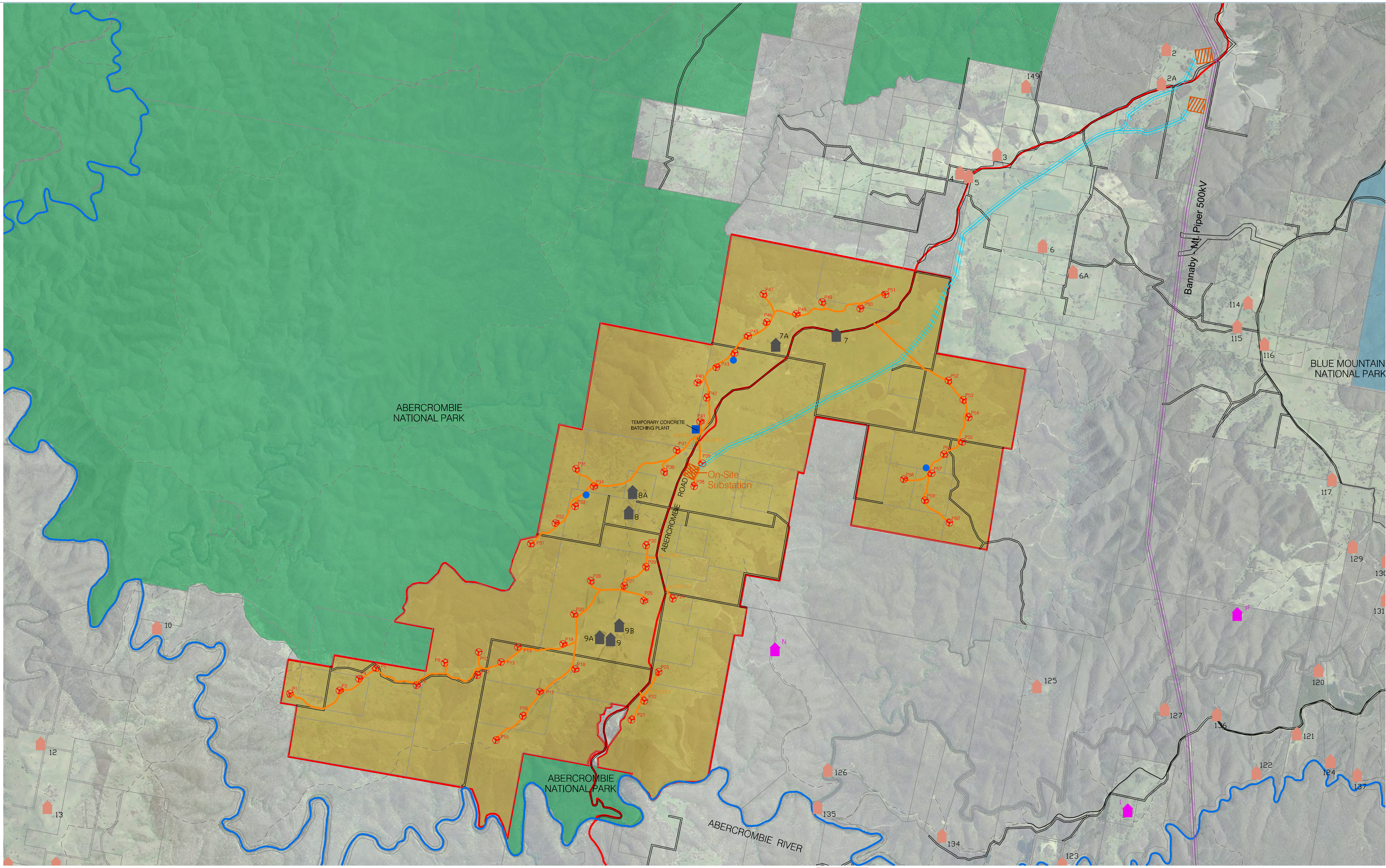


Figure 12 Indicative Access & Infrastructure Plan

Source: *Tract Consultants*



SCALE 1:50000 @ A3

0 750 1500 3750m

LEGEND

- Activity Area
- Major Road
- Secondary Road
- Crown Road
- Transmission Line
- Assessed & Proposed Transmission Line Options
- Proposed Substation Location
- Dwelling - Agreement
- Dwelling - No Agreement
- Dwelling - Non Identified

Figure 13 Proposed Transmission Line Plan

***Source:** Tract Consultants*

The technical assessment and consultation activities undertaken in preparing this EA established the northern connection option as the most feasible and therefore preferred option. Approval is accordingly being sought for this option.

Please refer to **Figures 12 – Indicative Access & Infrastructure Plan** and **13 – Proposed Transmission Line Plan**.

5.2 Turbine Specifications

The most important element in any wind farm is the wind turbine, often referred to as a wind turbine generator (WTG). Turbines consist of a tall tower with three long blades mounted at the top that capture the wind.

The turbine manufacturing industry is dynamic, with new and updated models regularly released. Existing models are often made redundant only a few years after their release. The industry is rapidly growing and is experiencing benefits from constant innovation and advancement in the efficiency of the turbines.

The major part of a wind farm's cost is the initial construction phase; and turbine selection is a critical determinant of this cost. A turbine's cost depends on a number of factors, including the current economic climate (for example, whether other wind farms also require supply in the upcoming period) and competition between suppliers. In order to maintain competition between suppliers of turbines and ensure that the most up to date turbines can be used, it is important that the project has flexibility to select from a number of different turbine models from alternative suppliers (including new models which may become available in the future).

UFWA is currently considering turbines from the following suppliers:

- Vestas, Denmark
- REpower, Germany
- Gamesa, Spain
- Nordex, Germany
- Siemens, Germany
- General Electric, USA
- Alstom, France/Spain

To provide this flexibility, the proponent is seeking approval for an indicative turbine 'envelope' rather than a single turbine model. This envelope represents the largest and widest of the turbine models currently under consideration.

Many of the turbine models currently under consideration are smaller than the assessed envelope. In general, if any of the smaller turbines are utilised for the project, the impacts described and assessed in this report are likely to be less significant.

The proposed envelope contemplates that the turbine would have an overall height of up to 175 metres when constructed. This envelope includes a tower of up to 107 metres in height to the hub, coupled with a 67 metre long blade (excluding hub) and an approximate 2 metre wide hub. Some of the turbine models considered have a smaller rotor diameter than the maximum proposed, and these can utilise a taller tower up to 119m to bring their tip height up to 175 metres. New turbines are continually coming onto the market; therefore it is possible that minor variations to these dimensions could occur prior to final turbine selection.

Accordingly, for the purposes of this EA, the largest turbine model under consideration has been assessed in relation to all potential impacts other than noise and shadow flicker impacts where these assessments have considered a mix turbine size layout to comply with the relevant standards. For details on the mix of turbine size layouts please refer to the Landscape Visual Assessment at **Appendix 6** and the Noise Assessment at **Appendix 7**. For an illustration of the wind turbine envelope under consideration refer to **Figure 14 – Wind Turbine Elevation**.

Whilst the majority of potential impacts of wind turbines are related to its height and length of blades, the noise produced by an individual turbine is a function of the various mechanical characteristics of the turbine, and not necessarily its height. Therefore, in assessing noise impacts, three models currently under consideration has been assessed based on the information provided by each of the turbine manufacturers on noise characteristics at various wind speeds. Should different models be ultimately selected, further testing will be undertaken.

The following table represents the differences between the various turbine models currently under consideration by UFWA for the project.

Table 2 Turbine comparison

Turbine Manufacturer	Turbine Model	Hub Heights	Blade Length	Rotor Diameter	Total Height (To Tip)	Turbine Capacity	Total Capacity (up to)
Alstom	ECO100	90-100m	49m	101m	140-150m	3.0 MW	165 MW
Alstom	ECO110	90-100m	54m	110m	145-155m	3.0 MW	165 MW
Gamesa	G90	78-98m	44m	90m	125-145m	2.0 MW	110 MW
Gamesa	G97	80-90m	48m	97m	129-139m	2.0 MW	110 MW
Gamesa	G128	111m	63m*	128m	175m	4.5 MW	247.5 MW
Gamesa	G136	107m	67m*	136m	175m	4.5 MW	247.5 MW
GE Energy	2.75-103	85-98m	50m	103m	136-150m	2.75 MW	151.25 MW
Nordex	N100	80-100m	49m	100m	130-150m	2.5 MW	137.5 MW
Nordex	N117	91m	58m	117m	150m	2.4 MW	132 MW
REpower	MM92	80-100m	46m	93m	127-147m	2.0 MW	110 MW
REpower	MM100	80-100m	49m	100m	130-150m	2.0 MW	110 MW
REpower	M104	80-100m	51m	104m	132-152m	3.4 MW	187 MW
REpower	M114	93m	56m	114m	150m	3.2 MW	176 MW
Siemens	SWT101	80-90m	49m	101m	130-140m	2.3 MW	126.5 MW
Siemens	SWT108	80-96m	53m	108m	134-150m	2.3 MW	126.5 MW
Siemens	SWT113	93-99m	55m	113m	150-156m	2.3 MW	126.5 MW

Vestas	V90	80-95m	44m	90m	125-145m	2.0 MW	110 MW
Vestas	V100	80-95m	49m	100m	130-145m	2.0 MW	100 MW
Vestas	V112	84-95-119m	55m	112m	140-150-175m	3.3 MW	181.5 MW

**** Segmented blade, transportable similar to G8X***

There are some slight differences in the electrical construction of the turbines under consideration. Some of the turbines under consideration have a 690V / 33kV transformer in the nacelle, and 33kV switchgear either in the base of the tower or next to the tower in a kiosk. Some turbines have the 690V / 33kV transformer and the 33kV switchgear in the base of the tower. Other turbines have the 690V / 33kV transformer and the 33kV switchgear on the ground in a kiosk next to the tower.

The components of all turbine models currently under consideration are as follows:

- Reinforced concrete ‘gravity foundations’ up to 20 x 20 metres wide and between 1.5 to 3 metres in depth, and/or Reinforced concrete ‘rock anchor foundations’ of up to 12 x 12 metres wide and reinforced concrete anchors of up to 20 metres into the bedrock depending on the prevailing ground conditions. Both gravity and rock anchor foundations are being investigated which would allow for much smaller concrete footing areas;
- A tubular steel or hybrid steel / concrete tower with a total height of up to 119 metres, weighing between 250-300 tonnes. Some of the larger towers are either concrete precast towers or hybrid towers with the concrete precast base and an upper steel section. The towers are painted in a non-reflective light grey/off-white paint;
- A nacelle at the top of the tower housing the gearbox (where a direct drive mechanism is not in operation) and electrical generator, ensuring that the turbine is always facing into the wind and adjusting the angle of the blades to ensure maximum output of electricity and minimum noise;
- A rotor comprising a hub (attached to the nacelle) with three blades, and a shaft that connects to the generator via the gearbox or direct drive mechanism; and
- Three blades, each up to 67 metres in length (excluding hub), made of lightweight materials.

A safety component incorporated in all models under consideration is a lightning protection system. All blades are manufactured with an anti-lightning protection system which minimises the damage to the turbines in the event of an atmospheric discharge (lightning). In the event of a lightning strike, power is diverted from the lightning to the nacelle which is grounded to the earth.

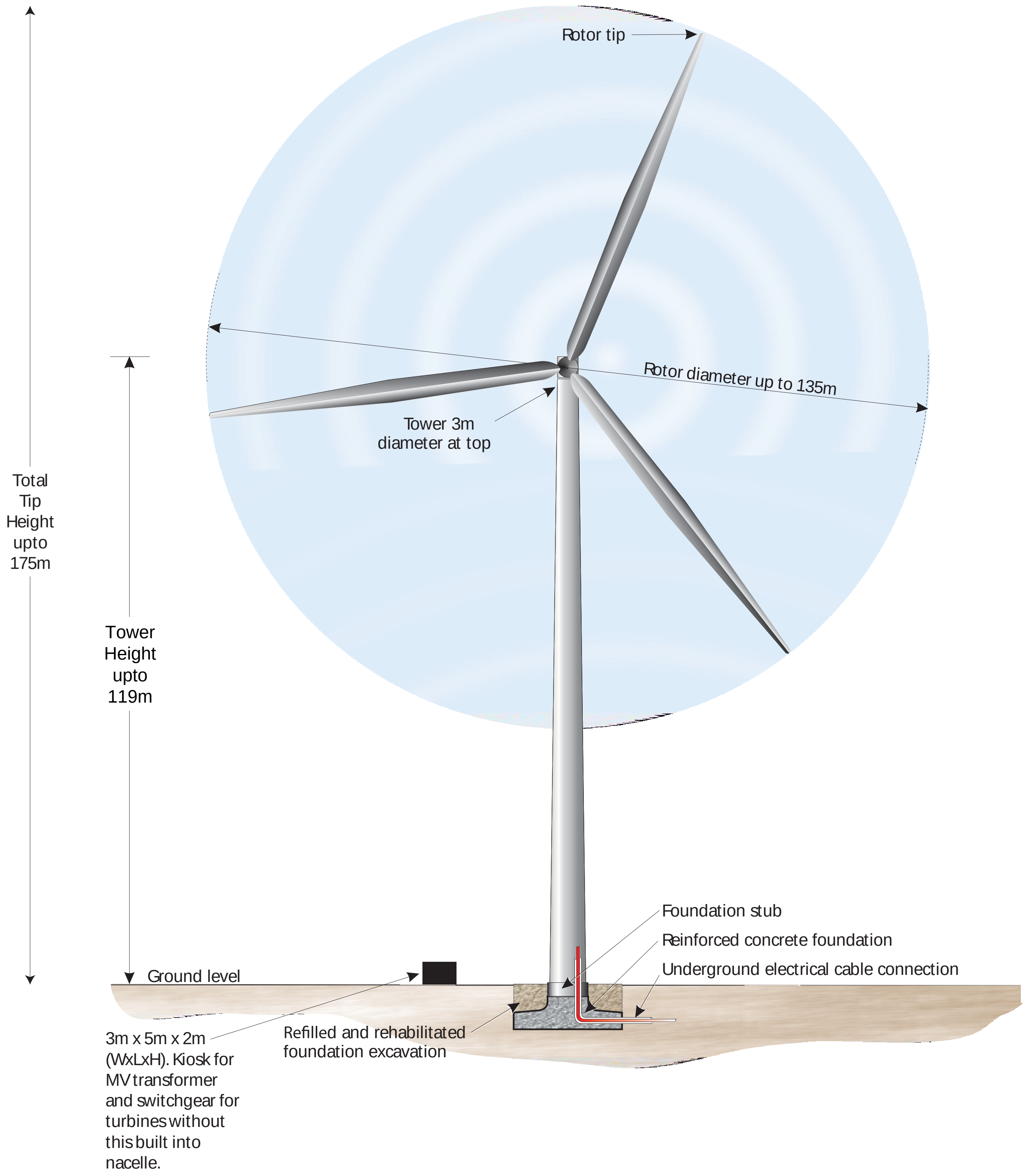


Figure 14 Wind Turbine Elevation

Source: *Tract Consultants based on URS 2006*

Other safety components of the turbines include:

- Sufficient standing and working space;
- Full containment of any leakage or spillage, by using dry-type transformers in the nacelle or using an oil-filled transformer in a kiosk adjacent to the tower with oil bunding built into the kiosk; and
- Fibreglass weather protector.

The turbines currently under consideration would result in efficient transfer of electricity as they have been chosen to match the local conditions at the site. As the height above the ground increases the wind resource generally increases and, as a result, the turbines under consideration are significantly more efficient than previous smaller models.

The turbines have a low 'cut-in' speed at nominal wind speeds (i.e. maximum output capacity is achieved at lower wind speeds). Generally, the wind turbines commence operation at a wind speed of approximately 3 to 4 metres per second, gradually increasing to the maximum output rate at 12 to 15 metres per second (depending on the turbine model). From this rate to approximately 20 to 25 metres per second (depending on the turbine model), the turbine operates at maximum capacity. In order to prevent damage to the, the turbines employ automatic shutdown at speeds above 20 to 25 metres per second (depending on the turbine model).

As turbines are becoming more technologically advanced they now incorporate other features which assist in monitoring performance with relevant standards. For example, turbines can employ a low noise mode or wind sector management to reduce the noise output and avoid reaching critical noise levels. These systems act to mitigate any isolated occasions where noise output has the potential to exceed the permitted threshold, facilitating adaptive management of noise impacts.

5.3 Turbine Layout

An indicative wind turbine layout plan has been prepared for up to 55 turbines (refer to **Figure 12 – Indicative Access & Infrastructure Plan)**. The indicative layout was prepared by the proponent using wind modelling software and reflects the site constraints and the typical spacing required for the wind turbines currently under consideration.

The indicative locations shown reflect the current understanding of the preferred location for the turbines, given the currently proposed turbine models, knowledge of the wind characteristics and the presence of significant vegetation.

The indicative wind turbine layout was based on a number of inputs, principally:

- The site boundary;
- Topographical data;
- Wind speed data collected on and off site;
- Dwelling locations;
- The location of significant native vegetation and native fauna;
- Noise assessments at key receiver points;
- Visual amenity impacts (including shadow flicker at the nearby dwellings); and
- Typical spacing required.

A number of draft layouts were provided and reviewed by the consultant team and the relevant stakeholders consulted. The feedback provided by the consultant team and stakeholders was incorporated into the current indicative layout plan so as to mitigate the potential impacts of the project.

On a hilly terrain such as the site, the wind speeds vary across the site depending on the elevation and the location of hills around the site. The predominant winds in the area are from the west and south-east, and therefore, wind turbine sites are designed to take maximum advantage of these flows.

The indicative turbine layout is based on the turbine models shown in **Table 2 – Turbine comparison**. If project approval is granted, this proposed layout will be refined at the detailed design stage and once the final turbine has been selected so as to achieve the best energy generation from the selected turbine model. It is estimated that this may result in individual turbines being moved approximately 25 to 100 metres from the currently nominated location on the site plan.

The determination of the final turbine locations during detailed design is required to address:

- the particular siting characteristics of the final turbine chosen;
- any additional site constraints discovered during ongoing site investigations (e.g. environmental or constructability constraints, such as the discovery of an unusual geotechnical issue);
- further wind speed analysis; and
- access issues determined during the detailed design phase.

Depending on final turbine selection, it is possible that not all turbine locations proposed would be used to ensure that the wind farm continues to meet all approval conditions.

Approval is sought on terms which allow the micrositing of the final turbine locations and infrastructure during detailed design subject to the following criteria:

- turbines would not be moved by more than 100 metres from their indicative locations;
- turbines would not be moved any closer than 1.0km to any non-project involved dwelling; and
- turbines would be located so as to avoid any unnecessary impacts on flora and fauna or heritage items (including items of Aboriginal heritage).

It is considered that any micrositing in accordance with the above criteria would have negligible influence on the impacts of the project.

The proposed micrositing approach is common for wind farm projects. It was endorsed by the NSW Land and Environment Court (Taralga Landscape Guardians v. Minister for Planning NSWLEC 2007) which found that that a 250 metres relocation of wind turbines is not unreasonable. It is also expressly contemplated by the standard conditions of approval prepared by DoPI.

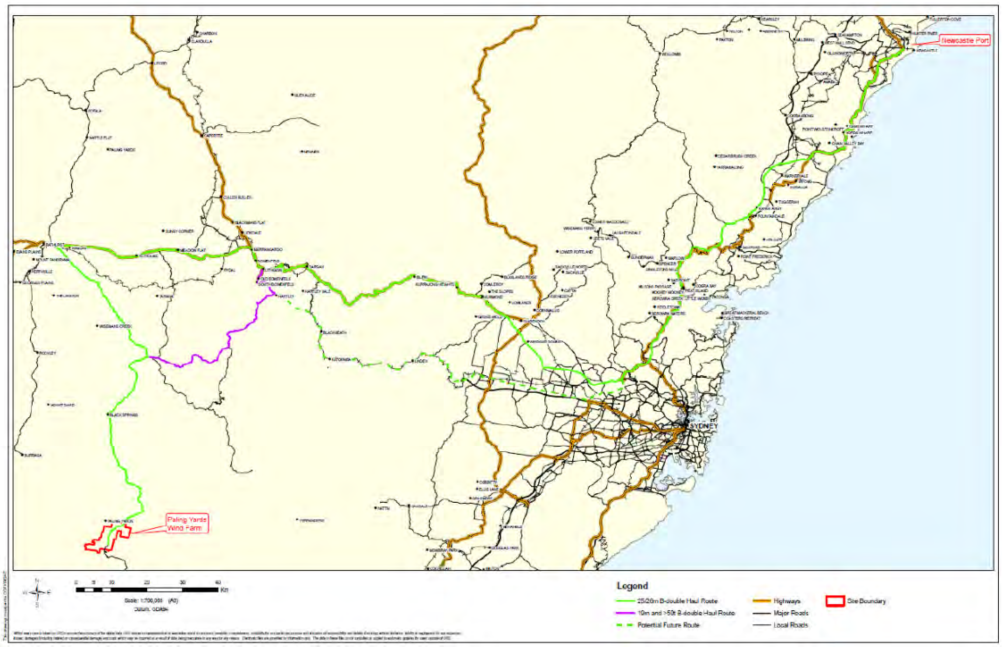
5.4 Access Points

Major wind farm components would be shipped to Australia, with raw construction materials and individual turbine components delivered to either Port Kembla or the Port of Newcastle.

As the turbine components would be considered over-dimensional (OD) loads, the different route options from Port Kembla and the Port of Newcastle to the site are of particular importance, and are shown in **Figures 15** and **16**. URS Australia Pty Ltd prepared a transport impact assessment, which identified the route options for OD vehicles to the site (refer to **Appendix 10 – Transport Impact Assessment**). The routes were selected based on road grade, road width, extent of works required for safe transportation of goods, costs, and appropriateness and directness of route.

Figure 15 Proposed Over Dimensional Route (Port Kembla)

Figure 16 Proposed Over Dimensional Route (Port of Newcastle)



The roads from the ports to Oberon are generally national highways or state roads and are able to accommodate OD vehicles, such as the Hume Highway, Westlink M7 and the Great Western Highway. From the ports, OD vehicles would travel to Bells Line of Road in the Blue Mountains National Park, which is a major arterial road.

The travel time from the Port of Newcastle to this point is slightly longer than from Port Kembla. From Bells Line of Road, two key options are available to the site via Oberon, which is approximately 60km north of the site.

For OD vehicles taking the first route option from Bells Line of Road, vehicles would continue in a southerly direction onto the Great Western Highway, which connects to Jenolan Caves Road, Duckmaloi Road and finally Abercrombie Road at Oberon. Access to the site from Oberon would be achieved by continuing south along Abercrombie Road for approximately 60km.

For OD vehicles taking the second route option from Bells Line of Road, vehicles would continue in a northerly direction onto the Great Western Highway, which connects to O'Connell Road at Kelso and finally Abercrombie Road at Oberon. Again, access to the site from Oberon would be achieved by continuing south along Abercrombie Road for approximately 60km.

The site is divided by the Goulburn-Oberon (Abercrombie) Road. To allow some flexibility for access this EA presents 6 entry options to the site from Abercrombie Road. The first access is located approximately three kilometres north of the Abercrombie River and the remaining five access points are positioned within a distance of 7.5 kilometres from the first access.

Refer to **Chapter 14 – Transport Impacts** for further details.

5.5 Access Tracks

A network of access tracks would lead from the proposed access points on the public roads to the turbines. The access tracks would connect each turbine and allow the safe passage of vehicles to the base of the tower. These access tracks would only intersect with government roads at nominated access points, therefore reducing impacts on public roads. Please refer to **Figure 12 – Indicative Access & Infrastructure Plan**.

Existing farm tracks would be used where possible to reduce the need for additional soil disturbance. During the construction phase of the project, these would be temporarily widened to approximately 8 to 10 metres in order to support the extra load of trucks carrying equipment and cranes for the erection of the towers. This width would then be reduced during the operation phase of the project to approximately 6 metres.

The tracks would continue to be used by the farmer to access the property and to attend to grazing livestock.

5.6 On-Site Substation, Control Room and Facilities Building

An on-site substation, together with a control room and facilities building, is proposed as part of the project, located at the heart of the site between turbines P38 and P39 off Access Track 4, as shown on **Figure 12**.

The substation would increase the voltage of electricity generated by the wind farm as is required for compatibility with the electricity transmission network. The substation would contain a number of circuit breakers of varying sizes as well as busbars and transformers.

A construction envelope of approximately 250m by 210m would house the buildings surrounded by a fence and screening vegetation. This area includes the control room and facilities building that are approximately 400m2 each.

The control room and adjoining facilities will include the following components;

- control room and office;
- canteen and toilets for the duty staff;
- small storage and workshop and maintenance area (for greases/cleaning agents and oils);
- electrical relay room, and;
- car parking.

The storage and workshop area will encompass safety measures to ensure that chemicals stored on site do not pose a risk to the surrounding area. Chemicals taken off-site would be transported by a licensed carrier. Rainwater would be collected from the roof of the building and stored in a tank and topped up by delivery if necessary. At such time as the project is operational, staff would be on-site during the normal working week and continuous remote monitoring will take place over a 24-hour period.

5.7 Electrical works

Electrical works are required to connect the turbines to each other and to the sub-station.

The electrical works comprise:

- 33kV electrical cables linking the turbines to each other and the substation. The electrical cables will be generally installed underground but overhead power lines may be utilised to overcome access and terrain constraints where required.
- Control cables linking the turbines to the control room, installed generally underground and adjacent to the 33kV electrical cabling.

The underground electrical cables are comprised of conductive wire surrounded by protective coating, and laid approximately 1 metre deep underground surrounded by soft sand with back fill. Cable markers would identify the path of the underground cabling to prevent accidental digging around the cable trenches.

All cables would generally follow the same alignment as the access tracks, thereby limiting the development footprint of the project. However, there may be several locations where the cable would diverge from the access tracks to reduce electrical losses and to overcome ground constraints.

5.8 Transmission Lines

The project proposes an overhead powerline connection of approximately 9km to a proposed off-site electrical Terminal Station, which would connect to the Mt Piper to Bannaby 500kV transmission line (the ‘north-eastern option’).

Two options were considered for overhead connection to the existing power transmission network. These are a southern and northern connection, with each including sub-options. Please refer to **Figure 17 – Former Transmission Line Options Plan**. The options are as follows:

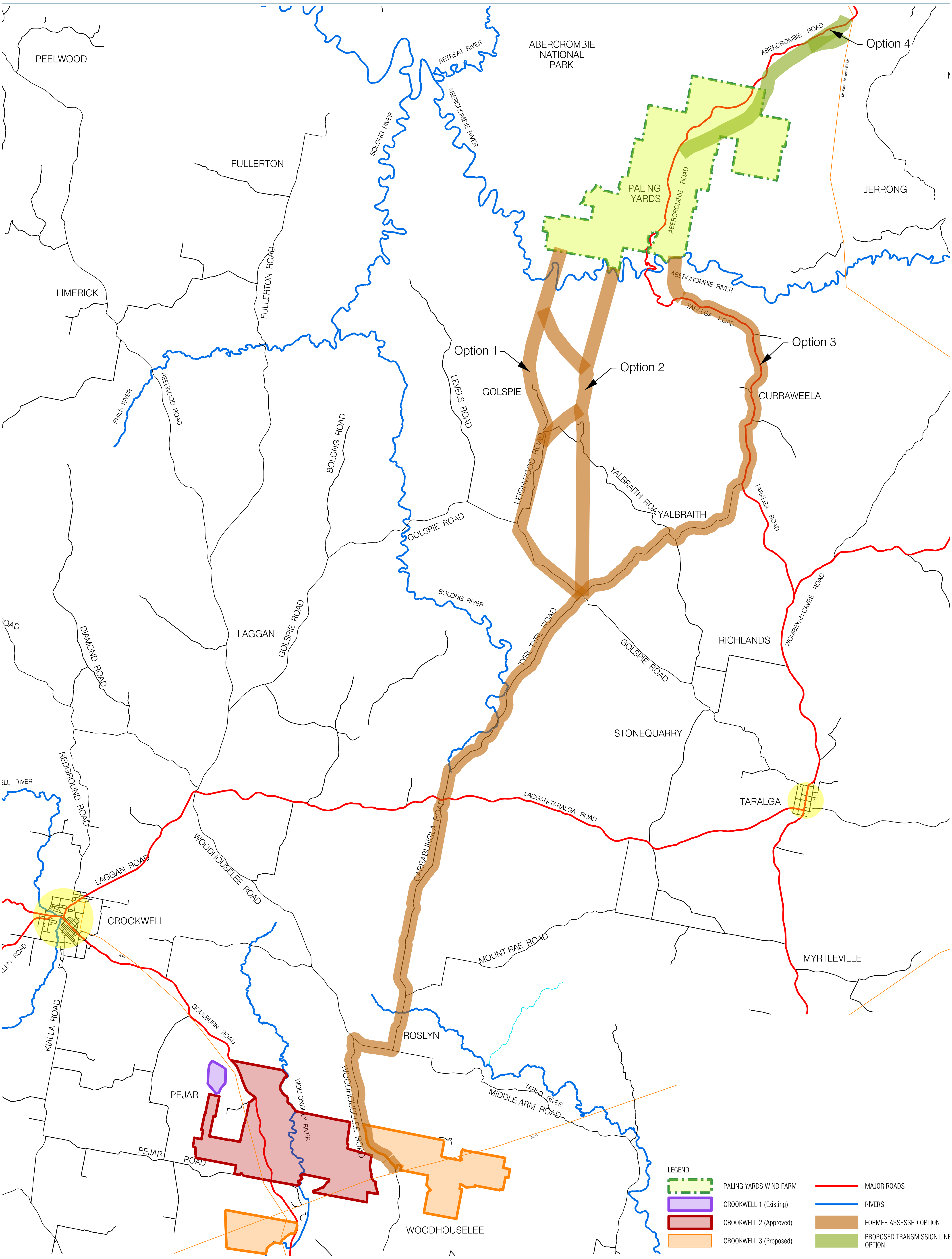


Figure 17 Former Transmission Line Options Plan

Source: *Tract Consultants*

- North-eastern option: an overhead powerline connection of approximately 9km to a proposed off-site electrical Terminal Station that would connect to the Mt Piper to Bannaby 500kV transmission line which passes the north-east and east of the site. This option has two sub-options, or
- Southern option: a 55km overhead powerline connection to the approved Crookwell 2 Wind Farm substation which connects to the Yass to Bannaby 330kV transmission line. This option has three sub-options.

Through the technical assessment and consultation process, it was established that the northern transmission line is the least impact route and the most feasible option. On this basis, approval is only being sought for the northern option. Please refer to **Figure 13 – Proposed Transmission Line Plan**.

The proposed transmission line will include the following:

- A proposed corridor of approximately 9km in length and 70 metres in width to avoid removal of native vegetation as much as possible.
- Transmission line power poles will be spaced approximately 200 to 250 metres apart. It is proposed that the spacing is flexible so as to minimise impacts on environmental features such as waterways.
- Power poles will be located no closer than 40 metres to any watercourse, except where these are only first order "minor streams" as defined by the *Water Management Act 2000*.
- A permanent access track will not be constructed along the length of the transmission line. Instead, access will be gained informally across grassed paddocks using the closest route from existing tracks/roads nearby. The routes which are selected will have the least potential for environmental impact.
- There will be no need to construct watercourse crossings for the purpose of vehicle access, whether permanent or temporary, during transmission line construction. This is on the basis that in situations where the lines cross a creek, cables can be pulled from one side of a creek to the other without needing to drive across the creek.

The proposed transmission line would be constructed over a maximum of eight or nine parcels of land (depending on the sub-option chosen). The parcels are generally cleared farmland, and the line route has been designed to avoid removal of native vegetation where possible.

5.9 Vegetation Removal and Planting

5.9.1 Vegetation Removal

Some vegetation removal is required to facilitate access and allow construction of the turbines. The required clearing is considered to be minimal as the site is already largely cleared and the project has been designed to avoid the need to remove native vegetation.

Approximately 1.0% of the site is required for wind farm infrastructure during the operation phase of the project.

The key reason for vegetation removal is for the provision of access tracks and potentially electricity easements. The access tracks have been designed to avoid native vegetation; however, some vegetation removal is unavoidable.

The areas and types of identified remnant vegetation within the development area are described in **Chapter 12 – Flora and Fauna Impacts** and in **Appendix 8a** and **Appendix 8b**.

A flora and fauna impact assessment for the project was undertaken, which included an assessment of native vegetation on site. It found that most of the areas where the turbines and access roads/electricity easements are proposed represent cleared grazing paddocks with high levels of disturbance. A total area of approximately 14.0 hectares of remnant vegetation removal would be required for the project including the transmission line, of which approximately 1.4 hectares is proposed to be rehabilitated post-construction.

5.9.2 Vegetation Planting

Vegetation screen planting can be an effective tool in mitigating the visual impact of wind turbines or other infrastructure. It is employed in the vicinity of nearby residences and along the roadside to screen potential views of turbines. However, screen planting is only effective where the planting can occur in close proximity to the viewing location (i.e. at a nearby dwelling). Planting would involve a variety of dense native vegetation, including both trees and shrubs, to effectively screen views. The flammability of the vegetation would be a key consideration in selecting species.

Many of the dwellings in the locality are already surrounded by vegetation that performs, at least to some extent, a screening role.

While the screening is proposed to be in close proximity to viewing locations, the exact area of screening and provision would depend on detailed design and discussions between an affected land holder and the proponent following the grant of project approval. The planting would be carried out at no cost to the landowner.

5.10 Wind Monitoring Equipment

Up to three new permanent wind monitoring masts are proposed to be installed during construction of the wind farm. These will be fitted with various instruments such as anemometers, wind vanes, temperature gauges and potentially other electrical equipment.

The proposed locations for these masts are:

- near the east of the site near turbine P57;
- near the northwestern edge of the site near turbine P43 and P44; and
- near the western edge of the site near turbine P34.

The masts consist of a tall, thin tubular or lattice structure and guy wires for support. These masts are up to 105 metres in height (though generally up to 60 metres) and are proposed to be located generally as shown in **Figure 12 – Indicative Access & Infrastructure Plan.**

The main purpose of the permanent wind monitoring masts is to provide an ongoing wind data source to assist with assessing the overall wind farm performance.

5.11 Hazard Lighting

Obstacle lighting consists of two flashing red lights mounted on the turbine nacelle to highlight their presence to nearby aircraft.

An obstacle marking and lighting assessment was undertaken in accordance with the guideline document - *Obstacle Marking and Lighting of Wind Farms (CASA Advisory Circular AC139-18(0))*.

An assessment under these guidelines shows that night lighting of 25 of the proposed turbines may be required. This lighting design is subject to confirmation of the final turbine layout. The characteristics of the lights would be consistent with CASA guidelines.

Visual impacts would be minimised by restricting the downward component of the light to either, or both, of the following:

- *Such that no more than 5% of the nominal intensity is emitted at or below 5° below the horizontal,*
- *Such that no light is emitted at or below 10° below the horizontal.*

The need for obstacle lighting for structures of this height is currently under review. It will also be reviewed at regular intervals by the proponent and, in the event that the CASA guidelines are revised such that night lighting is no longer required, then night lighting would not be installed, or switched off after installation.

5.12 Temporary Construction Facilities

A temporary construction area is required. The temporary construction area would contain portable toilets, vehicle parking, assorted construction equipment, a concrete batching plant and vehicle wash down facilities.

A temporary hardstand area of approximately 50 x 50 metres would be required to enable the construction of each turbine. The hardstand area would be constructed of compacted soil and gravel to provide a stable platform for construction equipment and the crane. The hardstand area is only required for the construction phase and would be removed following construction.

A temporary concrete batching plant would be required for the construction stage of the project to supply concrete for the turbine foundations. Batching plants need to be central to the activity area and well removed from houses due to the occasional generation of noise and dust. In consideration of these matters, the proposed temporary concrete batching plant is to be located west of Abercrombie Road, between P41 and P37. Access Road Number 5 will service this facility. Please refer to **Figure 12– Indicative Access & Infrastructure Plan** for the indicative location of the proposed batching plant.

This location is central to the activity area, which minimises travel distances to individual turbines. The area for the batching plant would be approximately 80 x 80 metres. This area would incorporate loading bays, hoppers, silos, hardstand areas, water tanks and stockpile areas for the storage of the aggregates, sands and other raw materials.

The concrete batching plant is likely to produce between $250m^3$ and $500m^3$ of concrete on an average day.

Where possible, raw materials for the concrete batching plant would be sourced on site, with all materials brought in from external sources being as clean as possible to minimise the potential of introducing weeds to the site. The water for the concrete would either be sought on site subject to a separate licence issued by the NSW Office of Water, or transported to the site via tanker trucks (refer to **Chapter 20** and **Appendix 14** for further details).

The areas affected by temporary construction activities would be rehabilitated to their former agricultural state on completion of the construction stage. Detailed Environmental Management Plans would be prepared prior to the commencement of construction, which would incorporate further detail to manage the impacts of construction activities including the temporary construction facilities.

5.13 Pre-Construction

If the project is approved, a number of further steps are required to prepare for construction. These include:

- Detailed design phase of the final wind farm layout, including determination of the final turbine and infrastructure locations in accordance with the principles set out at **Chapter 5.3** above;
- Obtaining all required secondary approvals;
- Preparation of the Pre-Construction Compliance Report;
- Finalisation and approval of the Construction Environmental Management Plan;
- Additional surveying and marking of locations for proposed infrastructure;
- Additional geotechnical investigation for the detailed design of the infrastructure;
- Obtaining a construction certificate (if required by the conditions of approval, if granted);
- Tendering for wind turbine components and other key infrastructure; and
- Tendering for the contracts for construction of the wind farm.

These further steps would take approximately one year.

Following this period the full construction phase would commence. This phase would likely take 18 to 24 months subject to delays due to weather and unforeseen circumstances.

5.14 Construction

At the peak of construction, the project is likely to be employing 65 people, across the tasks detailed in **Table 3** below.

Table 3 Construction activities

Activity	Works Involved
Site Establishment	Clearing of work areas, levelling and compaction, installation of portable buildings and installation / connection of utility services. Site Survey.
Internal Road Works	Removal of topsoil, levelling, sub-base compaction, gravel, drainage.
External Road Works	Upgrade existing roads where required. Provide new access roads to the site.
Foundations	Removal of topsoil, excavation, screed concrete, reinforcement steel bottom, installation of foundation ring, reinforcement steel top, concreting, concrete ring and conduits, backfilling.
Crane Pad Establishment	Removal of topsoil, base compaction, rock / gravel compaction.
Trenches and Cable Laying	Excavation; sand infill; lay cable; lay protective covering; back filling and compacting; installation of cable route markers.
Overhead Powerline	Installation of overhead powerline from the on-site substation to the off-site switching station adjacent to the Bannaby-Mt Piper 500kV transmission line.
Electrical Works (on-site substation)	Installation of control and auxiliary buildings; high voltage power transformer and switchgear; medium voltage switchboard, cabling and switchgear; communications equipment, Supervisory Control and Data Acquisition (SCADA) systems and turbine control panels. .
Turbine Supply	Transport of towers, nacelles, hubs and blades to site.
Turbine Erection	Erection of towers, nacelle, blades, installation of cabling.
Electrical Works (off-site switching station)	Installation of high voltage switchyard equipment; control and auxiliary buildings; communications pole; new transmission line tower adjacent or in line with existing transmission line; and all other ancillary equipment as required by TransGrid for construction and operation of a new Terminal Station; potential installation for an additional high voltage transformer and switchgear.
Wind Farm Commissioning	Pre-commissioning of turbines, SCADA, cables testing, optical fibre. Testing and commissioning of turbines, switchgear, SCADA.
Electricity Grid Connection Commissioning	Final commissioning by the transmission network service provider (Currently TransGrid) prior to connecting the generated electricity on the national electricity grid.
Construction Closure, Site Clean Up	Site cleanup, revegetation, landscaping.

The majority of the early work in the construction period is to prepare the site for the arrival of turbine infrastructure. This involves road upgrades, access track and hardstand area preparation.

Once this stage is complete, the turbine components can be transported and erected on site, usually at the rate of one or two per week. This involves transportation to the hardstand area at the base of each turbine and using cranes to lift turbine components to assemble the structure. In most circumstances, the turbine blades are assembled into the hub at ground level and are then lifted up to the nacelle by crane as a complete ensemble. In other circumstances, the turbine blades are individually lifted and assembled into the hub.

The turbines are anchored using large concrete gravity footings. In areas where granite rocks lie at or just below the surface, the footing is directly attached to the rock which would reduce the amount of concrete required. This may include the potential for rock blasting based on an assessment by the geotechnical engineer. Details of any rock blasting, and associated management techniques, would be provided in the Construction Environmental Management Plan (CEMP).

As outlined above, temporary facilities within a construction area would include portable toilets, vehicle parking, assorted construction equipment, a concrete batching plant and vehicle wash-down facilities. All temporary facilities would be located so as to minimise native vegetation loss and the land would be reinstated to its former state at the conclusion of the construction stage.

While this section provides an overview of the construction process, the construction would be managed by a management plan, which would address matters such as:

- Erosion control
- Water quality protection
- Soil protection
- Vegetation protection
- Air and dust pollution
- Safety
- Public road network access

Standard construction hours would apply to the project, as outlined below:

- Monday to Friday: 7:00am to 6:00pm
- Saturdays: 7:00am to 1:00pm
- Sundays: No construction

The following activities may be carried out outside of these hours as required:

- Any works that do not cause unreasonable noise emissions to be audible at any nearby residence not located on the site;
- The delivery of materials as requested by authorities for safety reasons; and
- Emergency work to avoid the loss of lives, property and / or to prevent environmental harm.

5.15 Operation

The operation phase of the project reflects the leasing arrangement with landowners. Landowners have agreed to grant the proponent a 30 year lease with the option to renew for another 30 years. Whilst no plan of subdivision will need to be registered as a result of these proposed leases, the project includes the grant of these leases and any deemed subdivision arising as a result.

During operation of the wind farm, all infrastructure associated with the wind farm would remain the property and responsibility of the proponent.

All access tracks used by the proponent would be maintained by the proponent as part of the operation of the wind farm, but would remain available for project involved landowners' use.

The wind farm would be controlled by a computerised system. The system would link each turbine by fibre-optic cables, typically laid in the same trench as the electrical cables. The computerised system would log all operating parameters and initiate the most efficient functionality of the turbines according to prevailing atmospheric conditions. The computerised system would also enable the controller to stop the turbine if required.

The system would ensure that rotational speed and the wind turbine angle operates automatically within the wind speed design envelope. Turbines would be disconnected from the grid at very low and very high wind speeds.

Maintenance of the turbines and associated infrastructure would be conducted throughout the operation phase. Maintenance includes a number of activities over different time periods. These are outlined in **Table 4** below.

Table 4 Typical maintenance schedule

Interval	Task
Monthly	Inspection of turbine generator and electrical infrastructure.
3-6 Monthly	Inspection of all machinery, greasing of bearings, checking of hydraulic oil.
As Required	Periodic painting of tower structure; Replacement of electronic and electrical components; Access track maintenance including erosion control; Substation maintenance inclusive of insulator cleaning, removal of debris and greasing of contacts.

As with any infrastructure project there is potential for equipment breakdown or failure during the lifetime of the project. Whilst most repairs would likely occur without impacts outside the wind farm site, should any of the raised components (within the nacelle or the blades themselves) need to be replaced, construction equipment such as cranes and other heavy machinery may be required to access the site temporarily. Such equipment may have a temporary impact on the road network but that impact would likely be minimal.

As part of the operation phase, a number of monitoring protocols would be implemented. These would include a program to ensure compliance with all approval conditions, including conditions relating to noise, flora and fauna and any other relevant potential impacts.

Whilst the life of a turbine is more than 20 years and often extends to 30 years, the project has been designed to allow for the possible removal and replacement of turbines during the lifetime of the project. If a turbine needs to be replaced, this process would follow the construction stages outlined above and be consistent with any project approval granted for the project.

Where possible, the existing footings, access tracks and other infrastructure would be reused for any replacement turbine(s) during the operation phase.

5.16 Decommissioning

As noted above, UFWA has entered into agreements for lease of land with the landowners who own land within the site. These agreements provide UFWA with leases for a term of 30 years and grant the proponent the opportunity to extend the lease for a further term of 30 years.

Any continuation of the wind farm beyond the first 30 year period may take the form of one of:

- Extended operation of the original turbines;
- Turbine replacement with the similar model that has newer and more efficient technology; or
- Turbine replacement with a different model that would be subject to the requisite approvals being obtained at that time.

Once the wind farm reaches the end of its useful economic life, the project would be decommissioned.

Decommissioning essentially involves the reverse process to construction. All materials would be removed from the site and recycled appropriately. Access tracks would remain where beneficial to the ongoing agricultural land use. Tracks considered surplus to the landowners' requirements would be rehabilitated and revegetated by introducing soil, mulch and grass seeds of local provenance.

AECOM Australia Pty Ltd (AECOM) was engaged by UFWA to prepare a Decommissioning and Rehabilitation Plan (DRP) for the project. It is a requirement of the Draft Guidelines that the EA for the project includes a DRP. Refer to **Appendix 4** of this report for the DRP for the project.

The proponent is responsible and committed to the decommissioning of the wind farm infrastructure, and the landowner is not liable for this obligation (as outlined in the land lease agreements with each of the project involved landowners).

The proponent seeks to mitigate the potential impacts resulting from the cessation of operation of the facility. The DRP outlines the stakeholder and landowner consultation, expected operational life, dismantling, land rehabilitation, funding arrangements, timeframes and responsibility associated with the decommissioning of the proposed project. UFWA has committed to implementing this plan.

The proponent has also consulted with the Oberon Shire Council regarding the project in general and aspects of the construction, operation and decommissioning phases.

The proponent will undertake further consultation with stakeholders prior to and during the decommissioning process.

5.17 Crown Land

Crown land is present within the site boundary and along the proposed transmission line route to the north-east.

Crown land is highlighted on **Figures 5**, **12** and **13**. A number of disused crown roads are impacted by the project infrastructure such as turbines, access tracks and the proposed transmission line options to the north-east. The Indicative Access and Infrastructure Plan at **Figure 12** identifies the locations where the impacts to crown land occurs within the site boundary, and the Proposed Transmission Line Plan at **Figure 13** identifies the locations where the impacts to crown land occurs on along the proposed northern transmission line route options.

Most of these roads are disused and not evident on the ground.

Where the impacts occur, turbines will be micro-sited (as described in **Chapter 5.3** of this report) to avoid the crown land where practicable, and where necessary the proponent will apply to have the crown roads closed, following the appropriate process for closing these roads, and consulting with the relevant authorities.

5.18 Minerals Titles

The project will not impact upon any minerals titles or mining areas. The formerly considered and assessed southern transmission line route options crossed minerals title boundaries; however these options are not proposed as part of this application.

5.19 Staging

The following table provides a timeline of the construction, operation and decommissioning phases of a 30 year lifespan of the project.

Table 5 Staging Timeline

Stage	Activity	Timing
Construction	Site establishment	March 2016
	Internal road works	30 weeks*
	External road works	24 weeks*
	Foundations	40 weeks*
	Crane pad establishment	41 weeks*
	Trenches and cable laying	45 weeks*
	Overhead powerline	
	Electrical works (on-site substation)	15 months*
	Turbine supply	12 months*
	Turbine erection	17 months*
	Electrical works (off-site switching station)	18 months*
	Wind farm commissioning	18 months*
	Electricity grid connection commissioning	19 months*
	Construction closure, site clean up	20 months*

Operation	Inspection of turbine generator and electrical infrastructure	Monthly, as specified by the turbine manufacturer
	Inspection of all machinery, greasing of bearings, checking of hydraulic oil	3-6 monthly as specified by the turbine manufacturer
	Periodic painting of tower structure	As required
	Replacement of electronic and electrical components	As required
	Access track maintenance including erosion control	As required
	Substation maintenance inclusive of insulator cleaning, removal of debris and greasing of contacts	As required
Decommissioning	Permanent cessation of electricity generation	At the end of either 30 or 60 years from commencement of operation**
	Electricity grid connection decommissioning	3 months***
	Removal of turbines	12 months***
	Removal of Electrical Works (on-site substation)	10 months***
	Removal of Electrical Works (Off-site switching station)	15 months***
	Removal overhead powerline	10 months***
	Removal of foundations	12 months***
	Removal of miscellaneous electrical works	11 months***
	Removal of crane pads	14 months***
	Site rehabilitation	15 months***
	Decommissioning closure	18 moths***

* denotes approximate completion timeline for the construction activity from the date of the site establishment activities.

** denotes approximate duration for the operation of the wind farm. The proponent has an agreement with the landholders for a minimum 30 years with an option of another 30 years.

*** denotes approximate completion timeline for the activities from the date of permanent cessation of electricity generation from the wind farm.