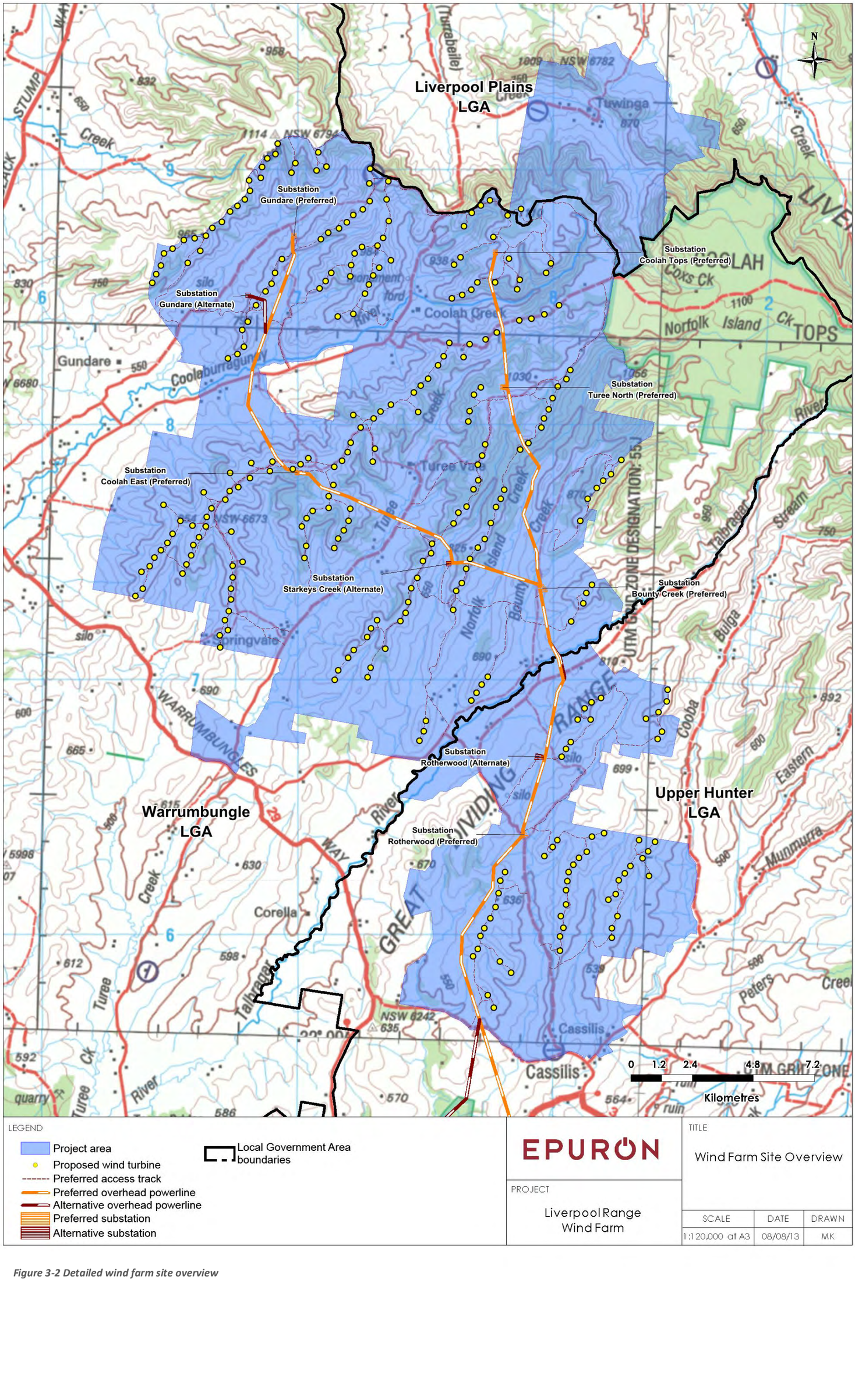

Figure 3-2 Detailed wind farm site overview

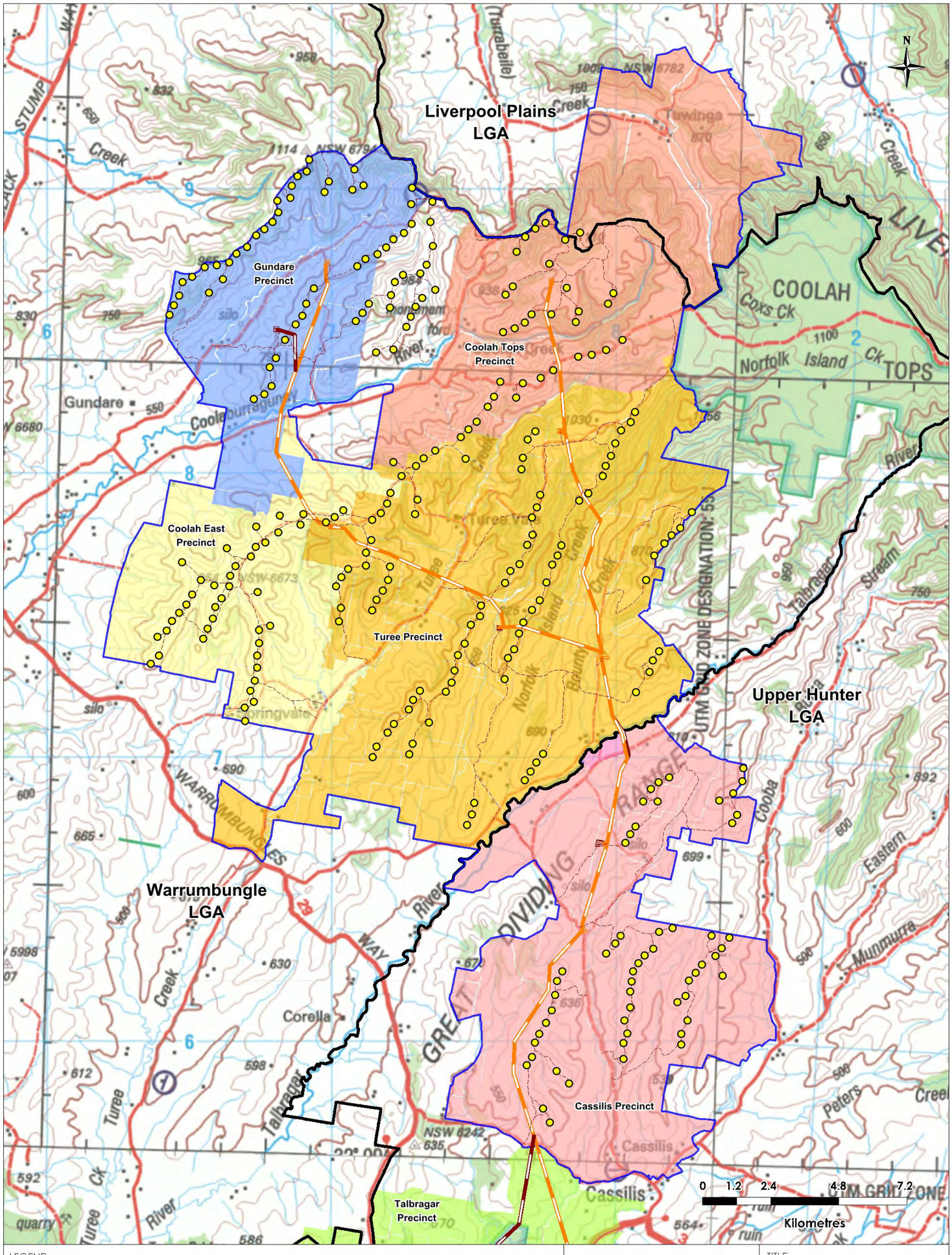

Figure 3-3 Liverpool Range Wind Farm development precincts

3.2 Wind Turbine Layout & Site Boundary

General

As outlined above, all wind farm components will be located within the assessed Project Corridor.

This EA has assessed an indicative wind farm layout which has been through a number of design iterations. The design process is focused around three core principles:

- minimising and/or avoiding negative environmental and community impacts;
- maximising positive impacts (clean energy production and greenhouse gas reduction); and
- incorporating practical limitations in relation to the construction and operation of the site, including costs.

Where trade-offs are required between these core principles, Epuron has used its experience and judgement, taking into consideration a balanced view of the public good in finalising the layout.

Preliminary Layout

In 2010-11 a preliminary layout accommodating approximately 550 wind turbine locations was prepared to guide initial landowner discussions and the progression of community consultation engagement. This layout was based primarily on early wind speed analysis and a desktop review of available terrain and mapping data. While some early feedback was available from discussions with landowners, this initial layout could not take into consideration many constraints which were not known at the time the preliminary layout was prepared.

The Preliminary Environmental Assessment was based on this preliminary layout.

Site Boundary and Stage 1 Development

During the development of the project, Epuron has negotiated with a large number of landowners in relation to their involvement in the project. A number of areas of land in the vicinity of the site which are suitable for turbines were not included in the Preliminary Environmental Assessment, however Epuron continued to liaise with these landowners in relation to their potential involvement. This has led to some small additions to the previous site investigation area.

In parallel, a number of properties have changed hands or are in the process of changing hands. This has meant that some land which was previously part of the project has new owners, and on some properties the ownership is still in transition.

On 24 August 2012, the Department of Planning advised that it was bringing forward the timeframes for assessment of Part 3A projects. This significantly reduced the time available for Epuron to finalise land negotiations with respect to the proposal and, in order to meet these revised timeframes, Epuron focused its attention on a reduced initial development stage which is the subject of this Application.

Accordingly, the area outside of this initial stage has been removed from this application. While Epuron remains keen to develop further stages of the proposal, these will be through a new Development Application process.

Figure 3-4 shows the site boundary of this revised application compared with the site boundary identified in the Preliminary Environmental Assessment.

Layout Revisions

The preliminary layout has been subsequently revised to take into account the revised site boundary, with a number of turbine areas removed from consideration under this application.

Having finalised the proposed wind turbine development area, a revised layout proposing 417 wind turbines was prepared in October 2012 for consultation. This layout was largely prepared by incorporating:

- consideration of the Draft NSW Planning Guidelines: Wind Farms;
- the final wind turbine development area identified for Stage 1;
- landowner and community feedback in relation to the preliminary layout;
- revised wind speed assessments based on additional wind data;
- proximity to final house locations identified through field surveys;
- constraints identified during initial field studies;

- technical constraints including in relation to access; and,
- consideration of commercial viability.

This "Version 2" layout was also featured in the October 2012 newsletter and also shown at the public open day held in Cassilis on 1 November 2012, where Epuron staff discussed the specifics of the layout in detail with members of the community. This layout has also been provided to the involved landowners for their consideration and feedback.

Various improvements to this "Version 2" layout were then made following further input from the community consultation process, including feedback at the public open day, as well as the results of specialist studies as they were finalised.

A description of the key improvements made to the layout over time with reasons for each improvement is included in Section 5.

Current Layout

The current wind turbine layout is shown in Figure 3-2, with more detailed maps in Attachment 1 – Detailed Site Maps. The wind turbine coordinates for this 288 turbine layout are provided in Attachment 4 – Turbine Coordinates. This EA seeks planning approval to locate all wind farm components within the assessed Project Corridor.

The current project layout contained in this EA is indicative only and is subject to detailed design. The indicative layout has been prepared on the basis of the best knowledge available at this time, and incorporates the avoidance, mitigation and management measures outlined in this EA. The Project assessed in this EA has assumed the maximum impact of each of the project components to ensure that the "worst-case" scenario is assessed.

The current 288 wind turbine layout reflects the typical spacing required for the wind turbines under consideration, while maximising the total energy output of the wind farm and taking into consideration the identified constraints.

Issues identified through the community consultation process guided the design and implementation of the various impact assessments, which informed the preparation of this layout.

To prepare this current layout, key parameters and constraints were considered for the site, including:

- high resolution aerial photography and topographic contours (to produce vegetation and roughness maps);
- wind speed data collected on site and correlated with locally available data sources;
- location of residences in the vicinity, particularly those within 2 km of a proposed turbine;
- results of background noise assessment including background noise logging and predicted noise limits at residences;
- results of ecological assessments including constraint mapping and field surveys;
- results of heritage assessments including field surveys;
- results of landscape and visual impact assessment of and around the site;
- results of telecommunication interference studies;
- results of aviation assessments including identification of landing grounds in the vicinity of the site;
- information on other known constraints within the site; and,
- accessibility for delivery of large scale wind turbine components.

Following the preparation of the wind turbine layout, the remaining site infrastructure has also been finalised as outlined in this EA, including the powerline (see Sections 3.4 & 3.5).

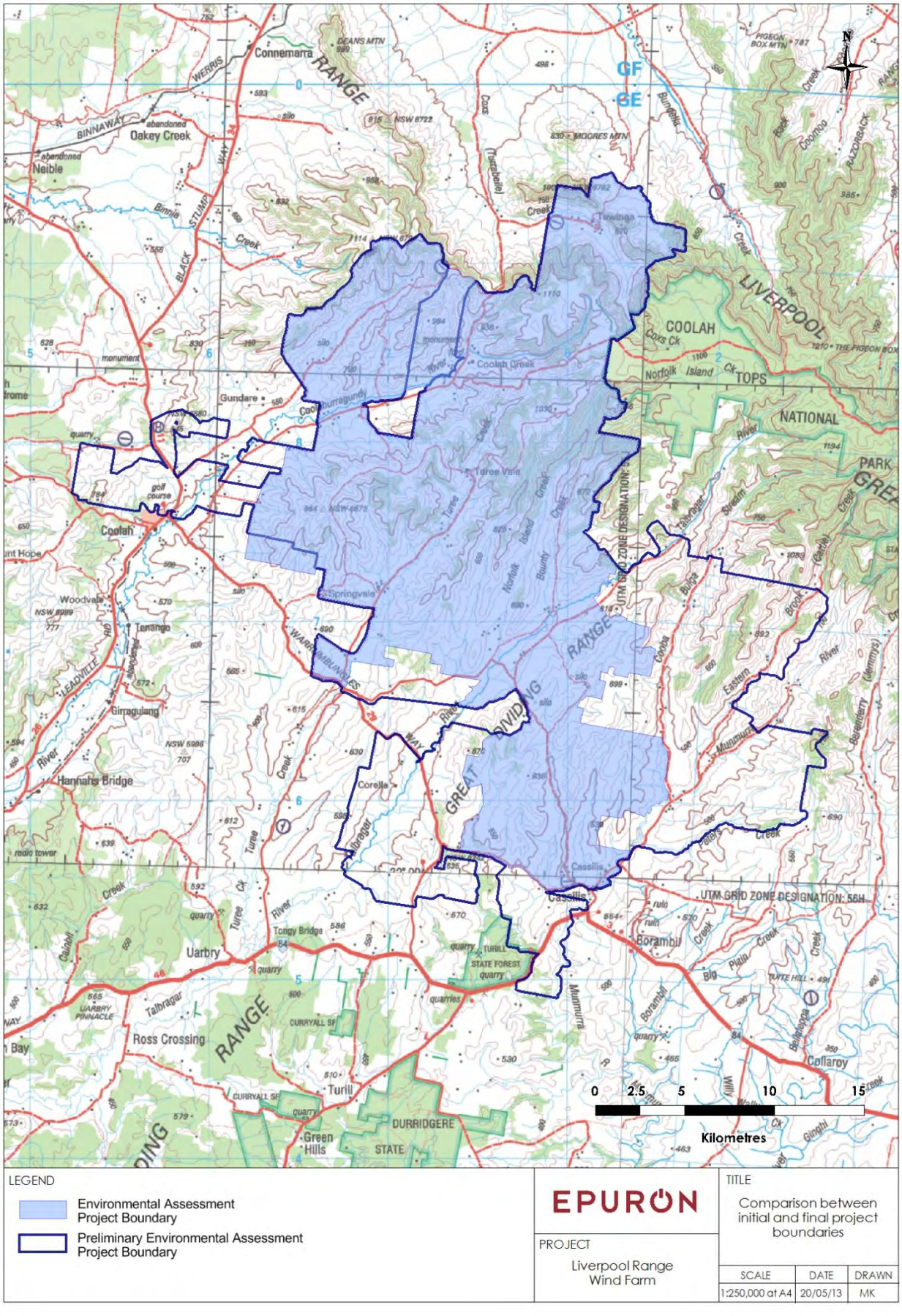

Figure 3-4 Comparison between the preliminary and final site boundaries

Final Construction Layout

Detailed geotechnical investigations and final engineering design can only be carried out once consent conditions are known and a turbine supplier has been selected. This is because each wind turbine model is different and requires different spacing, access and exit gradients and crane requirements. Accordingly, the detailed design of the final wind farm layout (including the final locations of all turbines, on-site access roads and hardstands and associated infrastructure) cannot be determined until the construction contractor surveyor traverses the entire project site and incorporates the requirements of the final conditions of approval. It is therefore essential for efficient project delivery that the consent authority provides this necessary flexibility by authorising the micrositing of infrastructure, in accordance with the conditions of approval, anywhere within the assessed Project Corridor. Accordingly:

- the current layout is indicative only and subject to detailed design; and
- Epuron seeks consent to microsite turbines and infrastructure anywhere within the assessed Project Corridor.

The current 288 turbine layout has undergone a preliminary review to determine if the layout is reasonably suitable for construction, meets planning guidelines and would comply with expected consent conditions. However, relocations of specific turbines and infrastructure within the assessed Project Corridor may be required prior to construction to take into account a number of factors including:

- detailed geotechnical works
- final turbine selection and wind farm design;
- final wind speed assessment and energy yield analysis;
- additional site constraints identified through ongoing investigations;
- constraints identified in relation to constructability or construction cost minimisation; and
- constraints identified after the results of final geotechnical investigations at each turbine location are completed.

Depending on final turbine selection, it is possible that not all turbines proposed would be installed. For example to ensure that the project continues to meet all conditions of approval.

To that end, a final layout would be prepared after final turbine selection has taken place and prior to the commencement of construction. This final layout would include adjustments to ensure all criteria are achieved. Further surveys and variations would be submitted for approval by the Director-General of Planning in accordance with the final conditions of approval.

Epuron would ensure that any minor changes do not create a detrimental overall impact and if any revisions are material, will resubmit noise and visual impact assessments if required based on the revised layout prior to construction.

Following this final construction layout, further detailed information will become available on site as geotechnical investigations progress and construction commences which may require minor relocation of equipment. As a result wind turbines and associated infrastructure may be relocated up to 100 m in any direction during construction to accommodate any localised issues (such as design and ground conditions, newly identified constraints etc.) arising during the excavations phase.

3.3 Wind Turbine Selection & Ancillary Infrastructure

Wind turbines Under Consideration

Epuron has not yet selected the turbine model to be used for this project. A number of turbines are under consideration for the proposal, each with varying characteristics including physical dimensions and technical attributes, production capacity and cost considerations.

In general, different characteristics of turbine models require different turbine layouts, however to simplify the environmental assessment of the project, an indicative layout has been developed that reflects the characteristics of a large range of turbine models.

For the purpose of assessing the wind farm impacts, Epuron bases its assessment on understanding both typical and worst-case impacts likely from the range of turbines under consideration. In general, only three impacts are materially affected by the turbine selection:

- **visual impacts** are carried out on typical and worst case turbine sizes, using the blade tip height when vertical as the indicator of turbine size;
- **noise impacts** are carried out on typical and worst case noise profiles; and
- **energy production** (which typically increases with the physical size of the wind turbine).

All other impacts are driven primarily by the turbine layout rather than the selection of the turbine model.

Final wind turbine selection would be carried out based on commercial and technical considerations within the consent conditions stipulated by the DPI. In particular, a final assessment of potential noise impacts would be undertaken prior to construction based on the final turbine selection and layout.

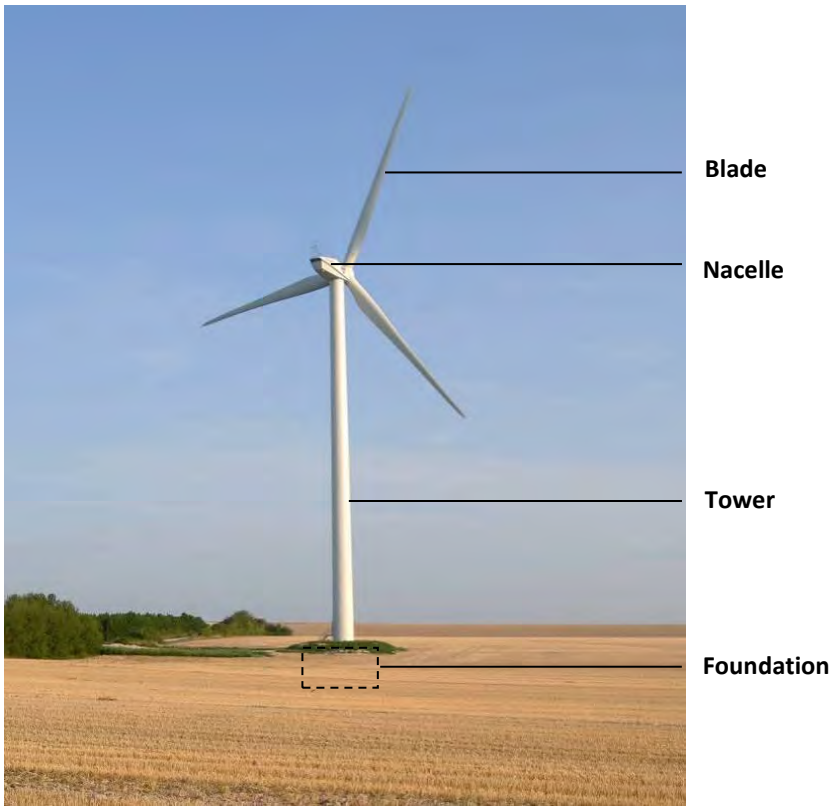

Figure 3-5 Typical wind turbine installed on an 80m tower (Photo courtesy REpower Systems AG)

Wind Turbines

The wind turbines under consideration are expected to have a typical hub height of approximately 80 m – 101 m and a typical blade length of 50 m – 65 m (approx. 100 m – 130 m overall rotor diameter). The overall turbine parameters are outlined in Section 3.1.

Each wind turbine would be a three bladed type of the "up-wind" design, meaning that the blades face into the wind and in front of the tower and nacelle. This design reduces noise levels generated during operation.

The maximum expected tip height is 165 m.

Nacelle

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

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

Tower

The tower is of tubular steel or steel and concrete construction typically 80-101 m high, tapering from around 5-6 m in diameter at the base to around 4-5 m at the top. Exact dimensions would depend on the wind turbine design selected.

The tower is constructed in up to five sections, each section bolted or welded together via an internal flange. Within the core of the tower are the power and control cables and an access ladder or mechanical person lift to the nacelle (with safety climb system).

Transformer

Each wind turbine generator would produce power at typically 690 V, and up to 1,000 V. Power is then transformed at each wind turbine to either 22 kV or 33 kV for reticulation around the site. The transformer for each wind turbine would be located either within the base of the tower, in the nacelle, or externally adjacent to the tower as a small pad-mount transformer installed on the ground, depending on the specific wind turbine model selected. The transformer would be either a dry-type transformer, or would be suitably bunded.

Lightning Protection

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

Obstacle Lighting

Depending on the requirements of the aviation authorities including CASA, aviation obstacle lighting of turbines may be required to be installed. This lighting requirement is usually a number of red flashing beacons mounted on the nacelle of some of the wind turbines.

The guidelines in relation to aviation warning lighting are currently changing as described in Section 14.1.

Epuron will not install aviation obstacle lighting unless required to do so by CASA, the consent conditions relating to the project or the requirements or recommendations of any other relevant authority.

Wind Turbine Controls and Operation

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

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

Various operating constraints can be programmed into the control system to prevent or limit operation under certain conditions. For example, if operational issues are identified such as excess noise or shadow flicker under certain conditions, these conditions can potentially be pre-programmed into the control system and individual wind turbines automatically controlled, shut down or limited whenever these conditions are present.

Access Tracks, Hardstands and Foundations

The tower would be mounted on a reinforced concrete foundation and would require removal of rock and subsoil at the base of each turbine. A number of foundation design options are under consideration including a gravity foundation (where subsoil geology is less stable) and a rock-bolted foundation (where subsoil geology provides good bedrock). A combination of different foundation designs may be used on the site depending on the geology identified at each turbine location.

Each wind turbine would require an access track and electrical cabling to the collection substation. Access tracks would be a minimum of 5 -6 m wide (wider at bends and passing lanes) and be all weather graded gravel tracks. Hardstand areas are required beneath each turbine for delivery, storage and assembly of turbine components, and for the safe operation of turbine installation cranes. Each hardstand area would be approximately 25 m x 45 m (1,125 m^2). The shape and exact size of the hardstand area is subject to final turbine selection and crane lifting requirements.

Access tracks and hardstands areas would generally be left in situ after construction to allow for any required maintenance and repairs.

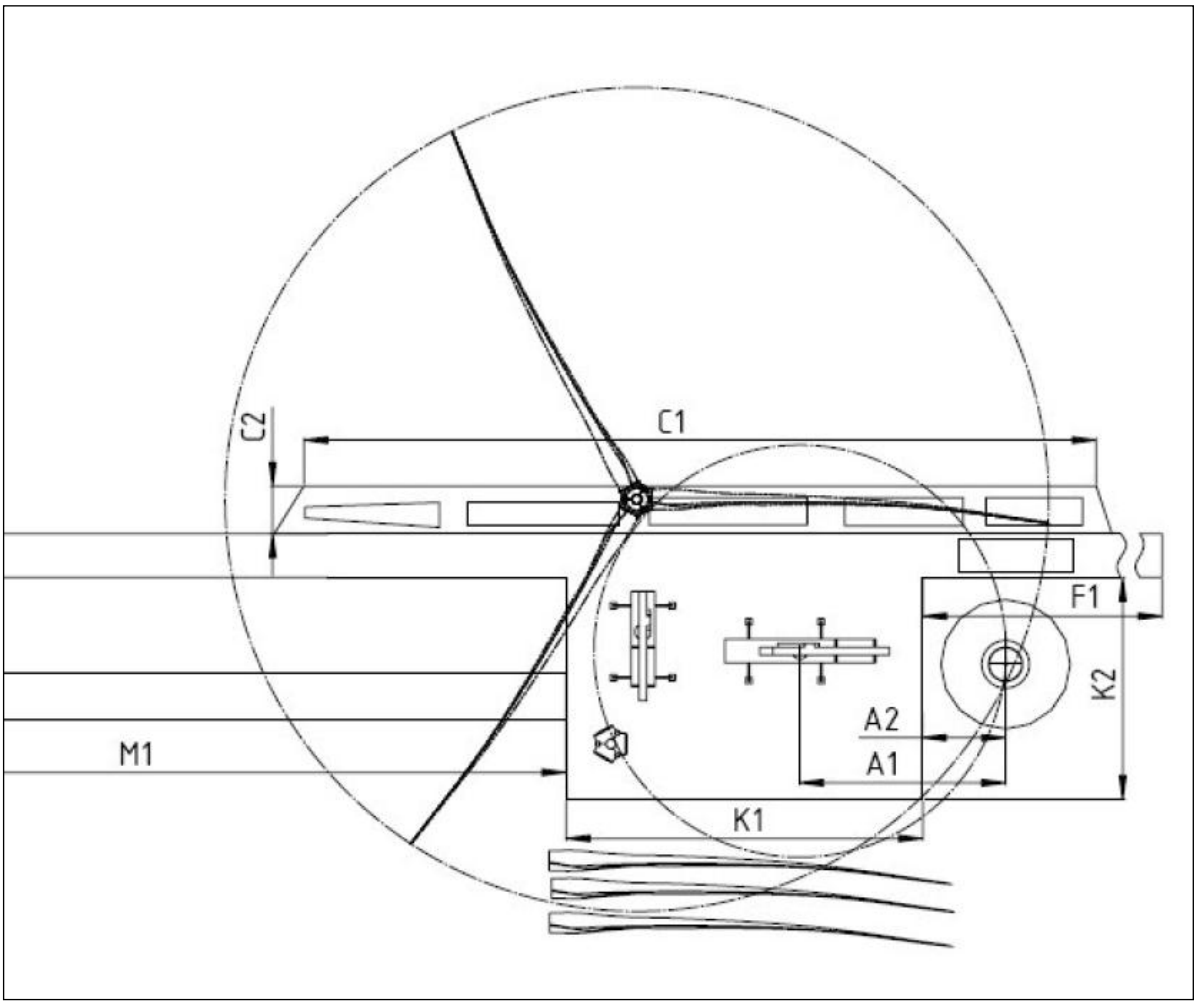

Figure 3-6 Example crane hardstand area (Source: REpower)

3.4 Grid Connection Corridor

Introduction

To export power from the wind farm, it is necessary to connect the wind turbines to the electricity grid. This is achieved through a combination of underground and overhead electricity cables connecting the turbines to the collection substations, which in turn are connected into the electricity grid via an overhead powerline to the wind farm Connection Substation.

The overhead powerline line will need to be designed and built with sufficient capacity to export the full output of the proposed wind farm. The assumed output of the wind farm is in the order of 800-1000 MVA.

Epuron has assessed a number of easement routes for placement of the proposed powerline infrastructure, and has considered a number of potential grid connection options and powerline corridors available in the vicinity of the wind farm.

The assessment determined the most viable grid connection option and powerline route for the project is within the corridor from the wind farm boundary to TransGrid's existing Wollar – Wellington 330 kV Transmission Line near Ulan to the south of the site (Corridor A). The grid connection option at Ulan has the capacity to receive and export the wind farms power output and a Preferred and Alternate powerline route has been selected within this corridor for further development.

The primary grid connection and wind farm electrical works would include:

- A new 330 kV wind farm grid Connection Substation located in the vicinity of the existing Transgrid Wollar – Wellington 330 kV Transmission Line near Ulan to the south of the wind farm site;

- A new overhead powerline operating at up to 330 kV (nominal) from the Ulan connection substation to the wind farm site, and then on to the wind farm collection substations;
- Multiple new collection substations located on the wind farm site, reducing the voltage of the powerline down to a reticulation voltage;
- A reticulation system comprising a network of underground and overhead electrical cables, at 22 kV or 33 kV, reticulating power from each turbine to the collection substations;
- Associated communications network necessary for site operations and control; and,
- An operations and maintenance facility.

Preliminary Corridor Selection

In 2010-11 at the same time as preparing the preliminary wind farm layout Epuron commenced investigations into the various grid connection options and general powerline corridors available for connecting the project. A number of broad grid connection options and powerline corridors were identified for connecting the project to the grid as indicated in Figure 3-7 and Figure 3-8. These grid connection options and powerline corridors were then assessed in more detail, and preliminary consultation carried out with potentially involved stakeholders to identify a Preferred and Alternate powerline route suitable for further development.

The following grid connection options were identified as being proximate to the wind farm site;

- Transgrid's Wollar – Wellington 330kV Transmission Line near Ulan.
- Transgrid's Wollar – Wellington 330kV Transmission Line near Gulgong.
- Transgrid's Wollar – Bayswater 500kV Transmission Line south of Merriwa.
- Country Energy's 66kV Substation located at Dunedoo.
- Country Energy's 132kV Substation located at Beryl (near Gulgong).

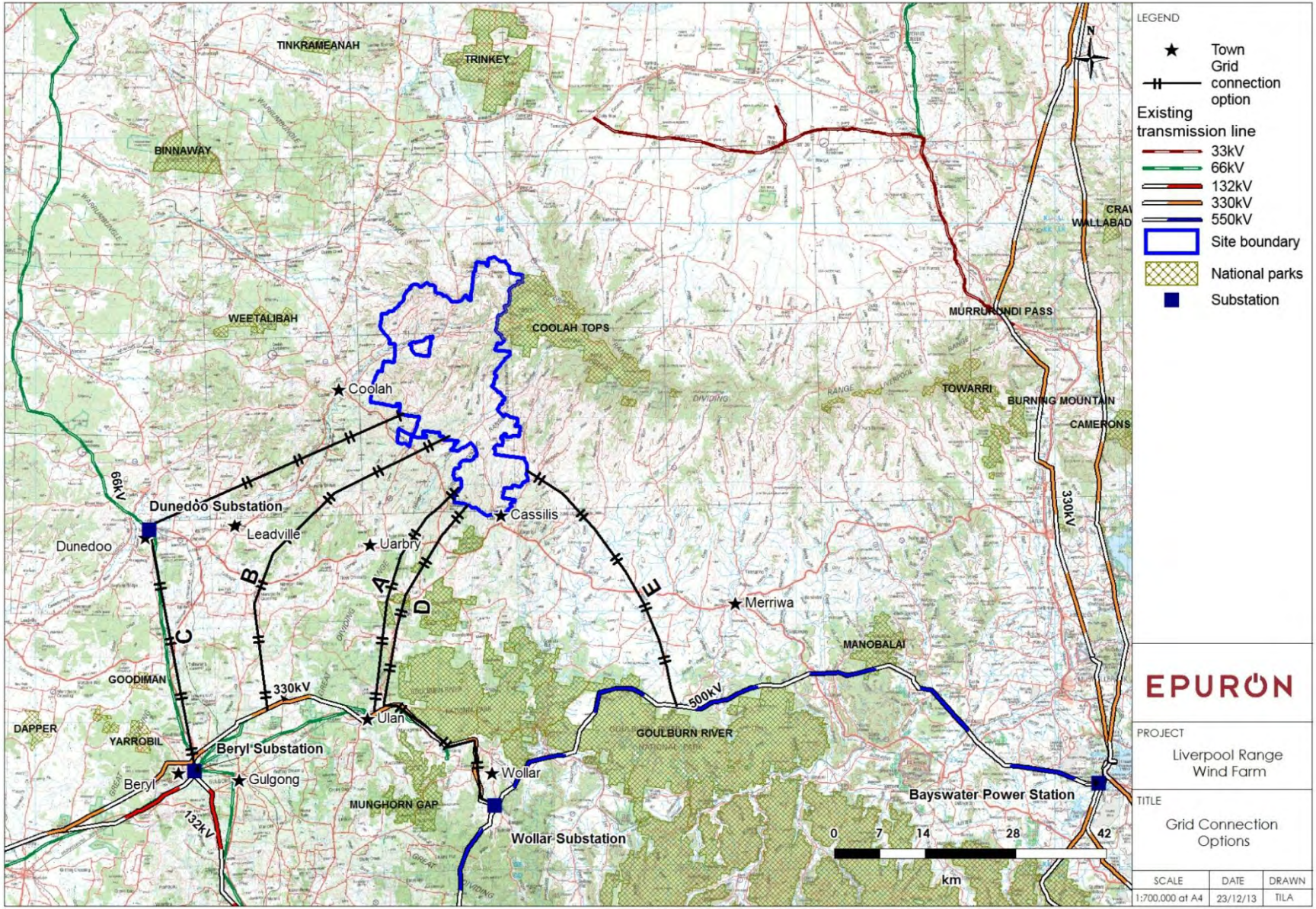

Figure 3-7 Grid Connection Options

Powerline Corridors

A grid connection assessment was carried out for the project with the aim to;

- Assess the viability of the identified grid connection options available in the vicinity of the wind farm.
- Assess the various lands, technical and environmental constraints for developing a powerline corridor to connect to the identified grid connection options from the wind farm site boundary.
- Identify and select a Preferred and Alternate powerline route suitable for further development within an identified corridor.
- Prepare an initial concept design of the Preferred and Alternate powerline routes to facilitate consultation with stakeholders and to enable development works to progress.

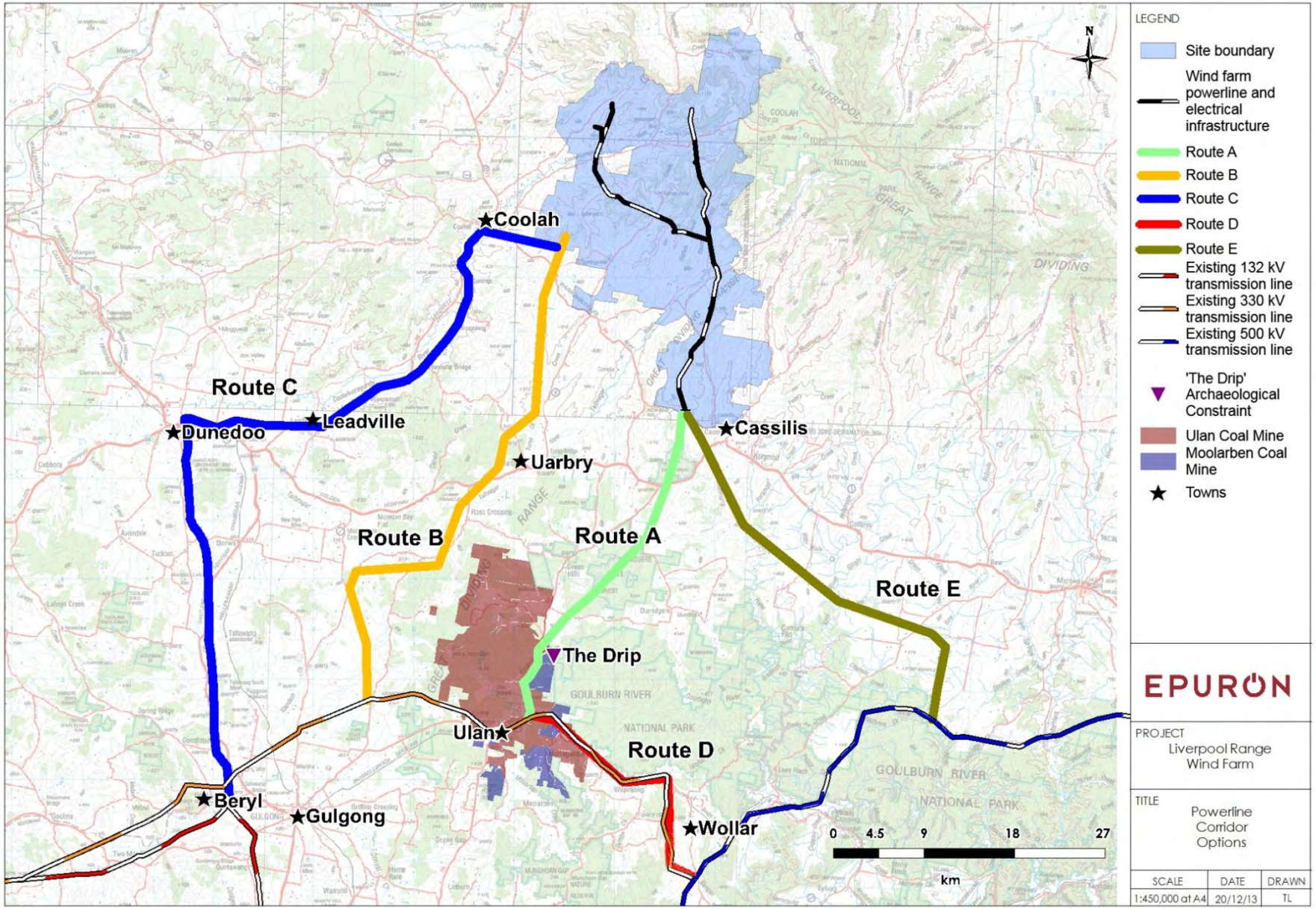

Figure 3-8 Powerline Corridor Options

Corridor A – South to 330 kV line near Ulan

This corridor starts at the southern boundary of the wind farm site and heads south west through the Durridgere State Conservation Area (DSCA). Beyond the southern limits of the DSCA the corridor continues south west through private land holdings and heads south along parts of Ulan Road reserve corridor and is proximate to the Ulan and Moolarben Mines. The corridor continues south and connects to the existing Transgrid Wollar – Wellington 330 kV transmission line near the town of Ulan.

Corridor Features:

- Overall Length
  - 35km
- Number land parcels route intersects
  - 57
- Number of Landowners
  - 11
- Number of Houses within 1000m
  - 7
- Key Constraints
  - Land limitations proximate to Ulan and Moolarben Coal Mines
  - Traversing Durridgere State Conservation Area
  - Minimising and avoiding impacts to identified environmental and heritage constraints
- Favourable Attributes
  - 800-1000 MVA of available grid connection capacity
  - Private landowners willing to enter powerline easement agreements
  - Most viable corridor in terms of length, cost, technical and environmental considerations

Corridor B – South west to 330 kV line via Uarbry

This option avoids the Ulan Coal Mine by heading in a more south westerly direction. This corridor heads south west from the site and avoids the small town of Uarbry. The corridor then zig zags south west where it connects to the existing Transgrid Wollar - Wellington 330 kV transmission line approximately half way between the Wollar 500 kV Substation and Beryl 132 kV substation.

Corridor Features:

- Overall Length
  - 56km
- Number land parcels route intersects
  - 87
- Number of Landowners
  - 28 Landowners
- Number of Houses within 1000m
  - 18
- Key Constraints
  - Close to Uarbry township and houses
  - Large number of landholdings and some unwilling landowners
  - Longer indirect route resulting in high costs and changes of direction
- Favourable Attributes

- Generally large and open land parcels
- 800-1000 MVA of available grid connection capacity

Corridor C – West to Beryl 132 kV substation via Dunedoo 66 kV substation

This option heads west from the site to intersect the disused rail easement from Coolah to Dunedoo (Via Leadville). The proposed transmission follows the easement all the way though until about 10km out from Dunedoo where it breaks away from the easement following a much more direct alignment to the Dunedoo substation. This break-away avoids using the curvy disused railway easement near the town of Dunedoo. The proposed transmission then travels south from Dunedoo along the existing 66 kV transmission line to the Beryl 132 kV Substation at Beryl (near Gulgong) where it would connect to the existing Transgrid Wollar – Wellington 330 kV transmission line via a new connection substation.

Corridor Features:

- Overall Length
  - Site to Dunedoo – 49km
  - Dunedoo to Beryl (Gulgong) – 38km
  - Overall length 87km
- Number land parcels route intersects
  - Site to Dunedoo – 34 parcels (of which1 parcel being disused rail easement)
  - Dunedoo to Gulgong – 101 parcels
  - Total 135
- Number of Landowners
  - 40 to 50 (researched estimate)
- Number of Houses within 1000m
  - 131
- Key Constraints
  - Insufficient grid connection capacity available
  - Close to Leadville and Beryl townships
  - Greatest length of all options and high cost
  - Large number of landholdings and some unwilling landowners
- Favourable Attributes
  - Generally large and open land parcels

Corridor D – South then east to Wollar 500 kV substation

This corridor generally follows Corridor A as far as Ulan and then turns east to the existing 500 kV Wollar substation at Wollar. This option was discounted early for detailed assessment due to the prohibitive cost to connect at 500 kV, and in addition to the other added constraints such as the additional distance and larger number of landholdings compared with Corridor A.

Corridor Features:

- Overall Length
  - 62km
- Number land parcels route intersects
  - 62
- Number of Landowners
  - 18
- Number of Houses within 1000m
  - 11
- Key Constraints

- Not viable and high technical barriers

- Favourable Attributes
  - Sufficient export capacity

Corridor E – South east to Wollar – Bayswater 500 kV transmission line

This corridor follows south east from the site to meet the existing 500 kV powerline. This option was discounted early due to the prohibitive cost of a new 500 kV substation that would be required, and the difficulty and time involved in achieving TransGrid's consent to such a substation. In addition, this route appeared largely similar to Route A in terms of length, number of landowners and potential impacts.

Corridor Features:

- Overall Length
  - 45km
- Number land parcels route intersects
  - 36
- Number of Landowners
  - 21
- Number of Houses within 1000m
  - 3
- Key Constraints
  - Not viable and high technical barriers
- Favourable Attributes
  - Sufficient export capacity

Table 3-1 Summary of possible grid connection corridors considered

Corridor	Overall Length (km)	Number of Land Parcels	Number of Landowners	Dwellings within 1 km	Estimated Cost ($M)	Land access constraints	Environmental Constraints	Grid connection and technical constraints	Assessment
Corridor A - South to 330 kV line near Ulan (Preferred and Alternate powerline route selected within this corridor)	35	57	11	7	65	low	medium	low	Most viable connection corridor overall. Land limitations in vicinity of Ulan and Moolarben Mines. Traversing Durridgere State Conservation Area. Sufficient connection capacity available for wind farm output.
Corridor B - South west to 330 kV line via Uarbry	56	87	45	18	85	high	low	low	Close to Uarbry township. Large number of landholdings but unwilling landowners. Long and indirect route increases cost and visual impact.
Corridor C - West to Beryl 132 kV substation via Dunedoo 66 kV substation	87	135	50	131	85	high	low	high	Insufficient grid connection capacity for wind farm output. Close to population centres at Beryl, Dunedoo and Gulgong Greatest length of all options and lowest viability. Large number of landholdings and unwilling landowners
Corridor D - South then east to Wollar 500 kV substation	62	62	18	11	100	high	medium	high	Significantly more expensive and complex than other routes and with greater impacts for no additional benefits.
Corridor E - South east to Wollar – Bayswater 500 kV transmission line	45	36	21	3	100	high	low	high	Cost prohibitive due to line length plus requirements for new 500kV substation and technical complexities.

The initial grid connection and powerline corridor assessment determined that connection to the existing TransGrid 330kV Wollar to Wellington transmission line in the vicinity of Ulan would be the most appropriate primarily due to its proximity to the wind farm, available capacity and least overall impact in terms of landowner, community, technical and environmental impacts. Accordingly, a Preferred and Alternate powerline route was identified and selected within the broader Corridor A for further investigation and development.

Preferred and Alternate Powerline Routes – Assessment

Epuron has now assessed the Preferred and Alternate powerline routes within Corridor A in further detail, including mapping of all nearby residences and completing appropriate specialist studies. The Preferred and Alternate powerline routes are shown in Figure 3-9 and has been consulted with route landowners. Large scale layouts of the proposed land and infrastructure arrangements near the grid connection point at Ulan and overall powerline routes to the wind farm boundary are shown in Attachment 1 – Detailed Site Maps.

In developing the Preferred and Alternate powerline routes and number of layout design iterations were necessary to accommodate landowner requirements, consultation feedback and outcomes of specialist studies. The Preferred route is generally located to the eastern side of Corridor A running through the Durridgere State Conservation Area and the Alternate route is generally located to the western side of Corridor A mainly traversing private landholdings and Ulan Road reserves. Both powerline routes utilise land proximate to Ulan and Moolarben mines and existing Ulan Road reserves near the connection point at Ulan. Once the Preferred and Alternate routes were selected, a Powerline Easement Information brochure was prepared and provided to powerline stakeholders for consultation purposes setting out information regarding easements and powerlines.

Accordingly, it is proposed a new overhead powerline will be built from the grid Connection Substation near Ulan to the new Collection Substations on the wind farm site. A single corridor is required for the Connection Powerline from the Connection Substation up to a central location on the wind farm site, where it will then diverge to the Collection Substations.

The Preferred and Alternate route options for location of the powerline infrastructure remain under consideration, and the final route has not yet been finalised and selected. Epuron's Preferred route, together with a likely Alternate route, is outlined in Figure 3-9, with more detailed maps in Attachment 1 – Detailed Site Maps. A number of additional nearby routes including a Second Alternate route have been identified as being suitable for the powerline as indicated in the attached consultant reports. Ultimately only one route and powerline will be finalised and built as the wind farm only needs to establish one powerline and grid connection point to enable export of power to the national grid. The final route selected may utilise a combination of the Preferred and Alternate routes. However, all of these route options remain under consideration, with the final selection to be carried out based on the following criteria:

- consent being provided by potentially involved landowners (including the Crown and, where relevant, the Minister for the Environment);
- avoiding and minimising impact on existing vegetation where possible, and particularly any sensitive native vegetation;
- avoiding where possible existing vegetation offset areas (e.g. in the Ulan Coal Mine area);
- avoiding where possible existing reserves where an alternate corridor exists (e.g. the Durridgere SCA);
- minimising biodiversity, archaeology, visual and noise impacts;
- technical and commercial feasibility consideration; and
- Consideration where possible to address any nearby stakeholder and community issues raised.

Each powerline route section has various constraints associated with it which make it impractical to select a final corridor until the Development Consent has been achieved. For example:

- involved landowners want certainty that the project is likely to proceed before committing to a powerline easement on their land, therefore not all land has been secured at this stage;
- the consent of the Minister for the Environment is required for the Preferred route through the Durridgere SCA, this can only practically be given after a thorough environmental assessment has taken place for the project; and,

- some powerline routes, while perhaps being preferred from an environmental perspective, are potentially restricted due to existing covenants and / or proposed biodiversity offset areas.

In addition, each powerline route has competing environmental impacts – for example, some may have lower aboriginal heritage impacts but higher native vegetation impacts, while others may minimise native vegetation impacts but increase social and visual impacts at nearby dwellings.

Table 3-2 indicates the various route options for each powerline section, and outlines the key constraints identified for that section. The detail of the possible impacts is included in the various specialist studies accompanying this EA and is summarised later in this section.

Table 3-2 Summary of current grid connection powerline route options being investigated

Section	*Route Option*	*Positives*	*Negatives*
Section A - B	Single option (Preferred and Alternate)	Generally follows existing disturbed road reserve corridor and land between road and coal mine.	Minimal. Need to observe and avoid existing mine infrastructure on and near the road reserve.
Section B - C	Western Option (Alternate)	Follows existing disturbed area on Ulan Coal Mine land. Principally follows existing drainage water pipeline and existing mine infrastructure corridor. Avoids new vegetation clearance corridor in vicinity of "Hands On Rock" and no known aboriginal heritage impacts nearby.	Encroaches on and near proposed environmental offset area declared for Ulan Coal Mine. Possible impacts on Ulan Coal Mine activities, therefore approval required. May not be possible due to proposed conservation covenant and approval requirements.
Section B - C	Eastern Option (Preferred)	Avoids negatives of Alternate option.	Proximity to aboriginal heritage sites including rock shelters and "Hands on Rock". New vegetation clearance corridor in vicinity of "Hands On Rock".
Section C - D	Eastern Option (Preferred)	Direct route over private landholding.	Minimal. Some vegetation clearance.
Section C - D	Western Option (Alternate)	Direct Route	Minimal. Some vegetation clearance.
Section D - E	Eastern Option (Preferred)	Most direct route with lower overall environmental impacts when compared to section D – F. Reduced clearing requirements and number of houses	Traverses DSCA.
Section D - F	Western Option (Alternate)	Avoids need to cross Durridgere SCA. Route options available for crossing Golden Highway.	Some impacts remain to sensitive vegetation. Proximity to houses in the vicinity of Turill.
Section F - E	Eastern Option (Preferred)	Most direct route. Utilises road reserve corridors.	Road crossing at Golden Highway and Ulan Road. Clearing vegetation on road reserves.
Section F - G	Western Option (Alternate)	Avoids negatives of preferred option F – E.	Longer and more expensive corridor. Traverses edge part of Turill State Forest.
Section E - G	Single Option (Preferred)	Avoids impacts to sensitive vegetation identified in F – G section. Avoids impacts to a larger number of landowners and residences, particularly in the vicinity of Turill.	Minimal. Crosses Golden Highway near Cassilis.

In all cases, landowner consent from both public and private landowners is required before the powerline can be built and a number of landowner arrangements are already in place. Given that Epuron does not have statutory power to compulsorily acquire land; this could prevent any of these options from proceeding without intervention. Epuron has undergone extensive consultation with landowners on and in the vicinity of the powerline routes and based on our consultation to date we expect landowner approvals to be achievable. A number of landowner arrangements are already in place and negotiations are ongoing.

Approval is sought for all of the above Preferred, Alternate and Second Alternate powerline route alignment options, subject to landowners agreement. It should be noted that while a number of powerline route options are sought only one route is ultimately required for the construction of the powerline to export power from the wind farm. The final powerline route selected may utilise a combination of the Preferred and Alternate powerline routes.

Durridgere State Conservation Area

Particular constraints in relation to the Preferred powerline route located within Corridor A are various former logging areas which were previously managed by NSW State Forests and subsequently declared as State Conservation Areas (SCA). In refining this Preferred powerline route, Epuron has managed to avoid impacts to the (formerly) Curryall State Forest and Turill State Forest. However, it is not possible to avoid the Durridgere State Conservation Area without increasing impacts on residences in the locality of Turill, as well as increasing impacts to native vegetation which the Biodiversity Assessment has shown to be more sensitive overall than that protected in the Durridgere SCA.

The Durridgere State Forest was declared circa 2005 to be part of the Durridgere State Conservation Area (DSCA), and its management transferred to the National Parks & Wildlife Service. While powerlines and powerline easements are permissible in a State Conservation Area, the consent of the Minister for the Environment is required in accordance with the National Parks and Wildlife Act. Any consent is entirely at the discretion of the Minister and subject to any reasonable conditions the Minister sees fit to impose.

Accordingly, Epuron has been in consultation with the OEH in relation to this SCA. The OEH have indicated a preference that the powerline route not cross the Durridgere State Conservation Area, however have indicated that they will consider an application in this respect once Epuron has considered all other options and completed a route comparison for assessment.

A key question answered in this EA is whether the Preferred powerline route crossing the DSCA would provide a better overall environmental outcome than the Alternate powerline route options which cross areas currently not protected. Accordingly the potential environmental impacts have been assessed in the Biodiversity Assessment as part of this EA and show that the Preferred powerline route traversing the DSCA has a lower overall environmental impact when compared to the Alternate powerline routes nearby. From a community perspective there are benefits in developing the Preferred powerline route as there are, in addition to the environmental benefits, less residences to be potentially impacted and reduced visual impacts. Consultation outcomes also reveal the community feels more comfortable with the powerline following the Preferred route as opposed to the Alternate route.

Epuron will continue to consult with OEH in relation to this access and, if the determination of this EA approves access through the SCA, will then seek the Ministers consent to establish an appropriate easement through the SCA.

Justification supporting the selection of the powerline route that traverses the DCSA as Preferred incorporates a number of contributing factors and influences, including;

- Feasibility of the Preferred powerline route, against all other routes, provides the the best overall outcome when considered against land access, proximity to dwellings, easement length, cost to build, local amenity and environmental considerations. Refer assessment findings set out in Table 3-1.
- The biodiversity assessment concluded that the Alternate powerline route has no apparent advantage towards biodiversity conservation over the Preferred route. Refer Sections 7, 8, 9 and 10 of the Biodiversity Assessment – Transmission Line Study Area attached to the EA as Appendix C.
- The Landscape and Visual Impact Assessment found that the Preferred powerline route provides a lower overall visual impact over the Alternate powerline route. Refer Section 12 of the attached to the EA as Appendix A.
- Consultation with easement landowners reveals general support for the Preferred powerline route through the DSCA as it minimises impacts to nearby private properties and dwellings by traversing one large land parcel in lieu of many smaller parcels.
- Powerlines and powerline easements are permissible in the Durridgere State Conservation Area with Ministerial consent.

Preferred and Alternate Powerline Routes – Potential Impacts

Potential impacts relating to the overhead powerline infrastructure to be sited along the Preferred and Alternate powerline routes are outlined below. On balance the overall impacts are reduced in relation to the Preferred powerline route when compared to the Alternate powerline route.

- ***Ecology***. – The biodiversity assessment found that the Alternate powerline route has no apparent advantage over the Preferred powerline route towards overall biodiversity conservation other than the avoidance of the DSCA. In DSCA, more recent logging, when the area was a State Forest, has meant that in general the trees are considerably younger than in many of the forest remnants on nearby private property. So with respect to vegetation quality and fauna habitat, there are large tracts of vegetation on private land that have an equal or higher biodiversity value than the vegetation of the DSCA. This also applies to the habitat for EEC vegetation as the DSCA did not contain much Box Gum Woodland.
- ***Visual***. The primary visible infrastructure traversing the powerline routes would be the 330kV overhead powerline structures and cables. The powerline infrastructure would collect and distribute electricity generated by the wind turbines and deliver it to the grid network. The potential visual impact of the proposed 330kV powerline routes is unlikely to have a significant impact on surrounding residential view locations associated with either the Preferred or Alternate powerline routes. The electrical works would be contained within a landscape with an overall moderate to high visual absorption capability, which would have some ability to accept modifications and alterations without the loss of landscape character or significant deterioration of existing levels of visual amenity. Further details can be found in Section 12 of the Landscape and Visual Impact Assessment attached as Appendix A to the EA.
- ***Proximity to dwellings***. A total of 20 residential dwellings have been identified within a 2km offset from the Preferred powerline route extending south from the wind farm boundary to Ulan. Of these 20 dwellings, 16 are uninvolved and 4 are involved landowers. Comparitively, there are 44 residential dwellings associated with the Alternate powerline route, of which 34 are uninviolved and 10 are involved landowners. In all cases an assessment of visual significance for the 330kV powerline is determined to be in the low to medium range of visual significance. In some instances the impact is considered to be nil due to the presence of topographical landforms and or vegetative screening between the dwelling and proposed powerline. Further details can be found in Section 12 of the Landscape and Visual Impact Assessment attached as Appendix A to the EA.
- ***Noise***. The noise consultant assessed and measured corona (powerline) noise. The results show that at a distance of 240m from a powerline the noise level would be below 35 dBA. Assuming a minimum RBL (Rating Background Level) value of 30 dBA, the minimum intrusive criteria as determined by the NSW INP would be 35 dBA. As such powerline line noise has also been assessed against NSW INP noise limits and has been found to be acceptable as all receiver (dwelling) locations are greater than 240 m from the Preferred and Alternate powerline line routes.
- ***Heritage***. The proposed works entail ground disturbance and, accordingly, the construction of the powerline has the potential to cause impacts to any Aboriginal areas, places or objects which may be present within the zones of direct impact. Impacts in the powerline area will be generally located on land utilised for sheep and cattle grazing and forestry purposes. Previous land use has resulted in relatively significant environmental impacts and a generally degraded landscape. European activated geomorphological processes and other natural processes associated with land degradation, will have caused significant prior impacts to Aboriginal objects within the proposal area. At the southern end of the powerline it would traverse land currently used for coal mining and other infrastructure such as roads. In addition, it is emphasised that proposed impacts are discrete and small in area. However, irrespective of prior impacts and the small and discrete nature of those proposed imacts, the construction of the powerline would entail ground disturbance and, accordingly, the project has the potential to cause impacts to any Aboriginal objects which may be present within the individual components of the proposal.
- ***Land use***. There are no material impacts predicted to ocurr to existing land uses or farming practises through the introduction of a powerline along the Preferred or Alternate powerline routes.

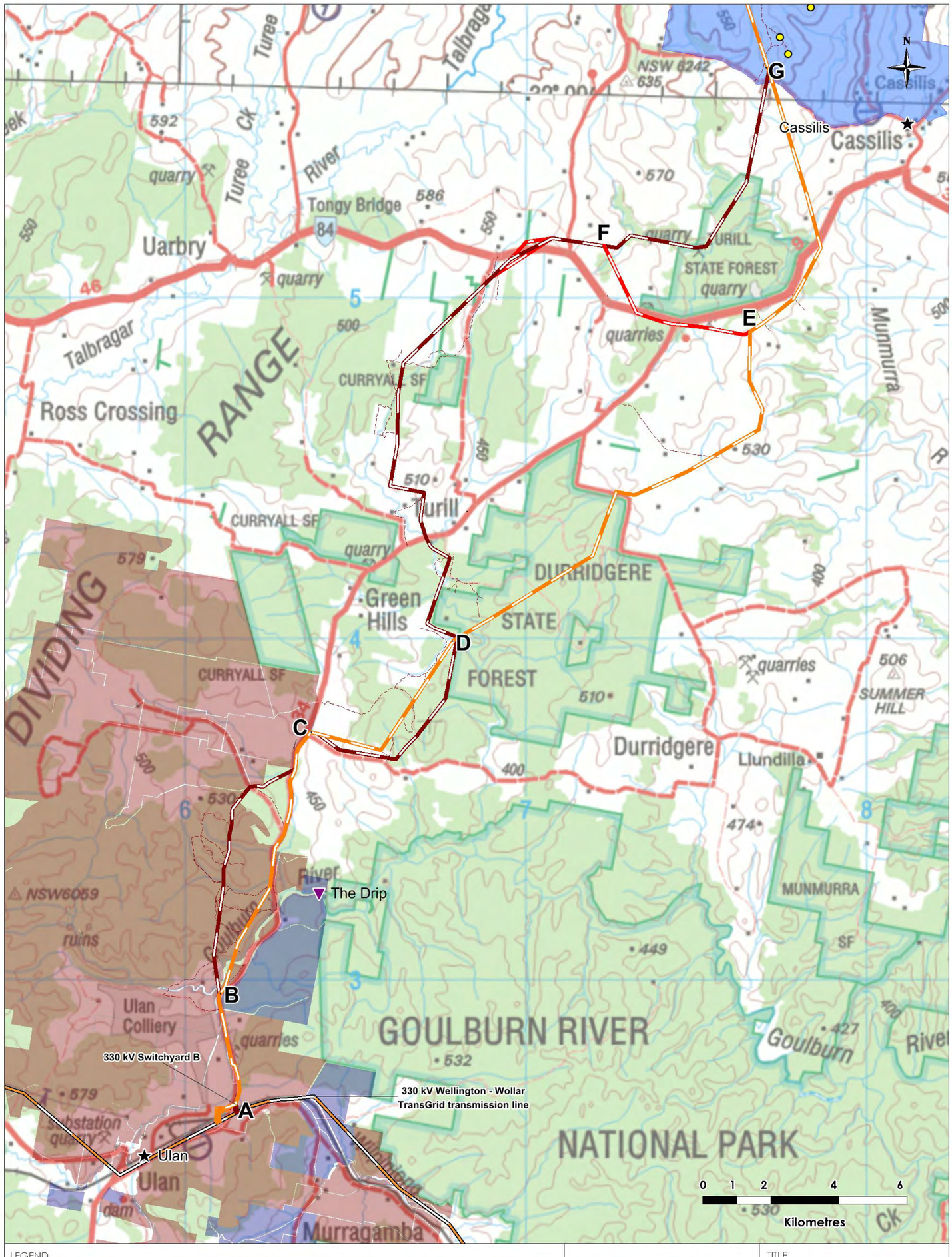

Figure 3-9 Preferred and alternate powerline routes

3.5 Wind Farm Electrical Connection Design

Connection to TransGrid Transmission Line

Epuron has submitted a Grid Connection Enquiry to TransGrid and carried out a grid connection assessment to confirm that TransGrid's existing 330 kV Wollar to Wellington transmission line that crosses to the south of the site has sufficient capacity to allow export from the wind farm.

A new 330 kV wind farm Connection Substation will be built to connect the wind farm into TransGrid's existing 330 kV Wollar - Wellington transmission line, located approximately 35 km to the south of the site. This Connection Substation would cover an area up to approximately 300 m x 300 m, plus an appropriate access road.

Two locations for the Connection Substation have been identified as shown in Figure 3-11:

A preferred location on the western side of Ulan Road in the vicinity of Ulan Coal Mine; and

An alternate location in the vicinity of the existing Moolarben Mine facilities buildings.

Only one of these locations will be used for construction as only one Connection Substation is required.

The connection substation will include all necessary ancillary equipment such as lengths of connecting powerlines, control room and cubicles, communication equipment and amenities. The connection substation also requires telecommunications (cable, optic fibre and/or microwave links) and backup electricity connections (415 V – 11,000 V) from local services.

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

If the powerline voltage differs from the existing transmission line voltage (330 kV), the Connection Substation may require up to four large power transformers to change the powerline voltage up to 330 kV. The transformers are likely to be of the oil-cooled variety, and therefore may contain considerable quantities of oil. In addition, lower power auxiliary transformers may be required. Provision would be made in the design of the Connection Substation for containment of any oil which may leak or spill.

The connection substation will include an appropriate bushfire Asset Protection Zone (APZ) that complies with the RFS *Planning for Bushfire Protection* guidelines. This has been evaluated based on the vegetation type and slope. The site parameters (predominantly flat land) indicate that a compliant inner protection area (which can be maintained under continued grazing practices) and outer protection area could be achieved.

A short length of 330 kV connecting transmission line would connect the Connection Substation to the existing 330 kV TransGrid transmission line as indicated in Figure 3-11.

Figure 3-10 **TransGrid's 330 kV Macarthur Substation in western Sydney**