UNION FENOSA WIND AUSTRALIA

Berrybank Wind Farm
Chapter 3:

DESIGN RESPONSE

3 Design Response

Having established the site characteristics and the specific constraints and opportunities of the subject site, this chapter details how the wind farm has been designed to minimise negative impacts whilst maintaining a viable wind farm that maximises the generation of renewable energy.

3.1 Location Criteria

Before the design of the individual components of the wind farm, a location for the project was selected. In establishing the location of the proposed wind farm the proponent has had regard to the following factors;

- Distance from coastline;
- Low population density and considerable buffers to residential communities;
- Willing land owners;
- Large land holdings;
- Proximity to existing electricity grid;
- Excellent wind resource;
- Access to existing infrastructure (ports, good quality roads etc)

These factors combine to make the Berrybank site very suitable for a large wind farm. Early wind farms were often located along the coast but advances in turbine technology have allowed wind farm proponents to select inland areas and away from sensitive coastline locations.

The subject site is also favoured by the presence of two existing high voltage powerlines, which run at the north western and south eastern extremities of the site. As a result, long distance overhead power line connections are not required, and if the 500KV line is selected, it is possible to connect straight from the substation to the existing line, avoiding the need for overhead powerlines.

3.2 Design Criteria

In designing the wind farm the consultant team and proponent has also had regard to the following site specific factors as described in **Chapter 2;**

- Site Details
- Wind Resource
- Land Use
- Dwellings
- Topography and Soils
- Hydrology
- Transport and Infrastructure
- Vegetation
- Landscape and Visual Features

The design of the wind farm followed an iterative process whereby specialist inputs fed into the design at various stages. An initial wind farm layout was produced which was the subject of preliminary consultant studies. The results from the studies and the community consultation undertaken informed several revisions to the plan. Changes included reducing the number of turbines south of Hamilton Highway, increasing the buffer distances to houses, increased screening vegetation, and changes to the access tracks.

As a result, the plan forming part of this application has responded to the range of specialist studies and the results of the community consultation such as the public information day, and door knock.

In establishing the design of the wind farm the proponent has had regard to the views of the local community and other key stakeholders, including DSE, DPCD, and both local Councils. This was determined following the community consultation process detailed in **Chapter 18.**

The following principles guided the evolution of the wind farm layout.

Access to infrastructure - A 220kv and 500kv transmission line are easily accessible to the site, enabling good transmission of energy to the grid. Connection to transport routes and destinations (Hamilton Highway to Portland and Geelong) are also readily available.

Balance impacts with energy production – The wind farm has been designed to minimise the following impacts whilst retaining the viability of the project to substantially contribute to the generation of renewable energy;

- Economic and Social Impacts – Ensure the project is of positive community benefit.
- Visual amenity – Ensure visual impact is minimised and where appropriate mitigation measures to reduce impact.
- Noise – Ensure noise impacts are within acceptable standards with significant buffers to non-participating land holders.
- Flora and Fauna – Ensure that native vegetation is avoided, any loss of vegetation is minimised and any unavoidable loss is offset through replanting.
- Aviation – Ensure the safety of aircraft in the vicinity.
- Transport – Ensure the safe and efficient transportation of equipment to the site and the upgrading of roads to facilitate access and for the benefit of the community.
- Telecommunications – Ensure any disruption to telecommunication services is ameliorated.
- Fire – Ensure the potential risk of fire is managed appropriately.
- Shadow Flicker – Ensure the incidence of shadow flicker is managed to acceptable standards.
- Heritage – Ensure the protection of aboriginal and cultural heritage.

Match turbines with the wind resource – The turbine selection has been made to respond to the moderate but consistent wind resource at Berrybank with low cut in features.

Separation to non-participating land holders – In order to manage the cumulative impacts of the development on neighbouring land holders, substantial distances from turbines to non- participating landholders (1km at a minimum) have been employed.

UNION FENOSA WIND AUSTRALIA

Berrybank Wind Farm
Chapter 4:

THE PROPOSAL

4 The Proposal

The following chapter outlines the proposal 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.

4.1 General

The proposal comprises a number of elements, and includes:

- 100 individual wind turbines standing up to 131m at top of blade tip;
- 100 individual kiosks for housing of 33kV Transformers and 33kV Switchgears and associated control systems next to the wind turbine towers (some turbine models don't require these kiosks);
- Internal unsealed tracks for turbine access;
- Upgrades to local road infrastructure;
- An electrical substation and overland powerline connection to the existing 220 or 500 kilovolt (kV) transmission line;
- An underground electrical and communication cable network linking turbines to each other and the proposed substation including crossings of Hamilton Highway and the Gheringhap To Maroona Railway;
- A temporary concrete batching plant to supply concrete for the foundations of the turbines and other associated structures;
- Up to 3 wind monitoring masts fitted with various instruments such as anemometers, wind vanes, temperature gauge and potentially other electrical equipment;
- Two business identification signs;
- Obstacle lighting to selected turbines;
- A wind farm control room and facilities building co located with the substation;
- A substation control room and facilities building co located with the substation;
- A small amount of native vegetation removal and screen planting.

The turbine layout for the proposed wind farm is shown in **Figure 7 – Site Plan**. The locations shown reflect the current understanding of the best location for the turbines given the current knowledge of wind characteristics and presence of vegetation.

4.2 Turbine Specifications

The most important element in any wind farm is the wind turbines, often referred to as WTG's (Wind Turbine Generator's). The turbine manufacturing industry is dynamic, with new and updated models constantly being released and existing models frequently being made redundant only a few years after their release. The industry is rapidly growing and benefits from constant innovation and advancement in the efficiency of the turbines.

As a result, to allow for flexibility in the selection of turbine models, this application seeks approval for a maximum turbine 'envelope' rather than a single turbine model. This envelope represents the largest and widest of the 6 turbine models under consideration. Many of the turbine models under consideration are smaller than the maximum envelope. In general, if any of the smaller turbines are utilised for the Berrybank Wind Farm the impacts described and assessed in this report are likely to be slightly less.

The proposed envelope contemplates that, as a maximum, the turbine will have an overall height of 131m when constructed. This envelope includes a tower of 80m in

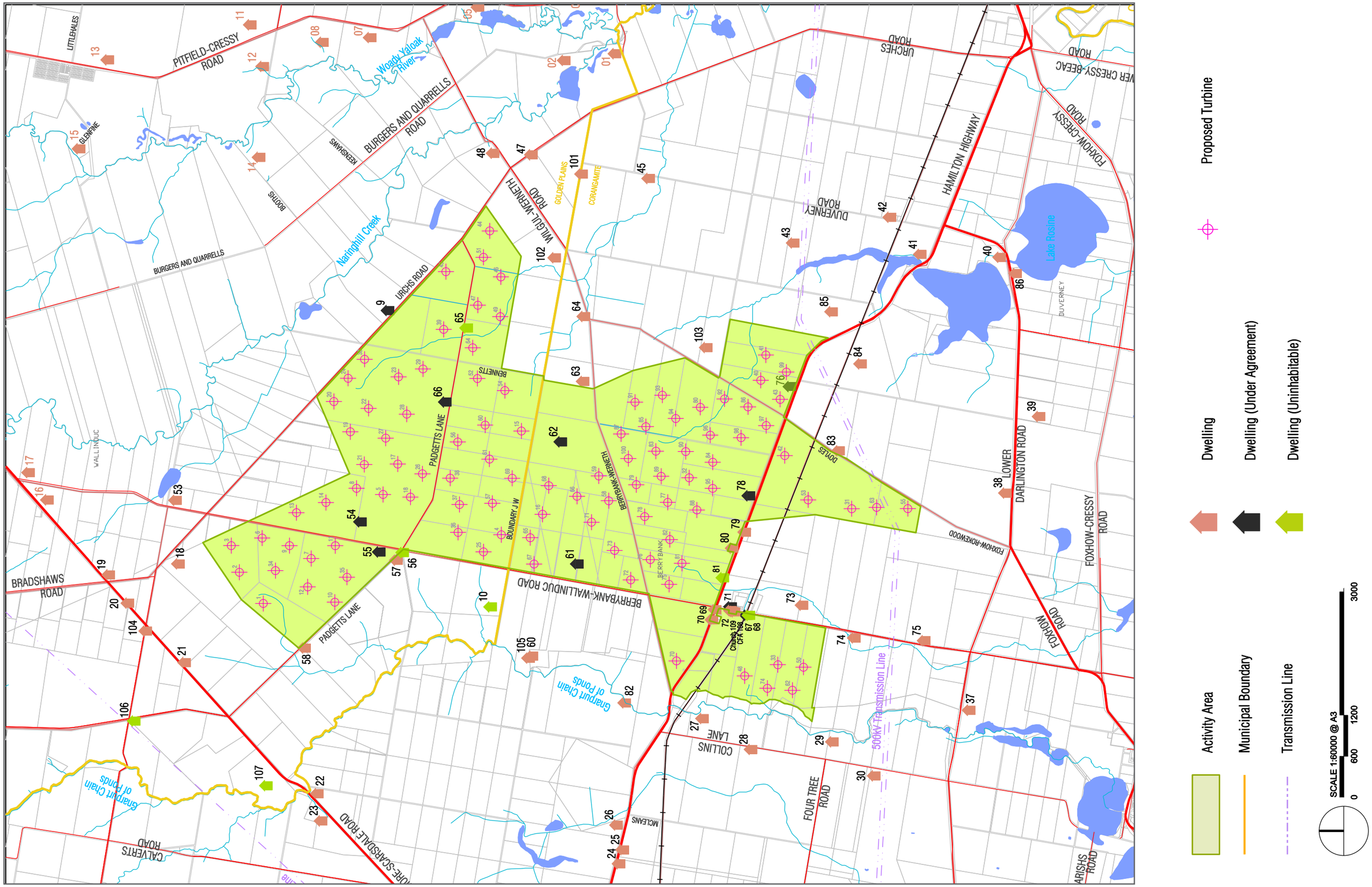

Figure 7 – Site Plan

Source: Tract Consultants

height to the hub, coupled with a 49m long blade (excluding hub) and a 2.5m wide hub.

Accordingly, for the purposes of this application the largest turbine model under consideration has been assessed in relation to the majority of potential impacts. For an illustration of the wind turbine envelope under consideration refer to **Figure 8- Wind Turbine Elevation.**

Whilst the majority of potential impacts of wind turbines are related to its height and width, noise impacts are not related to height. The noise produced by an individual turbine is a function of the mechanical characteristics of the turbine, and not necessarily its height. Therefore, in assessing noise impacts, each of the 6 wind turbine models currently under consideration have been assessed.

The table below illustrates the difference between the various models under consideration (Refer to **Table 3 – Turbine Comparison**).

Table 3 – Turbine Comparison

Turbine Option	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
No. of Turbines	100	100	100	100	100	100
Tower Hub Height	80m	80 m	80 m	80 m	80 m	80 m
Rotor Blade Length	44m	49 m	48.7 m	49 m	45.2 m	46.2 m
Rotor Diameter	90m	100 m	100 m	101 m	92.5 m	95 m
Total Height (To Tip)	125m	130 m	130 m	131 m	127 m	128 m
Turbine Capacity	2.0 MW	1.8 MW	2.5 MW	2.3 MW	2.0 MW	2.4 MW
Total Wind Farm Capacity	200 MW	180 MW	250 MW	230 MW	200 MW	240 MW

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 a 33kV switchgear either in the base of the tower or next to 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 each of the turbine models under consideration are as follows;

- Reinforced concrete 'gravity foundations' up to 17m x 17m and between 2m to 3m in depth. A rock anchor foundation is being investigated which would require much smaller concrete footing areas.
- A tubular steel tower approximately 4.3 m in diameter at the base, tapering to a diameter of 3.0 m at the top, with a total tower height of 80 m, weighing approximately 210 tonnes;
- A nacelle at the top of the tower housing the gearbox and electrical generator;
- A rotor comprising a hub (attached to the nacelle) with three blades, and a shaft that connects to the generator via the gearbox; and
- 3 blades up to 49 m long (excluding hub), made of light weight materials.

Safety components incorporated in all models under consideration include a lightning protection system. All new blades are manufactured with an anti-lightning protection system which minimises the damage to the turbines in the event of an atmospheric

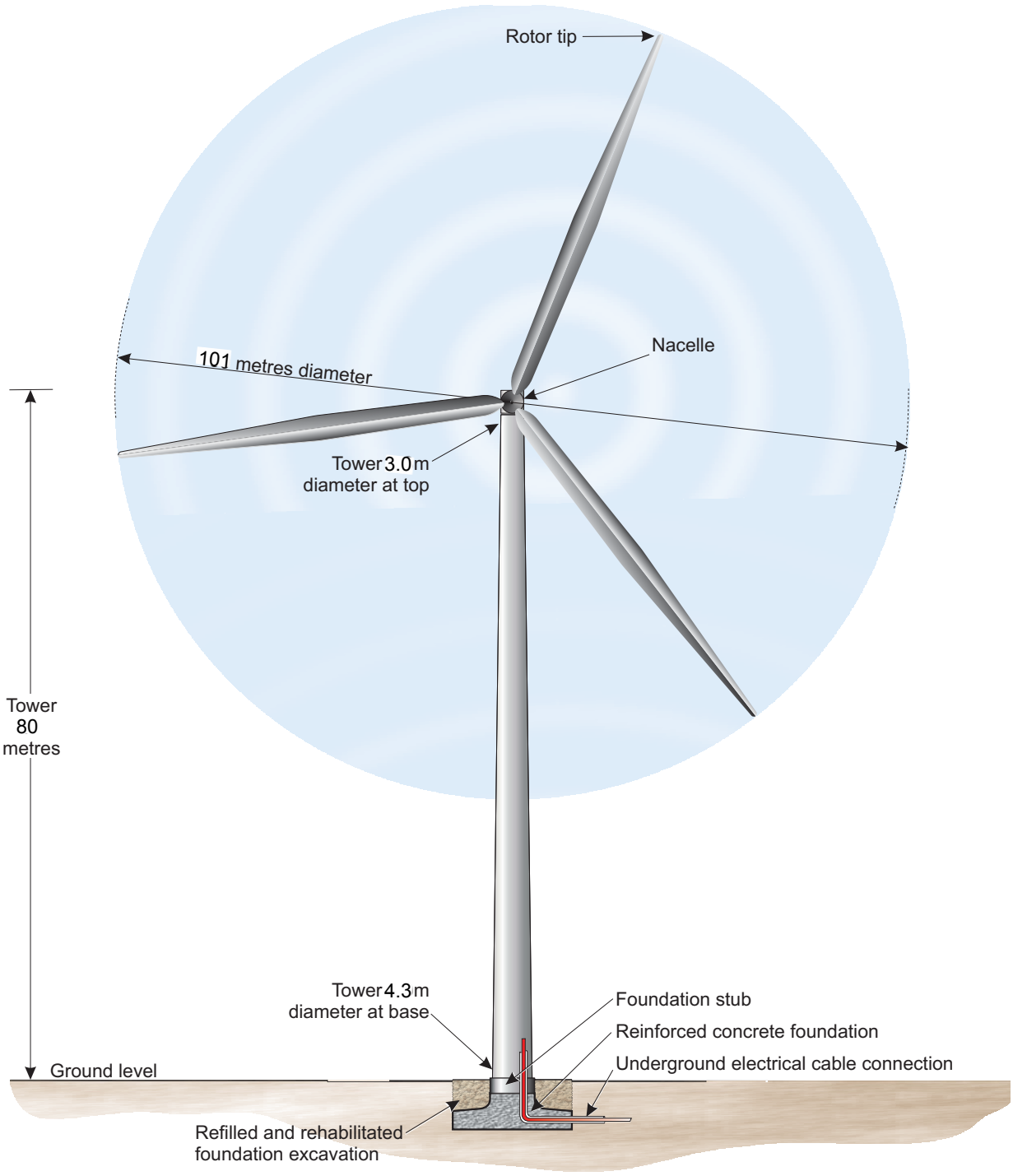

Figure 8 - Wind Turbine Elevation

Source: Adapted from URS 2005 - note not to scale

discharge (lightning). In the event of a lightning strike, power is diverted from the lightning to nacelle which is grounded to the turbine earth grid.

Other safety components include;

- Sufficient standing and working room;
- Full containment of any leakage or spillage; and
- Fibreglass weather protector.

The proposed turbines will result in efficient transfer of electricity as they have been chosen to match the local conditions in Berrybank. As the height above the ground increases the wind resource generally increases and as a result the turbines under consideration will be significantly more efficient than previous smaller models. The turbines under consideration are a appropriate fit with the wind resource at Berrybank, allowing maximum output capacity to be achieved at significantly lower wind speeds.

The turbines under consideration all have low 'cut-in' speed and low nominal wind speeds (ie maximum output capacity is achieved at lower wind speeds). These turbines also allow for the employment of low-noise mode if necessary.

All turbines will be painted in a non-reflective light grey/off white paint.

4.3 Access

Major access to the region will be achieved by Hamilton Highway which bisects the site. Raw construction materials will likely be delivered from Geelong whilst the individual turbine components are most likely to be transported from Portland.

As the turbine components will be considered Over Dimensional (OD) loads, the route from Portland is of particular importance. The routes proposed from Portland and Geelong are shown in **Figure 9a** and **9b – Road Network Access.**

The proposed access routes utilise "A" and "B" class roads designated under the VicRoads hierarchy of roads classification and arterial roads under the Moyne Shire and Warrnambool City road classifications. Refer to **Appendix 3 – Traffic Impact Assessment** for more information.

For direct access purposes, the site can be divided into 2 parcels – north and south of Hamilton Highway. Owing to the large site area (5,034 ha) and that the site crosses numerous roads, access to the site from a single point is impractical. Primary access to the northern portion will be from the main entrance off Berrybank – Wallinduc Road, just north of Berrybank – Werneth Road.

This main entrance will provide access into the northern component of the site, and a network of access tracks will lead to the turbines. These access tracks cross a number of roads, including:

- Berrybank – Wallinduc Road (north of Padgetts Lane)
- Padgetts Lane (between Berrybank – Wallinduc Road and Bennets Road)
- Padgetts Lane (between Bennets Road and Urches Road)
- Boundary Road (between Berrybank – Wallinduc Road and Bennets Road)
- Berrybank – Werneth Road (between Berrybank – Wallinduc Road and Doyles Road)
- Berrybank – Wallinduc Road (between Hamilton Highway and Berrybank – Werneth Road)
- Doyles Road (between Hamilton Highway and Berrybank - Werneth Road)

Movements will occur at these points only across the road, and they will not be used to gain access to the site from the public road.

Access to the southern portion (south of Hamilton Highway) is proposed from:

Figure 9a - Road Network Access - Portland

Source: Aecom

Figure 9b - Road Network Access - Geelong

Source: Aecom

- Foxhow Road (south of the railway)
- Doyles Road (north of the railway)
- Doyles Road (south of the railway)

No direct access is proposed from Hamilton Highway. Access points have been selected taking into account traffic engineering principles, wind farm construction and operation requirements, and the avoidance of native vegetation.

The road upgrades will include the following;

- **Berrybank-Wallinduc Road** - Widening the existing pavement from 3.6m to 6.2 m with 1.5m unsealed shoulders between the Hamilton Highway and the main site entry immediately north of the Berrybank-Werneth road.
- **Foxhow-Berrybank Road** - Establish a consistent 2.0m shoulder (0.5m sealed, 1.5m unsealed) between the Hamilton Highway and site entry.
- **Doyles Road** - Widen and seal the existing traffic lane (from 3.0m to 3.5m) and establish a consistent 2.0m shoulder (0.5m sealed, 1.5m unsealed) between the Hamilton Highway and site entry.

Two existing rail level crossings which cross the Gheringhap to Maroona Railway will provide access to the southern section of the site at the following locations;

- Existing level crossing at Foxhow - Rokewood Road to be used for construction and operation vehicles.
- Existing level crossing at Foxhow Road to be used for construction and operation vehicles.

Discussions have taken place with VicTrack to use these crossings.

Within the site unsealed access tracks will be created to connect to the turbines and some of these will use existing farm tracks. During construction these will be widened to approximately 10m in width to support the extra load of trucks carrying equipment and cranes. This is then reduced during the operation phase of the project to approximately 3m. The tracks will also be used by the farmer to access the property.

4.4 Wind Farm and Substation Control Rooms / Facilities Buildings

Two control rooms / facilities buildings are proposed to be constructed within the site and each includes 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 control room and facilities building will be co-located with the substation (outlined in the following section). The exact location of the buildings are yet to be determined, however six (6) potential locations have been nominated. The final location will depend on the transmission connection point and discussion with the grid operator. Refer to **Figure 10 – Access and Infrastructure Plan.**

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 wind farm is operational, staff would be on-site during the normal working week and continuous remote monitoring will take place over a 24-hour period.

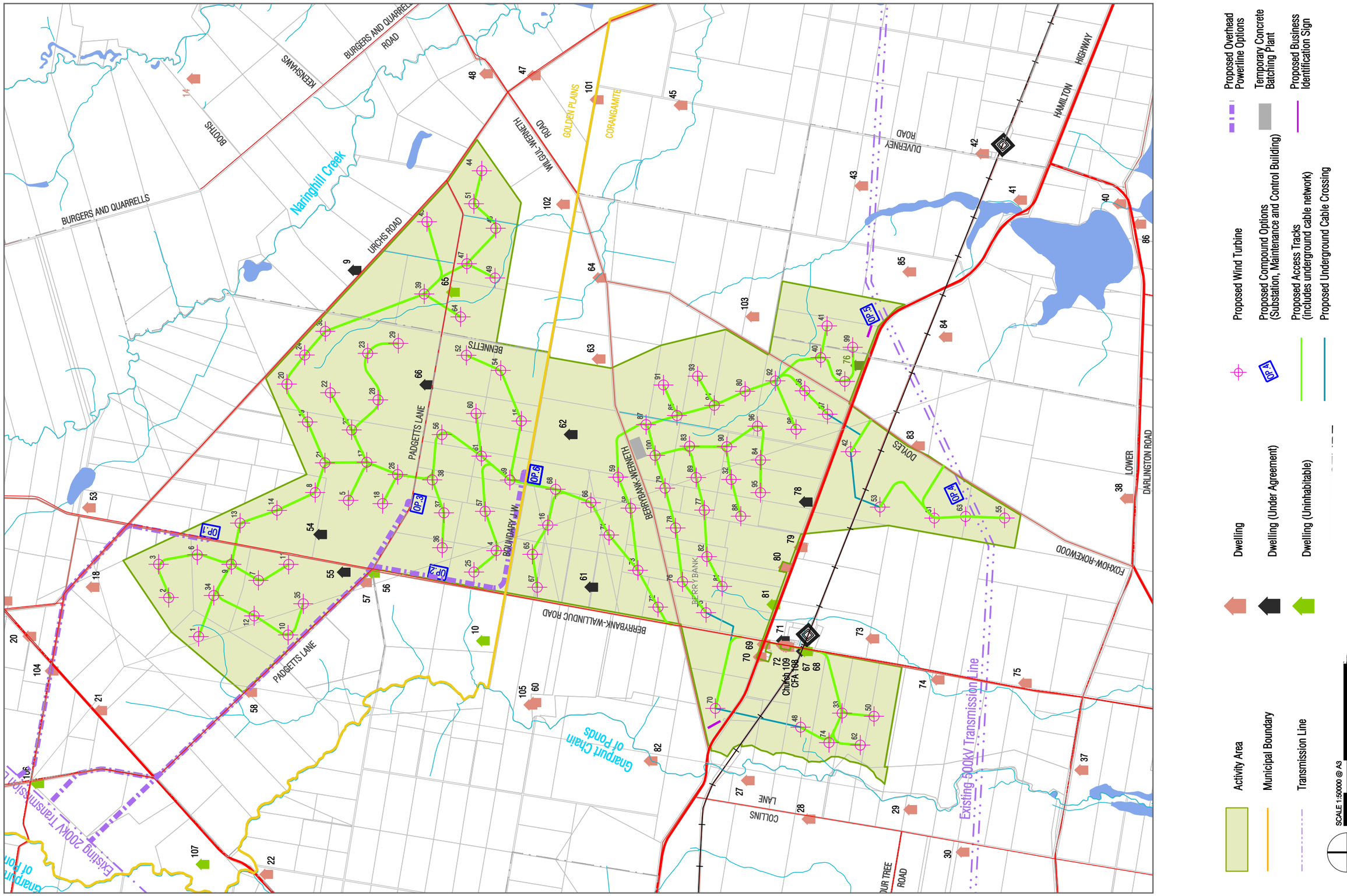

Figure 10 – Access and Infrastructure Plan

Source: Tract Consultants

The control room, facilities building and substation will be screened from outside views by thick native vegetation surrounding the compound.

4.5 Electrical works

The electrical works proposed comprise;

- 33 kV electrical cables linking the turbines to the sub-station, installed underground;
- control cables linking the turbines to the control room, also installed underground;
- a 33 / 220 kV or 33 / 500kv transformer substation, including main transformer and switchgear; and control and communications equipment installed within the control room.
- An above ground connection to the 220kv or 500kv transmission line;

The underground electrical cables would be steel wire, protected by cable markers and laid approximately 1m deep underground (surrounded by soft sand with back fill). A number of options exist for the above ground electrical connection depending on the location of the substation.

There are four locations which require electrical cabling to cross Hamilton Highway and the rail line. These include the following;

- 33KV MV electrical cables in conduit and communication cables in conduit underground crossing the Gheringhap To Maroona Railway at 153.614km (west along rail from the Melbourne CBD reference point) or approximately 1200m west of Foxhow Road.
- 33KV MV electrical cables in conduit and communication cables in conduit underground crossing the Hamilton Highway at approximately 1200m west of Foxhow Road.
- 33KV MV electrical cables in conduit and communication cables in conduit underground crossing the Gheringhap To Maroona Railway at 150.007km (west along rail from the Melbourne CBD reference point) or approximately 1200m west of Foxhow - Rokewood Road.
- 33KV MV electrical cables in conduit and communication cables in conduit underground crossing the Hamilton Highway at approximately 300m west of Foxhow – Rokewood Road.

Approaches have been made to both VicTrack and VicRoads to obtain their consent for the proposed crossings.

The above ground electricity connection would link via Padgetts Lane or Urchs Road within the road reserve. Alternatively a connection to the 500kv line will be achieved within the site boundary. The proposed route to the 220kv line is shown in **Figure 10 – Access and Infrastructure Plan.**

4.6 Substation

The substation would increase the voltage of electricity generated by the wind farm from 33kV to 220kV or 500kV 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 equipment surrounded by a fence and screening vegetation. This area includes the control rooms / facilities buildings that are approximately 400m2 each which would house the relay switch control gear, battery room, storage area and staff amenities.

VENCorp is the Network Transmission Line Regulator (Government) which provides guidelines for connection and will assess the proponent's connection application. SP

AusNet is the network transmission line owner and maintainer (Private Entity) for both transmission lines in the area and will potentially own and control the switchyard of the proposed substation. The electrical works and connection will comply with the requirements of these organisations.

4.7 Vegetation Removal and Planting

4.7.1 Vegetation Removal

The proposed vegetation clearing is minimal as the site is already largely cleared and the proposal has been designed to avoid the need to remove native vegetation. Further, only 1% of the site area is needed for buildings and works associate with the wind farm. The key reason for vegetation removal is for the provision of crossovers across Council managed roads.

The removal is confined to the area south of Hamilton Highway on Doyles Road, where two entrance locations are required to cross vegetation to gain access to the site either side of the railway line. These access points were chosen to avoid the native trees and make use of the existing clearings. However some loss of the native grasses is unavoidable as access to this area of the site is constrained in other areas. Access is not permitted along Hamilton Highway because of VicRoads traffic policies.

Other areas of vegetation that may need to be removed to secure overland electricity line connection to the 220kv transmission line. The areas affected include;

- Padgetts Lane (east of Berrybank - Wallinduc Road)
- Berrybank-Wallinduc Road (north of Boundary Road)
- Urchs Road (East of Berrybank - Wallinduc Road).

If the wind farm is connected to the 500Kv transmission line, the overhead powerline connection and therefore the vegetation removal will not be requited.

The internal access tracks have been designed to avoid native vegetation, as well as exotic or planted vegetation. In some instances access tracks will need to cross existing wind breaks, which are either exotic vegetation or planted natives, and therefore do not constitute native vegetation as defined by the Victorian Planning Provisions.

An additional source of vegetation removal is the removal of wind breaks in some areas to assist in efficient conversion of the wind resource. As discussed, the wind breaks are predominantly planted or exotics and therefore do not constitute native vegetation. Where trees are removed the relevant land owner will be consulted and a suitable native species which does not affect the wind resource will be planted in place of the removed vegetation.

No native vegetation removal is required for the substation or control building or any of the turbines. Similarly, hardstand areas adjacent to the turbine locations will avoid the removal of native vegetation. The areas of vegetation removal are demonstrated graphically in **Figure 6 – Vegetation Plan.**

4.7.2 Vegetation Planting

Alongside siting considerations to reduce visual impacts, vegetation screen planting can be an effective tool in screening the visual impact of wind turbines.

It is employed in the following areas;

- Surrounding the substation and control / facilities buildings;
- In the vicinity of nearby residences and along the roadside to screen potential views of turbines.

Screen planting is only effective where the planting can occur in close proximity to the common viewing location (ie a nearby dwelling).

Many of the dwellings in the locality are already surrounded by vegetation that performs, to at least some extent, a screening role. Planting will involve a variety of dense native vegetation, including both trees and shrubs, to effectively screen views. Whilst the exact area of screening will depend on detailed design and consultation with landowners, the general extent is depicted in **Figure 6 – Vegetation Plan.**

4.8 Hazard Lighting

The proposed wind farm will use obstacle night lighting in accordance with the Civil Aviation Safety Authority (CASA) guidelines to minimise potential hazards to aircraft. An indicative obstacle lighting layout that's shows obstacle lighting to 52 of the 100 turbines has been produced and can be found as **Figure 11 – Indicative Obstacle Lighting.**

This layout meets CASA's recommendations for obstacle lighting. The lighting would be consistent with the guidelines under which the following type of lighting would be used;

- *Two flashing red medium intensity obstacle lights should be provided;*
- *Light fixtures to be mounted sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction.*

Further that;

- *Both lights should flash simultaneously;*
- *Characteristics of the obstacle lights should be in accordance with MOS Pt 139;*
- *All obstacle lights on a wind farm are to be synchronised to flash simultaneously; and*
- *An appropriate monitoring, reporting and maintenance procedure is to be established to ensure outages are detected, reported and rectified.*

More information on aviation impacts can be found in **Chapter 10 – Aviation.** Visual impacts will be minimised by restricting the downward component of 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.*

More information in regard to visual impacts can be found in **Chapter 7 – Visual Impacts.**

4.9 Business Identification Signs

Two business identification signs are proposed to identify the project and inform the community and travellers along Hamilton Highway. The signs would identify the name of the project, proponent and provide a phone number and website for enquires. The locations for the two signs are shown in **Figure 10 – Access and Infrastructure Plan.** The size of each sign would be 1.5m2 (1m by 1.5m) set on a metal frame immediately within the wind farm boundary in a location visible from Hamilton Highway.

These signs would contain the following information;

- The name of the proponent;
- The name of the wind farm;
- A contact number and website address for enquiries.

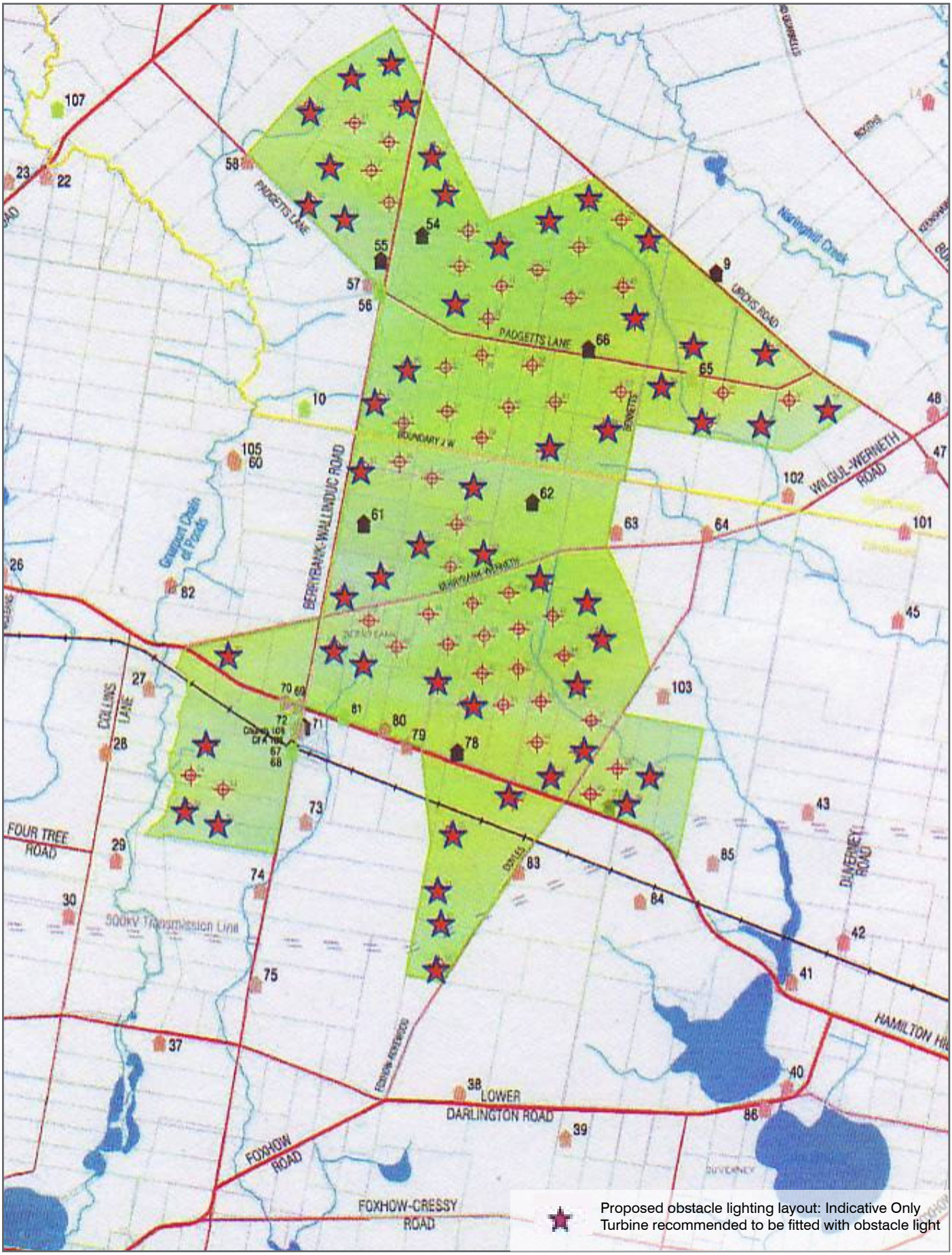

Figure 11 – Indicative Obstacle Lighting

Source: Ambidji Group 2009

4.10 Temporary Concrete Batching Plant

A temporary concrete batching plant will be required for the construction stage of the project. The location of the batching plant requires that it is central to the activity area and significantly removed from houses due to the occasional generation of noise and dust.

In consideration of this, the concrete batching plant will be located on the south side of Berrybank - Werneth Road approximately 2.5kms from the Berrybank – Wallinduc Road intersection. This location is significantly removed from habitable dwellings and central to the activity area which minimises travel distances to individual turbines. Refer to **Figure 10 – Access and Infrastructure Plan** for batching plant location.

The establishment and operation of the temporary concrete batching plant will be in accordance with the Environment Protection Authority's Environmental Guidelines for the Concrete Batching Industry, Publication No. 628. The area for the batching plant will be approximately 2500m2 and will be rehabilitated to its former agricultural state on completion of the construction stage.

Detailed environmental management plans prepared as a condition on permit will manage the operation of the plant.

4.11 Construction

The full construction phase would likely take 12 to 14 months subject to delays due to weather and unforseen circumstances. The construction phase of the project (subject to planning approval) would likely commence in the last quarter of 2010.

At the peak of construction, the project is likely to be employing 240 people, across the tasks detailed in **Table 4 – Construction Program.**

Table 4 – Construction Program

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, cable laying with protective covering, backfilling and compacting, installation of cable route markers.
Substation Civil Works	Site survey, site clearing, levelling/compaction. Building foundations including excavation, formwork and concrete. Installation of columns, walls, roof, gutters, doors, floors. Installation of building services including plumbing, electrical, fire protection, security.

Activity	Works Involved
Control Buildings	Foundation works including excavation, formwork, reinforcement, concreting. Installation of columns, walls, carpentry, roof, floors, doors. Installation of services including plumbing, electrical, fire protection, air conditioning, security.
Switchyard Works	Site survey, site clearing, levelling/compaction. Equipment foundations including excavation, formwork, reinforcement steel, concrete, grouting. Oil containment and separation system including excavation, formwork, concrete, ladders, hatches, pipes and bund walls. Security Fencing.
Electrical Works	Control building switchboards, communications, Supervisory Control And Data Acquisition (SCADA) systems. Installation of cabling, switchgear, turbine control panels.
Turbine Supply	Transport of towers, nacelles, hubs and blades to site.
Turbine Erection	Erection of towers, nacelle, blades, installation of cabling.
Substation Electrical Works	Installation of steel structures, busbars, transformers, equipment, earthing system, metering system
Transmission Line works	Surveying, Site establishment, clearing, installation of foundations, poles / towers, conductors and fittings.
Wind Farm Commissioning	Pre-commissioning of turbines, SCADA, cables testing, optical fibre. Testing and commissioning of turbines, switchgear, SCADA.
Substation Commissioning	Testing and commissioning of transformers, equipment, earthing, cabling and wiring checks, protection relays, SCADA, communications and security systems.
Electricity Grid Cut in	Site establishment, clearing, levelling / compaction. Installation of foundations, poles / towers, connections to the High voltage transmission line.
Construction Closure	Site cleanup, revegetation, landscaping.

Temporary facilities would include a site mobilisation area, site offices, portable toilets, materials storages; vehicle parking, equipment, a concrete batching plant and vehicle wash-down facilities. All temporary facilities would be located so as to avoid vegetation loss and the land would be reinstated to its former state at the conclusion of the construction stage.

Construction hours

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

The following activities may be carried outside of these hours:

- Any works that do not cause 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.

In the event that it is required to undertake other works outside the above construction hours, prior approval will be obtained from the relevant authority.

4.12 Operation

The operation phase of the project reflects the leasing arrangement with landowners. A 30 year lease with the option to extend for another 30 years has been entered into with the landowners. During the operation all infrastructure associated with the wind farm would remain the responsibility of the proponent, although control of the switchyard of the substation would remain in the control of the transmission infrastructure owner (SP Ausnet). All access tracks used by UFWA would be maintained by UFWA as part of the operation of the wind farm, and are available for host landowner's use.

The wind farm would be controlled by a computerised system. The system would be linked to each turbine by fibre-optic cables laid in the same trench as the electrical cables. The computerised system would log all relevant operating parameters and initiate the most efficient functionality of the turbines according to the atmospheric characteristics. The computerised system would also enable the controller to stop the turbine through an automated response.

The computerised system would ensure that rotational speed and the wind turbine angle operate automatically within the wind speed design envelope. Turbines would be disconnected from the grid at low wind and very high wind speeds. Maintenance will be conducted throughout the operation phase. Maintenance includes a number of activities over differing time periods. These are outlined in **Table 5 – Typical Maintenance Schedule** below.

Table 5 – 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.

4.13 Decommissioning

As noted above, UFWA has entered into agreements for lease of land with the landowners who own the site. These agreements provide UFWA with leases of the site for a term of 30 years (and grant UFWA an option to extend the lease for a further term of 30 years) in the event that certain conditions are satisfied.

At the end of the 30 years the wind farm can either be extended, renewed or decommissioned.

Any continuation of the wind farm beyond the first 30 year period may take the form of either turbine replacement (subject to the requisite approvals being obtained) or the extended operation of the original turbines.

If the wind farm reaches the end of its useful economic life and no extension is pursued by UFWA, it would be decommissioned. Decommissioning would represent the reverse process to construction. All materials would be taken from site and recycled appropriately. Access tracks would remain where beneficial to the ongoing agricultural land use. Tracks considered surplus to requirements would be rehabilitated and revegetated by introducing soil, mulch and grass seeds of local provenance.

The model conditions for wind farms (DPCD, 2009) contains a condition that outlines requirements for decommissioning of a wind farm. It reads that

> *The wind energy facility operator must, no later than 2 months after any or all wind turbines have permanently ceased to generate electricity, notify the Minister for Planning in writing of the cessation of the use. Within a further 12 months of this date, the wind energy facility operator, or in the absence of the operator, the owner of the land on which the relevant turbine(s) is/are located, must undertake the following to the satisfaction of the Minister for Planning within such timeframe as may be specified by the Minister*

> *remove all above ground non-operational equipment;*

> *remove and clean up any residual spills or contamination;*

> *rehabilitate all storage, construction, access tracks and other areas affected by the project closure or decommissioning, if not otherwise useful to the on-going management of the land associated with the use, development and decommissioning of the wind energy facility;*

> *submit a decommissioning traffic management plan to the Minister for Planning and, when approved by the Minister for Planning, implement that plan; and*

> *submit a post-decommissioning revegetation management plan, including a timetable of works to the Minister for Planning and, when approved by the Minister for Planning, implement that plan.*

A similar condition has been applied to other wind farm projects and it is expected that this will be used as the basis for a similar condition that may be applied to any planning permit issued in relation to this project.