G.4 Biodiversity Development Assessment Report (Vegetation/Habitat and Birds/Bats)

Liverpool Range Wind Farm

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

AUGUST 2022

umwelt
Environmental & Social Consultants

LIVERPOOL RANGE WIND FARM

Biodiversity Development Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Liverpool Range Wind Farm Pty Ltd

Project Director:	Allison Riley
Project Manager:	Bill Wallach
Report No.	4859/R03
Date:	August 2022

umwelt
Environmental & Social Consultants

Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Ryan Parsons	19/08/2022	Ryan Parsons	19/08/2022

Executive Summary

Background

Liverpool Range Wind Farm Pty Ltd (a subsidiary of a portfolio of companies that are trading as Tilt Renewables) (the Proponent) is seeking to modify State Significant Development (SSD) approval (SSD 6696) granted on 27 March 2018 for the Liverpool Range Wind Farm Project (the Project). The Project is located along a series of ridgelines approximately 6 kilometres east of Coolah township, and spans three Local Government Areas (LGA), being the Warrumbungle, Upper Hunter and Mid-western Regional LGAs, New South Wales (NSW). The Project is located within the NSW Government's Central-West Orana Renewable Energy Zone (REZ) where new transmission line infrastructure is being proposed and where renewable energy projects are encouraged to be located.

Since acquiring the Project in 2019, the Proponent has undertaken a detailed layout review and design optimisation process to firm up the indicative location of infrastructure, understand the extent of associated impacts and required mitigation measures, identify and assess anticipated public road upgrades and to progress the Project towards construction. This process has been informed by recent wind farm construction experience, environmental constraints and updated survey information, and extensive use of 3D terrain modelling. The outcome of this extensive review and design optimisation has resulted in a number of changes to the Approved Project, including a revision to the turbine layout and associated infrastructure and extent of ground disturbance and vegetation removal.

The Proposed Modification seeks to modify an SSD approval under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and requires application of the Biodiversity Assessment Method (BAM) under the *Biodiversity Conservation Act 2016* (BC Act).This Biodiversity Development Assessment Report (BDAR) has been prepared by Umwelt on behalf of the Proponent to assess the potential biodiversity impacts of the Proposed Modification in accordance with the BAM (DPIE 2020a), and based on extensive consultation with key agencies including the NSW Department of Planning and Environment (DPE), Biodiversity Conservation and Science Directorate (BCS), National Parks and Wildlife Service (NPWS) and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Approved Project – applicable methodology for biodiversity assessment

The Approved Project was originally assessed as a Major Project, under Part 3A of the NSW EP&A Act. The Project was subsequently transitioned to a SSD under the EP&A Act by an order made on 21 March 2014. Section 5.4 of the Determination Assessment Report (DPIE 2018b) states that the Approved Project was assessed under the *NSW Biodiversity Offsets Policy for Major Projects 2014* (NSW Offsets Policy) using the *Framework for Biodiversity Assessment* (FBA).

A preliminary calculation of the likely credit requirements for the Approved Project was undertaken by NGH Environmental using the FBA calculator as part of the Revised Offset Strategy, as presented in Appendix F of the Biodiversity Assessment Addendum (2017). This preliminary FBA assessment calculated the likely ecosystem and species offset requirements for the Approved Project as presented in Table 16 and Table 17 of the Determination Assessment Report (DPIE 2018b). It was noted in Section 2.1 of the Revised Offset Strategy (NGH Environmental February 2017) that these credits were only indicative and would be confirmed "using field collected plot data, and would be based on the final impact areas derived from civil construction drawings (not yet available)". Consent Condition 19(b) (SSD 6696) required the Approved Project to calculate the biodiversity offset credit liabilities for the development in accordance with FBA. In 2016, the NSW *Threatened Species Conservation Act 1995* (TSC Act) was repealed and replaced with the BC Act, which commenced 25 August 2017. The inception of the BC Act changed the assessment requirements for SSD projects in NSW with biodiversity impact assessment needing to meet the requirements of the Biodiversity Offset Scheme (BOS) via the application of the BAM. Consultation with BCS and DPE, as described in **Section 1.5,** confirmed that the BAM would be the applicable assessment methodology for the Modified Project.

Proposed Modifications

The proposed modifications include, amongst other things, a reduction in the maximum number of wind turbines to 220 (decrease of 47), increased maximum blade tip height to 250 metres above ground level (AGL) (increase of 85 m), increased operational and maintenance facilities, changes to associated infrastructure, consideration of impacts associated with anticipated public road upgrades, and an increase to the extent of ground disturbance and vegetation removal (the Modified Project). The Modified Project also includes eight relocated turbines (Turbines C11, C14, C17, C19, C20, C21, D60, and D61) proposed in the northeast portion of the Project site that are located outside of the Approved Development Corridor on land parcels that were included in Development Consent SSD 6696 (the North East Turbine Cluster).

Changes to the Indicative Development Footprint

The Modified Development Corridor is a buffer area that occupies approximately 12,601.7 hectares (ha), within which all proposed infrastructure must be located and allows for micrositing of infrastructure to occur.

The Indicative Development Footprints (Wind Farm, External Transmission Line and Public Road Upgrades) represent the indicative ground disturbance and vegetation removal associated with all relevant infrastructure and public road upgrades. The combined Indicative Development Footprints are estimated to result in approximately 1,790.1 ha of ground disturbance and vegetation removal, compared to 752.82 ha that was estimated for the Approved Project (approximately a 2.4 times increase). The combined Indicative Development Footprint comprises an Indicative Development Footprint – Wind Farm (1,367.4 ha), Indicative Development Footprint – External Transmission Line (232.0 ha) and Indicative Development Footprint – Public Road Upgrades (190.7 ha).

Changes to the impacts to biodiversity values

The infrastructure layout including turbine locations, access track alignments and External Transmission Line alignment is generally consistent with the Approved Project. However, as described in **Section 1.2** and **Section 1.4** the Modified Project results in an increase in the extent of ground disturbance and associated native vegetation/habitat clearance, including to the Box Gum Woodland CEEC listed under the BC Act (NSW Box Gum Woodland). The largest proportion of the increase to ground disturbance and associated impacts to native vegetation/habitat and the NSW Box Gum Woodland CEEC is attributable to the two following aspects of the development, which together account for nearly 85% of the additional ground disturbance:

- Wind farm access tracks and adjacent underground cabling, which account for an additional ~604 ha of ground disturbance (or 64% of the total increase within the Wind Farm and External Transmission Line sites); and

- Internal and External Transmission Line access tracks, string pads, and pole/tower construction areas, which account for an additional 178 ha of ground disturbance (or 19% of the total increase within the Wind Farm and External Transmission Line sites).

While the Modified Project proposes an increased Indicative Development Footprint compared with the footprint assessed for the Approved Project (SSD 6696), the increase in biodiversity impact is also a function of the following important factors, some of which are not directly related to the revised layout and design proposed by the Modified Project:

- As detailed in **Section 1.2** it is important to clarify that the Approved Project (SSD 6696) did not include an impact assessment of the required external public road upgrades. The Modified Project has captured impacts associated with these critical infrastructure upgrades.

- As per Consent Condition 19(a) (SSD 6696), the Modified Project has updated "the baseline mapping of the vegetation and key habitat within the final disturbance area". Through the completion of this process, there has been refinement of the Plant Community Type (PCT), Vegetation Zone, threatened ecological community (TEC) and threatened species habitat mapping across the Modified Project. This has included:

- re-allocation of PCTs (of those identified in the Approved Project)
- identification of new PCTs (not identified in the Approved Project)
- detailed analysis of 85 BAM Vegetation Integrity Plots to determine their alignment, or otherwise, with Box Gum Woodland CEECs listed under the BC Act and EPBC Act
- preparing species-credit polygons in accordance BAM (DPIE 2020a).

- As the PCTs, Vegetation Zones and species-credit polygons have been undertaken in accordance with BAM (DPIE 2020a), this will have naturally increased the extent of mapping within the Modified Development Corridor due to the rigour of BAM.
- The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.
- As shown in **Table 5.2**, impacts to threatened species (species-credit species and ecosystem-credit species) were not assessed in detail for the Approved Project (SSD 6696) (Determination Assessment Report (DPIE 2018b)). Instead, these species were assessed using a uniform area of habitat. As the Modified Project has assessed impacts to species-credit species in accordance with BAM (DIPE 2020a), species polygons were naturally going to increase in size due to the rigour of BAM.

Due to factors summarised above, it fundamentally limits the ability to directly compare the impacts identified in the Approved Project (SSD 6696) with those of the Modified Project.

Potential impacts to native vegetation and habitat

The Indicative Development Footprints impact 11 PCTs across 16 condition classes and seven species credit species, as listed in **Table ES1** and **Table ES2**.

In relation to the North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61) it is considered that impacts are generally consistent with the broader Modified Project. Four PCTs (395, 488, 490 and 495) were recorded at this location, all of which are widely recorded throughout the wind farm component of the Modified Project. There are no impacts to NSW Box Gum Woodland CEEC or Commonwealth Box Gum Woodland CEEC associated with the North East Turbine Cluster. Vegetation within this section does support species polygon habitat for eastern cave bat and large-eared pied bat.

Following the application of avoidance and minimisation measures, the BAM assessment identified the required biodiversity credits to offset the impacts of the Project, which are listed in **Table ES1** and **Table ES2**.

Table ES1 Impacts Requiring Offset – Ecosystem Credits

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion - *Moderate/Good*	6.5	-	1.6	8.1	**94**
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion - *Moderate/Good*[1]	0.7	12.0	0.7	13.4	**514**

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region - *Moderate/Good* [2]	149.2	41.9	6.3	197.4	**3,807**
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion - *Moderate/Good*	-	19.2	0.7	19.9	**462**
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region - *Moderate/Good*	-	12.7	-	12.7	**274**
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley - *Moderate/Good* [3]	23.3	5.4	-	28.7	**1,332**
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley - *Low* [4]	191.3	39.2	10.9	241.4	**8,273**
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley - *Exotic*	322.8	2.3	73.4	398.5	**5,716**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion - *Moderate/Good*	95.9	-	-	95.9	**3,241**
10	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion - *Moderate/Good-Shrubby*	0.5	-	-	0.5	**10**
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion - *Low*	152.2	-	4.9	157.1	**3,967**
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion - *Exotic*	364.4	-	10.0	374.4	**0**
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion - *Moderate/Good*	11.0	-	-	11.0	**317**
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion - *Moderate/Good*	7.3	-	-	7.3	**147**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin - *Moderate/Good*	-	52.9	0.3	53.2	**1,290**

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin - *Moderate/Good*	-	30.6	0.4	31.0	**657**
-	Nil (incl. roads, tracks and waterbodies)	14.1	4.1	79.2	97.4	**N/A**
-	Category 1 – Exempt Land	28.2	11.6	**2.3**	42.1	**N/A**
Total		**1,367.4**	**231.79**	**190.7**	**1,790.0** [5]	**30,101**

[1] Associated with BC Act and EPBC Act listed CEECs

[2] Partly associated with BC Act listed CEEC

[3] Associated with BC Act and EPBC Act listed CEECs

[4] Associated with BC Act listed CEEC

[5] The discrepancy with the 1,790.1ha of total impacts referenced elsewhere is due to rounding errors.

Table ES2 Impacts Requiring Offset – Species Credits

Species	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Wind Farm (ha)	External Transmission Line (ha)	Public Road Upgrades (ha)	Total Combined Indicative Development Footprints (ha)	
Ausfeld's wattle	-	10.5	-	10.5	**311**
Silky swainson-pea	-	19.4	-	19.4	**432**
Glossy black-cockatoo	-	0.8	0.2	1	**13**
Large-eared pied-bat	265.6	12.6	6.3	284.5	**6,862**
Square-tailed kite	-	1.4	-	1.4	**29**
Squirrel glider	167.0	74.1	2.2	243.3	**5,848**
Eastern cave bat	267.7	12.6	6.3	286.6	**6,910**
Total	**n/a**	**n/a**	**n/a**	**n/a**	**20,405**

Summary of change between the Approved Project and Modified Project

The summary of change in direct impacts associated with the Modified Project compared with the Approved Project is presented in **Table ES3.**

Table ES3 Summary of Change Between Approved Project and Modified Project

PCT/Species	Approved Project Area of Impact (ha)[1]	Modified Project - Area of Impact (ha)	Order of Change between Original Approval and Modified Project
Ecosystem			
PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	6.47	8.1	**+1.63**

PCT/Species	Approved Project Area of Impact (ha)[1]	Modified Project - Area of Impact (ha)	Order of Change between Original Approval and Modified Project
PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	18.94	13.4	**-5.54**
PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	77.26	197.3[4]	**+120.04**
PCT 467 – Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)	3.30	-	**-**
PCT 477 – Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion	31.51	-	**-**
PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	42.65	20.0	**-22.65**
PCT 480 – Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion	10.32	-	**-**
PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	30.04	12.7	**-17.34**
PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	101.10	668.6[4]	**+567.5**
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	70.16	627.8[4]	**+557.64**
PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion	3.12	11.0	**+7.88**
PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion	1.51	7.3	**+5.79**
PCT 278 – Blakely's Red Gum – Grey Box – White Box – Riparian Woodland	3.55	-	**-**
PCT 478 – Sandstone Forest – Red Ironbark dominant	1.20	-	**-**
PCT 588 – White Box – Cypress Pine Shrubby Open Forest	0.36	-	**-**

PCT/Species	Approved Project Area of Impact (ha)[1]	Modified Project - Area of Impact (ha)	Order of Change between Original Approval and Modified Project
PCT 1661 - Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	n/a	53.2	**+53.2**
PCT 1675 - Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	n/a	31.0	**+31.0**
Sub-total (ha)	**401.49**	**1,650.40**	**+1,248.91**
Species			
Ausfeld's wattle	-	10.5	**+10.5**
silky swainson-pea	1.0	19.4	**+18.4**
glossy black-cockatoo	19.0	1.0	**-18.0**
large-eared pied bat	19.0	284.5	**+265.5**
square-tailed kite	-	1.4	**+1.4**
squirrel glider	19.0	243.3	**+224.3**
eastern cave bat	19.0	286.6	**+267.6**
black-chinned honeyeater[2]	19.0	-	**-**
powerful owl[3]	19.0	-	**-**
corben's long-eared bat[2]	19.0	-	**-**
grey-crowned babbler[2]	19.0	-	**-**
diamond firetail[2]	19.0	-	**-**
masked owl[3]	19.0	-	**-**
eastern bentwing bat	19.0	-	**-**

[1] Determination Assessment Report (DPIE 2018b); [2] This species is an Ecosystem Credit Species under BAM (DPIE 2020a) and as such does not require an individual assessment of habitat; [3] This species is a Dual Credit Species (Ecosystem and Species) (DPIE 2020a), however only breeding habitat is recognised as the species credit component and no breeding habitat for the species were recorded; [4] Denotes vegetation that occurs within the transmission line Balance of Easement, either within the Indicative Development Footprint – Wind Farm or Indicative Development Footprint – External Transmission Line. Areas indicated by this denotation includes the areas exposed to direct ground disturbance and vegetation removal. Impacts have only been assessed for vegetation zones within the transmission line easement that are currently or have the potential to grow to four metres in height, or higher. PCT 395 is a derived native grassland condition and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement (i.e. vegetation impacts have been calculated for poles, string pads and other infrastructure associated with the transmission line). Vegetation Zone 8 (PCT 483) and Vegetation Zone 12 (PCT 488) are primarily exotic grasslands with scattered trees and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement; n/a – represents those PCTs that were not identified as part of the current BDAR.

Potential Impacts to NSW Box Gum Woodland CEEC

The Modified Project will impact a total of:

- 427.0 ha of NSW Box Gum Woodland CEEC within Vegetation Zone 2 (13.4 ha), Vegetation Zone 3 (143.5 ha), Vegetation Zone 6 (28.7 ha) and Vegetation Zone 7 (241.4 ha). This impact occurs across the three Indicative Development Footprints:
    - 316.7 ha within the Indicative Development Footprint – Wind Farm (including 40.9 ha of partial direct impact within the Internal Balance of Easement)
    - 97.1 ha within the Indicative Development Footprint – External Transmission Line (including 40.7 ha of partial direct impact within the External Balance of Easement)
    - 13.2 ha within the Indicative Development Footprint – Public Road Upgrades

There are no impacts to NSW Box Gum Woodland CEEC associated with the North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61).

Impacts to the NSW Box Gum Woodland CEEC are approximately 2.1 x greater (**226.15 ha**) than the impact threshold of 200.85 ha for this TEC as specified in Condition 18(a) of the Development Consent SSD 6696.

Of the 427.0 ha of direct impacts to the NSW Box Gum Woodland CEEC, 81.7 ha (approximately 19%) will be partially directly impacted within the internal and external transmission line easements proposed by the Modified Project. These partial direct impacts result from vegetation removal required within that portion of the 60 m wide transmission line easement that is not directly impacted by civil ground disturbance such as poles/towers, string pads, and access tracks. Within this area, also referred to in this BDAR as the 'balance of easement' area, vegetation currently greater than 4 m tall is assumed to be removed, in accordance with TransGrid's vegetation management guidelines. For vegetation zones that meet these characteristics, partial direct impacts have been calculated within the balance of easement area as per Section 8.1.1.2 of the BAM (DPIE 2020a). This means that the future vegetation integrity score for these applicable areas are not reduced to the default score of 0 (no biodiversity value). Within the balance of easement area, it is assumed that there are no impacts to those Vegetation Zones that are not currently or will not grow equal to or greater than 4 m tall.

Approximately 384.9 ha (90.1 %) of the NSW Box Gum Woodland CEEC proposed to be impacted within the Indicative Development Footprints is considered to be in either derived native grassland or low condition. Vegetation Zone 3 (143.5 ha conforming with the NSW Box Gum Woodland CEEC) is a derived native grassland (scattered canopy trees do occur) and Vegetation Zone 7 (241.4 ha) is considered to be in low condition. The remaining 42.1 ha (9.9%) of the NSW Box Gum Woodland CEEC proposed to be impacted within the Indicative Development Footprints is considered to be in moderate to good condition.

In total, 4,152 ha of the NSW Box Gum Woodland CEEC (including moderate to good, derived native grassland and low condition) were identified within the Modified Development Corridor indicates the extent of the vegetation across the landscape. Despite the proposed removal of 427.0 ha of the NSW Box Gum Woodland CEEC by the Modified Project, approximately 3,725.0 ha (or nearly 90%) will remain in the Modified Development Corridor.

A range of avoidance and minimisation measures have been designed and will be implemented on the Modified Project as part of the Biodiversity Management Plan (BMP) to reduce impacts to the NSW Box Gum Woodland CEEC. These are discussed in **Section 4.0** and **Section 5.4.1** and includes avoidance of higher quality patches of the NSW Box Gum Woodland CEEC, reducing the number of proposed wind turbines, no-go zones, pre-clearance and tree-felling protocols, and salvage of habitat. Given the extent of the NSW Box Gum Woodland CEEC that occurs across the Modified Development Corridor (4,152 ha) it is not considered possible for the Modified Project to substantially avoid the NSW Box Gum Woodland CEEC.

In an effort to minimise ground disturbance, the Proponent has prioritised the use of spur lines along the ridges to locate access tracks from the nearby public roads to the ridgelines. Wind turbines are also typically located on ridgelines to make the best use of the available wind resource. Given the broad extent of the NSW Box Gum Woodland CEEC within the Modified Development Corridor, it is impossible to completely avoid impacts to the NSW Box Gum Woodland CEEC, and very difficult to further minimise impacts by re-routing access tracks from public roads to the turbines without requiring circuitous and excessively long access track alignments which would result in perverse ground disturbance impacts and impacts to other constraints including landholder no-go-zones, existing land uses, and better quality patches of NSW Box Gum Woodland CEEC. Ultimately, such alternative options are not likely to be supported by landholders, and therefore are not feasible for the Modified Project.

Partial direct impacts have been assessed for Vegetation Zones 2, 6 and 7 within the transmission line easements of the Modified Project and were identified as conforming with NSW Box Gum Woodland CEEC under the BC Act. Vegetation Zones 2 and 7 also conform with White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (referred to as Commonwealth Box Gum Woodland CEEC) under the EPBC Act. Given the ecological sensitivity of these three Vegetation Zones, strict construction and post-construction monitoring protocols will be implemented where partial direct impacts have been assessed to ensure the respective CEECs persist. Indicative management actions and monitoring activities are summarised in **Section 4.3**. The final management actions and monitoring activities will be detailed in the Biodiversity Management Plan (BMP) that will be prepared in consultation with BCS in accordance with the Development Consent.

Improved Vegetation Mapping and Implications for Impact Assessment

Substantial additional vegetation survey and TEC analysis was undertaken as part of this biodiversity assessment to satisfy consent condition 19a of SSD 6696, being updating "the baseline of the vegetation and key habitat". This assessment identified a discrepancy between the revised extent of NSW Box Gum Woodland CEEC mapping in the Approved Development Corridor (3,081.19ha) compared to the area of NSW Box Gum Woodland EEC (now CEEC) identified as part of the Approved Project (1,871.87 ha) (NGH Environmental 2013a, 2013b and 2017). An additional 1,209.32 ha or 1.6 times more NSW Box Gum Woodland CEEC was identified in the Approved Development Corridor following the additional detailed survey and analysis. It is likely the more comprehensive survey and analysis undertaken as part of the biodiversity assessment of the Modified Project has resulted in a more detailed map of PCTs, vegetation zones and TECs across the Project site.

Potential impacts to birds and bats

A detailed prescribed impact assessment has been prepared to consider the potential impacts associated with turbine strike and barotrauma on protected bird and bat species. The assessment considered 27 species, comprising 17 threatened species (12 bird and five bat species). 18 species were assessed for risk of blade strike/barotrauma based on them being recorded within the Project site, and the known susceptibility of the species to turbine strike and barotrauma in Australia. The results of the risk assessment determined that six (6) species were considered to be at High risk, 10 species were considered to be at Moderate risk and the remaining two (2) species were considered at Minor risk of being impacted by turbine strike and barotrauma as a result of the Modified Project. The resultant risk rating for these species is primarily due to their relative abundance within the Project site, their predicted or observed flight behaviour and/or their known susceptibility to blade strike at wind farms in south-east Australia. Those species identified as having a high risk of impact are listed below:

- White-throated needletail
- Barking owl
- Large bent-winged bat
- Powerful owl
- Regent honeyeater
- Swift parrot.

In relation to the North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61) these relocated turbines are considered to propose a negligible change (if any) on the outcome of the prescribed impact assessment for the Modified Project in relation to turbine strike. These turbines have not specifically influenced the resulting risk ratings for assessed species. Furthermore, they specifically are not believed to pose a

considerable risk of altering the aerial connection of habitat or available foraging habitat for avifauna species that may reside in the adjacent Coolah Tops National Park.

In comparison with the 'Collision Risk Analysis' of the Approved Project (NGH Environmental 2017), regent honeyeater was also assessed as having a high risk rating. Barking owl, powerful owl and swift parrot were all assessed as having a Moderate risk rating. Large bent-winged bat was assessed as having a Low risk rating, while white-throated needletail was not an assessed species for the Approved Project (SSD 6696). It is important to note that the dataset used and risk assessment methodology used differs between the two assessments.

The results of this assessment have informed the identification of prescribed impacts on protected species in the BDAR and will inform the Bird and Bat Adaptive Management Plan (BBAMP) which will be prepared in consultation with BCS and in accordance with Development Consent. The Bird and Bat Adaptive Management Plan will detail the mitigation measures aimed at reducing the collision risk of identified species.

Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles prescribed in the Biodiversity Conservation Regulations 2017 (BC Regulations). Under Section 6.7(2) of the BC Regulations an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct. Section 3.2 of the Biodiversity Assessment Method Operational Manual – Stage 2 (DPIE, 2019a) specifies that the assessor is not required to provide a recommendation on whether the impact is serious and irreversible. It is for the consent authority to determine whether an impact will be serious and irreversible. Ultimately the approval authority is responsible for deciding whether an impact is serious and irreversible and can approve a SSD which is likely to have serious and irreversible impacts (SAII), under Section 7.16(3) of the BC Act.

NSW Box Gum Woodland CEEC and two microbat species that were recorded within the Modified Development Corridor are identified by DPE as entities likely to be at risk of an SAII.

An assessment was undertaken of the impacts to these three entities against the principles set out in Section 6.7 of the BC Regulations, the additional impact assessment criteria provided in Section 9.1. of the BAM 2020 and in accordance with the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019b). The detailed SAII assessment is contained in **Appendix H**. A high level summary of the assessment against the three at-risk entities is as follows:

- NSW Box Gum Woodland CEEC is identified by DPE as an entity at risk of SAII based on Principles 1 and 2. The assessment in **Appendix H** found:
    - Principle 1. The NSW Scientific Committee determination identifies that the community has suffered a very large reduction in geographic distribution and there is evidence that clearing is ongoing and has increased in recent years; with approximately 93% of the pre-1750 area having been cleared (TSSC 2020). The Modified Project Indicative Development Footprints impact a total of 427.0 hectares of the NSW Box Gum Woodland CEEC in the Modified Development Corridor over a construction period of three years minimum. The total impact is an increase of 226.15 hectares compared with the impact threshold of 200.85 ha to the then NSW Box Gum Woodland EEC (now CEEC) for the Approved Project (SSD 6696).
    - Principle 2. The determination identifies that the ecological community is subject to a number of threatening processes that have caused severe disruption to biotic processes and interactions throughout its range, compositional change is evident, and these processes are likely to cause continuing decline in the future (TSSC 2020, Tozer and Simpson 2020). Of the four vegetation zones (2, 3 [partially], 6 and 7) identified as the NSW Box Gum Woodland CEEC, only Vegetation Zone 2 (13.4 ha, representing 3.1% of the NSW Box Gum Woodland CEEC) and Vegetation Zone 6 (28.7 ha, representing 6.7% of the NSW Box Gum Woodland CEEC) are considered to be in moderate to good condition

(totalling 42.1 ha or 9.9% of the total impact area for this NSW Box Gum Woodland CEEC by the Project). The remaining two vegetation zones (3 and 7) representing about 90% of the impacted CEEC are highly disturbed and do not support remnant woodland. These vegetation zones are likely to have been disrupted by management for agricultural production.

- Principle 3. The geographic range of the NSW Box Gum Woodland measured by extent of occurrence, area of occupancy and threat defined locations, does not meet the criterion related to geographic distribution for listing as a NSW Box Gum Woodland CEEC (TSSC 2020). Accordingly, it is not identified as an entity at risk of SAII due to a very limited geographic distribution.
- Principle 4. The NSW Box Gum Woodland CEEC is likely to respond to measures to improve its vegetation integrity and accordingly is not identified as an entity at risk of SAII due to evidence that it is unlikely to respond to management. The Modified Project has sought to avoid higher quality remnants, minimise fragmentation and provide buffers. Less than 10% of the NSW Box Gum Woodland CEEC to be cleared is in moderate to good condition with the majority of the NSW Box Gum Woodland CEEC (90%) impacted by the Modified Project being either derived native grassland or low condition woodland. During detailed design and through the construction phase, the Modified Project will implement a range of avoidance, minimisation and mitigation measures targeted at further reducing impacts on the NSW Box Gum Woodland CEEC.

- Large-eared pied bat is identified by DPE as an entity at risk of SAII based on Principle 4. That is, the species is unlikely to respond to measures to improve its habitat and therefore its members are not replaceable. As highlighted in **Appendix H** this is due to its reproductive characteristics that severely limit its ability to occupy new habitat as they are reliant upon specific cave structures for maternity roosts, and they require high fertility forests or woodlands nearby. The large-eared pied bat was recorded at five locations, primarily within and adjacent to the Durridgere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017). The Modified Project Indicative Development Footprint would clear about 18.1% of the area of habitat recorded within the Modified Development Corridor as defined by the BAM (that is habitat within 2km of suitable rocky habitat). The species is particularly vulnerable to threats that impact shelter and breeding sites. While the project will clear about 18.1% of habitat it will not impact directly on shelter and breeding sites. There is a risk that individuals may be impacted by turbine strike and/or barotrauma.

- Eastern cave bat is identified by DPE as an entity at risk of SAII based on Principle 4. That is, the species is unlikely to respond to measures to improve its habitat and therefore its members are not replaceable. As highlighted in **Appendix H** this is due to it being reliant upon on caves for maternity roosts and therefore breeding habitat cannot be restored or replaced. The species was recorded at 7 locations, spanning the north of the Project site to Durridgere State Conservation Area as part of the original assessment (NGH 2013a, 2013b and 2017). Umwelt recorded this species to a possible or species group confidence at one location. Similar to the large-eared pied bat, habitat for the eastern cave bat is defined in the BAM as habitat within 2km of potential roosting habitat. The Modified Project Indicative Development Footprint would not impact roosting habitat but will clear about 18% of the area of potential habitat recorded within the Modified Development Corridor. There is a risk that individuals may be impacted by turbine strike and/or barotrauma.

To assist the consenting authority, a range of avoidance, minimisation and mitigation measures have been implemented in the Approved Project and have been developed further in the Modified Project as informed by this Biodiversity Assessment, and are presented in **Section 4.0**. Measures to further avoid and minimise impacts will be considered in the detailed design and in the BMP that will be prepared in consultation with BCS in accordance with the Development Consent.

Matters of National Environmental Significance (MNES) under the EPBC Act

The Modified Project will impact five Matters of National Environmental Significance (MNES), being Commonwealth Box Gum Woodland CEEC, regent honeyeater, swift parrot, large-eared pied-bat and koala. Impacts to three of the five MNES impacts by the Modified Project are consistent with the Approved Project (EPBC 2014/7136), being Commonwealth Box Gum Woodland CEEC, regent honeyeater and swift parrot. While the additional two species were not identified in the EPBC Approval (EPBC 2014/7136), the Approved Project also undertook Assessments of Significance for the koala and large-eared pied-bat. Impacts of the Modified Project include:

- 42.1 ha of Commonwealth Box Gum Woodland CEEC within Vegetation Zone 2 (13.4 ha) and Vegetation Zone 6 (28.7 ha)
- 577.8 ha of potentially suitable habitat for the regent honeyeater (threatened species)
- 471.7 ha of potentially suitable habitat for the swift parrot (threatened species)
- 284.5 ha of potentially suitable habitat for the large-eared pied bat (threatened species), and
- 672.3 ha of potentially suitable habitat for the koala (threatened species).

None of the potentially impacted threatened species have been recorded in the Modified Development Corridor.

Impacts to the Commonwealth Box Gum Woodland CEEC is 31.73 ha more than the impact threshold of 10.37 ha specified in Condition 1 of the existing Federal Approval (EPBC 2014/7136).

As described above, the Modified Project has updated "the baseline mapping of the vegetation and key habitat within the final disturbance area" in line with Consent Condition 19(a) (SSD 6696). Through the completion of this process, there has been refinement of the PCT, Vegetation Zone, TEC and threatened species habitat mapping across the Modified Project. Undertaking this work in accordance with BAM (DPIE 2020a) and the Bilateral Agreement with the Commonwealth, in combination with the more realistic estimate of ground disturbance (including detailed design and inclusion of necessary public road upgrades) the Modified Project has resulted in increased extent of impacts on these five MNES.

Conclusion

The significance of impacts and mitigation measure proposed as part of the Proposed Modification are considered to be generally consistent with the Approved Project, and any residual significant impacts will be offset through the retirement of biodiversity credits identified through the application of the BAM and as detailed in this BDAR.

Due to the increased extent of ground disturbance and vegetation removal proposed by the Modified Project, this BDAR identifies that the Modified Project is proposed to have increased impacts on biodiversity values compared with the original biodiversity assessments (NGH Environmental 2013a, 2013b and 2017), including non-threatened vegetation and species habitat as well as threatened ecological communities and species. While the extent of impacts is inconsistent with the original biodiversity assessments (NGH Environmental 2013a, 2013b and 2017), the nature of the impacts and the biodiversity values to be impacted is considered to be consistent with the Approved Project for which Development Consent SSD 6696 and Federal Approval EPBC 2014/7136 were granted.

The Proponent is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the Modified Project as required under the BC Act and EPBC Act. This will be undertaken using one or more of the following options:

- The establishment and retirement of credits within Stewardship sites.
- Securing required credits through the open credit market and/or
- Payments to the Biodiversity Conservation Fund.

The Development Consent allows for staging of the development, and requires that the Proponent retire the required biodiversity offsets within two years of commencement of construction, or stage thereof.

Glossary

AOO	Area of Occupancy
Balance of easement	The portion of the 60 m wide easement area along the proposed 330 kV transmission line outside of civil works areas (e.g. access tracks, string pads, pole/tower disturbance areas) where only vegetation above 4 metres in height at full maturity is assumed to be removed, in accordance with TransGrid vegetation management guidelines
BAM	Biodiversity Assessment Methodology
BBS	Brigalow Belt South IBRA Region
BC Act	NSW *Biodiversity Conservation Act 2020*
BCS	Biodiversity Conservation and Science Directorate – part of NSW Department of Planning and Environment
BDAR	Biodiversity Development Assessment Report
CCS	Composition condition score (part of the BAM)
CEEC	Critically endangered ecological community
DAWE	(Former) Commonwealth Department of Agriculture, Water and the Environment (now DCCEEW)
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water (previously Department of Agriculture, Water and the Environment)
DoEE	(Former) Commonwealth Department of the Environment and Energy (now DCCEEW)
DPE	NSW Department of Planning and Environment
Ecosystem credit	A measurement of the value of threatened ecological communities and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity value at a development site and the gain in biodiversity value at an offset site.
EEC	Endangered ecological community
EOO	Extent of Occupancy
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
External Transmission Line Site	A short-hand heuristic term that refers to the portion of land within the Modified Site Boundary generally located south of Rotherwood Road, Cassilis, where the external transmission line infrastructure including connection substation (switchyard), upgrade works to TransGrid infrastructure at Ulan and associated works are located. The portion of land within the Modified Site Boundary generally north of Rotherwood Road, Cassilis is referred to as the Wind Farm Site.
FCS	Function condition score (part of the BAM)
ha	Hectare(s)
GIS	Geographic information system
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
Indicative Development Footprint – Public Road Upgrades	The total indicative impact zone associated with the construction of the anticipated public road upgrades required as part of the Project. It is a realistic estimate of ground disturbance and vegetation removal (this was not assessed as part of the Approved Project (SSD 6696)) and will be refined further during detailed design once contractor(s) are engaged.

Indicative Development Footprint – External Transmission Line	The total indicative impact zone within the External Transmission Line Site associated with the construction of the transmission line (i.e. that portion of the transmission line generally between the southern on-site collector substation and the point of connection at Ulan). It includes access tracks within the transmission line easement and access tracks to the transmission line easement from nearby public roads, pole/tower locations, string pads, and potential upgrade to Transgrid infrastructure at Ulan, and vegetation removal required within the balance of easement required in accordance with Transgrid vegetation management guidelines. It is a realistic estimate of ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696) and will be refined further during detailed design once contractor(s) are engaged.
Indicative Development Footprint – Wind Farm	The total indicative impact zone within the Wind Farm Site associated with the construction of the wind farm, including wind turbines, internal access tracks and ancillary infrastructure, internal portion of the transmission line and vegetation removal required within the balance of easement required in accordance with Transgrid vegetation management guidelines. It excludes the public road upgrades and external portion of the transmission line. It is a realistic estimate of ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and will be refined further during detailed design once contractor(s) are engaged.
Indicative Development Footprints	Equivalent to the *Development Footprint* terminology in the BAM; this is a combination of the *Indicative Development Footprint – Wind Farm, Indicative Development Footprint – External Transmission Line* and the *Indicative Development Footprint – Public Road Upgrades* and comprises the entirety of the ground disturbance and vegetation removal required for the construction and operation of the Liverpool Range Wind Farm project.
LGA	Local Government Area
m	Metre(s)
m^2	Square-metres
MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
Modified Development Corridor	Land to which the BAM is applied to assess the biodiversity values of the land. It includes the Indicative Development Footprint – Wind Farm and Indicative Development Footprint – External Transmission Line in its entirety as well as areas of adjoining land. It does not include the full entirety of the Indicative Development Footprint – Public Road Upgrades but does intersect with it in multiple locations.
NSW	New South Wales
PCT	Plant Community Type
PMST	Protected Matters Search Tool
the Proponent	Liverpool Range Wind Farm Pty Ltd
RSA	Rotor Swept Area
SB	Sydney Basin IBRA Region
SCS	Structure condition score (part of the BAM)
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection database.
SSD	State Significant Development
Strahler Stream Order	Classification system that allocates a waterway an 'order' according to the number of tributaries associated with it.
TEC	Threatened ecological community

TBDC	Threatened Biodiversity Data Collection
VIS	Vegetation Information System
Wind Farm Site	A short-hand heuristic term that refers to the portion of land within the Modified Site Boundary generally located north of Rotherwood Road, Cassilis, where wind farm infrastructure including the internal portion of the transmission line is located. The portion of land generally south of Rotherwood Road is referred to as the External Transmission Line Site.

Table of Contents

Figures

Plates

Tables

Appendices

1.0 Introduction

Liverpool Range Wind Farm Pty Ltd (the Proponent), a subsidiary of a portfolio of companies that are trading as Tilt Renewables, proposes to construct the Liverpool Range Wind Farm (LRWF) project, located approximately 6 kilometres (km) east of Coolah township, within the Central-West Orana Renewable Energy Zone (REZ), central New South Wales (NSW). This Biodiversity Assessment has been undertaken to assess the potential impacts associated with the proposed modifications to the Liverpool Range Wind Farm project (the Project).

The Project constitutes an approximately $2 billion investment. State Significant Development Consent (SSD) 6696 (DPIE 2018a) (the Development Consent) was granted by the State Government in March 2018 for the construction, operation, and commissioning of up to 267 wind turbines with a maximum blade tip height of 165 metres above ground level (AGL) and associated infrastructure (Approved Project). In the years since the original Development Consent was determined, there have been significant advances in wind turbine technology, most notably the sector-wide shift towards longer blades and taller towers, allowing more energy to be produced with less turbines.

Since 2019, the Proponent has undertaken a detailed layout review and design optimisation process to firm up the indicative location of infrastructure, understand the extent of associated impacts and required mitigation measures, and to progress the Project towards construction. This process has been informed by recent wind farm construction experience, environmental constraints and updated survey information, and extensive use of 3D terrain modelling.

A modification to the Development Consent is proposed so that the Project can take advantage of these technology changes and provide greater certainty with regards to the constructability of the Project.

The Modification Application will be lodged with DPIE for consideration by the Minister for Planning and Public Spaces. A summary of the proposed modifications is provided below (collectively referred to as the Proposed Modifications):

- Increase the maximum blade tip height to 250 metres AGL (increase of 85 m).
- Decrease the maximum number of turbines to 220 (decrease of 47 turbines).
- Modify a range of site layout, ancillary infrastructure, and connection works.
- Modify a range of haulage route and public road upgrades.
- Modify a range of site boundary and development corridor components.

A full description of the Proposed Modifications is provided below in **Section 1.2**.

1.1 Project Description

The Project will provide 100% emissions-free renewable energy and contribute to NSW's transition away from its current reliance on carbon intensive fuels. The Project is predicted to make significant contributions to the shortfall in generation that will arise with the forecast retirement of Liddell Power Station in NSW's Hunter Valley.

The Project will provide approximately 800 full-time positions during constructions and approximately 47 full-time staff during its operational life, thus providing increased employment opportunities in the local region.

The Project will also result in a direct injection of approximately $6-7 million per annum to the local community through direct payments to landholders, Voluntary Planning Agreement (VPA) contributions and other community benefit sharing initiatives to the local community.

A summary of the Modified Project is provided below in **Table 1.1**.

Table 1.1 Project Summary

Turbine Parameters
Maximum blade tip height of 250 m AGL
Maximum of 220 wind turbines
145 m hub-height AGL (indicative)
105 m blade length (indicative)
Rotor Swept Area (RSA) of 34,636 m^2 per turbine OR 762 ha for the 220 proposed turbines (indicative)
Modified Development Corridor and Indicative Development Footprints
Modified Development Corridor of 12,601.66 ha
Indicative Development Footprints of 1,790.1 ha (Wind Farm, External Transmission Line, and Public Road Upgrades)
Site Layout, ancillary infrastructure, and connection works
Permanent infrastructure, including on-site collector substations, access tracks, Operations and Management (O&Ms) facilities (up to 3), overhead power lines and underground cabling
Temporary infrastructure, including concrete batching plant (up to 9), laydown areas and construction compounds (up to 9)
Ancillary equipment required to meet the grid connection standards (e.g. statcom, synchronous condenser, small battery [i.e. not utility-scale])
Up to 14 permanent Power Curve Validation (PCV) meteorological masts
Upgrade works to TransGrid's transmission line infrastructure at the point of connection at Ulan, NSW
Haulage route and public road upgrades
Over-size/over-mass (OSOM) Haulage Route from Port of Newcastle to site
Over Dimensional (OD) and Heavy Vehicle Access Route
Up to 93 potential site access points along public roads
Public road upgrades within and surrounding the Project

1.2 Proposed Modification

Following detailed layout review and design optimisation, the Proponent identified several aspects of the Project which require modification. Key components of the modification are provided below in **Table 1.2**. Further detailed description of the design changes that have been incorporated into the Modified Project are provided in **Table 1.3**. An overview comparison of the Approved Project and Modified Project is provided in **Figure 1.1**, and the tiled figure set is provided in **Appendix A**.

The Biodiversity Assessment Method (BAM) (DPIE 2020a) has been used as the assessment tool for the Proposed Modification.

Table 1.2 Summary of Key Modifications of Components of the Project

Component	Existing Approved Project (SSD 6696)	Proposed Modification	Difference
Number of turbines	Up to 267	Up to 220	-47 turbines
Maximum blade tip height of turbines	Up to 165 m	Up to 250 m	+85 metres
Development Corridor	12,405.04 ha	12,601.7 ha	+196.7 ha (9,163 ha [73%] overlap)
Indicative Development Footprint	752.82 ha *Note: this value does not include existing farm access tracks proposed to be used or anticipated public road upgrades, as they were not assessed*	1,790.1 ha (combined Wind Farm, External Transmission Line, and Public Road Upgrades)	+1,037.28 ha (x2.4)
Indicative Blade Length	50 – 65 m	105 m	+40 to + 55 metres
Indicative Rotor Swept Area	13,273 m^2 of aerial habitat per turbine of OR 354 ha in total Based on 65 m long blades.	34,636 m^2 of aerial habitat per turbine OR 762 ha in total Based on 105 m long blades.	+21,363 m^2 of aerial habitat per turbine +408 ha in total
Permanent PCV Meteorological Masts	Up to 10	Up to 14, at 40 indicative locations	+4
Collector Substations	Up to 4	Up to 7, at 11 indicative locations	+3
Connection substation	1 (at Ulan)	1 (at Ulan)	No change
Temporary Concrete Batch Plants	Up to 4	Up to 9, at 19 indicative locations	+5
Temporary Construction Compounds	Up to 6	Up to 9, at 19 indicative locations	+3
O&M Facilities	Up to 1	Up to 3, at 6 indicative locations	+2
Transmission Line Alignment (combined Internal and External)	85.01 kms long	100.17 kms long	Various changes to alignment within Wind Farm Site, and minor re-alignment of short section within External Transmission Line Site.
Site Access Points	28	93	+65

Component	Existing Approved Project (SSD 6696)	Proposed Modification	Difference
Over-size/Over-mass (OSOM) Haulage Route	1 x route proposed - impacts not assessed	1 x route proposed - impacts assessed	Various changes to the route to enable longer blades and larger components to be transported from Port of Newcastle to site

Table 1.3 Detailed description of proposed modifications

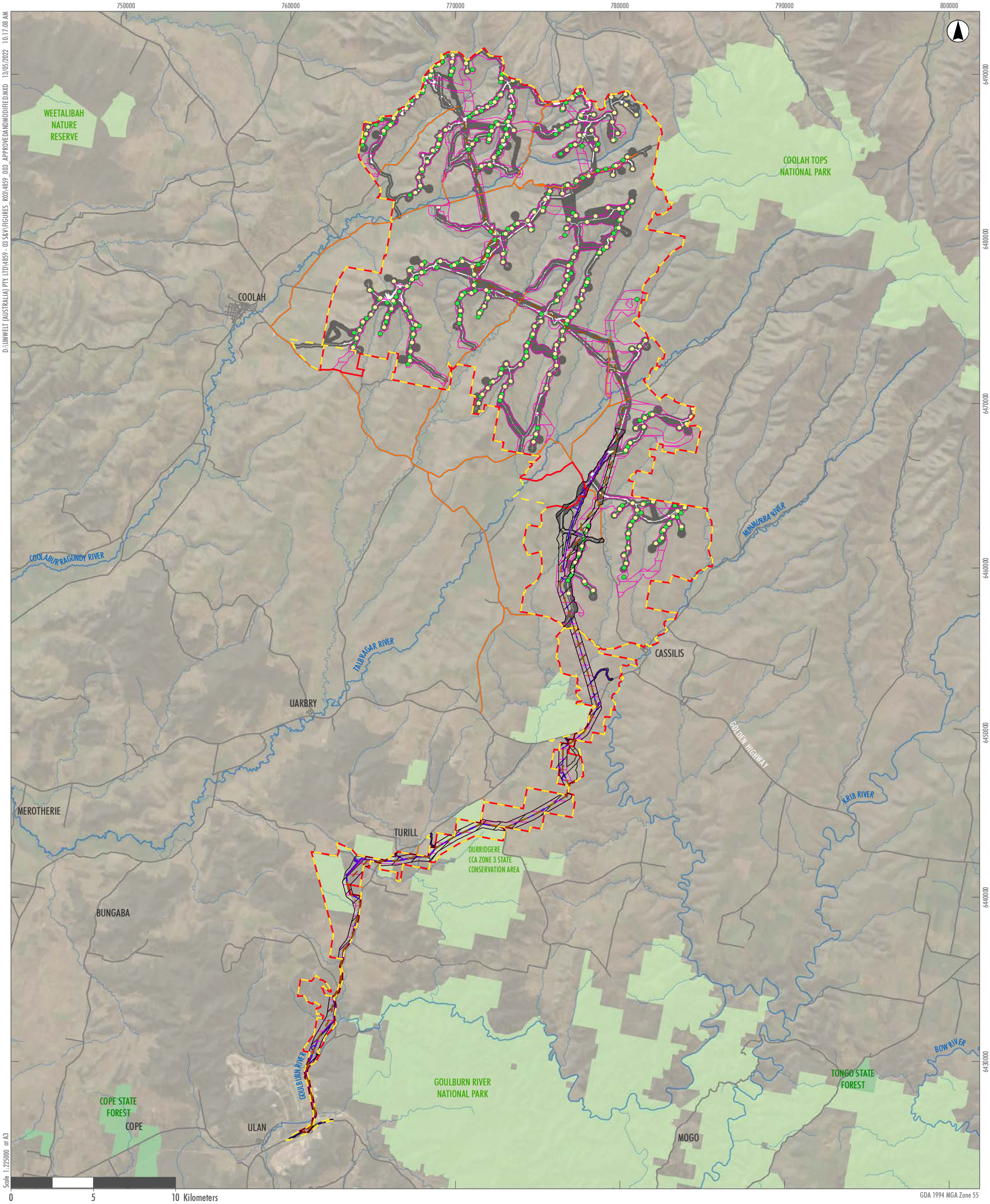
Themes	Proposed Modifications
Turbine Parameters	• Increase the maximum blade tip height to 250 m above ground level (AGL) (currently approved up to 165 m AGL). • Decrease the maximum number of turbines to 220 (currently approved up to 267). • Increase turbine micro-siting limit to 250 m of their approved locations (currently a micro-siting limit of 100 m is specified).
Wind Farm Infrastructure	• Modify turbine locations and other associated wind farm infrastructure such as on-site collector substations, access tracks, O&M facilities, overhead power lines and underground cabling, and temporary infrastructure such as concrete batch plants, laydown areas, and construction compounds, based on an improved understanding of site constraints and constructability. • Make minor amendments to the alignment of the portion of the transmission line internal to the Wind Farm Site to reflect revised turbine layout and based on an improved understanding of site constraints and constructability. • Include up to 14 x permanent Power Curve Validation (PCV) meteorological masts (referred to as permanent met masts) to the final hub height (currently approved for up to 10) at 40 indicative locations. • Include up to 28 x temporary site calibration met masts to the final hub height, to be located at a subset of the final turbine locations and removed prior to erection of the relevant turbine. • Include up to 7 x on-site collector substations (currently approved for up to 4) at 10 indicative locations within the Wind Farm Site, including any ancillary infrastructure required to meet the grid connection standards (e.g. statcom, synchronous condenser, small battery [i.e. not utility-scale]) • Include up to 3 x permanent O&M facilities (currently approved for up to 1) at 6 indicative locations. • Include up to 9 x temporary concrete batch plants operational at any given time (currently approved for up to 4) at 19 indicative locations. • Include up to 9 x temporary construction compounds and material laydown areas (currently approved for up to 6) at 19 indicative locations.

Themes	Proposed Modifications
External Transmission Line and Connection Infrastructure	• Amend a short section of the external transmission line alignment near Durridgere State Conservation Area to minimise potential visual impact to nearby Non-associated residence. • Include an optional alternate transmission line alignment to avoid a portion of the Durridgere Conservation Area. • Include up to 1 x temporary construction compound/laydown area/concrete batch plant within the External Transmission Line Site near Cliffdale Road. • Amend a short section of the external transmission line alignment near Hands on Rock cultural heritage site to avoid/minimise impacts to the land parcel the site is located within. • Include additional access tracks from nearby public roads to facilitate construction and ongoing maintenance of the proposed external transmission line located south of the Golden Highway. • Include any ancillary infrastructure at the connection substation required to meet the grid connection standards (e.g. statcom, synchronous condenser, small battery [i.e. not utility-scale]). • Include potential upgrade works to TransGrid's transmission line infrastructure at the proposed point of connection at Ulan.
Preferred Transport Route	• Modify the Approved Over Dimensional (OD) and Heavy Vehicle Access Route to remove the southern section of Rotherwood Road (no longer required) and to include the eastern portion of Gundare Road that is located within the Modified Site Boundary to be used for Light and Heavy vehicles (Modified OD and Heavy Vehicle Access Route). The western portion of Gundare Road outside of the Modified Site Boundary is not proposed to be used. • Remove Approved Site Access Point #9 off Vinegaroy Road as it is no longer required. • Include up to 90 potential site access points from nearby public roads (currently approved for 28 site access points). Of these, 47 potential site access points provide access to the wind farm site (currently approved for 24). The remaining 43 potential site access points provide access to the approximately 50 km long External Transmission Line between the wind farm site and the connection point at Ulan and associated upgrades to TransGrid infrastructure (currently approved for 4). • Assess a revised indicative Over-size/over-mass (OSOM) Haulage Route to which allows for the transport of longer blades and larger wind farm components from the Port of Newcastle to the Project site (Modified OSOM Haulage Route).

Themes	Proposed Modifications
Public Road Upgrades	• Identify the public road upgrades that are anticipated to be required to construct and maintain the Project. • Define the applicable road upgrade standards as agreed with the relevant Councils, and include a mechanism to review the applicable road upgrade standards at highly constrained locations • Include accurate estimates of ground disturbance associated with the anticipated road upgrades based on detailed 3D terrain modelling, to appropriately assess potential ecology, heritage and private property impacts.
Potential Staging	• Include the potential to sequence the delivery of public road upgrades and on-site construction activities to allow on-site construction works to commence progressively throughout the initial stage of the construction program.
Development Corridor and Indicative Development Footprint	• Modify the Approved Site Boundary and Approved Development Corridor to reflect the changes to the wind farm layout and transmission line alignment proposed by the Modified Project (referred to as Modified Site Boundary and Modified Development Corridor, respectively). • Assess revised indicative development footprints which has been informed by updated key project design metrics (e.g. infrastructure disturbance areas and access track and reticulation cabling lengths) and to reflect the Modified Project layout (referred to as Indicative Development Footprint – Wind Farm, Indicative Development Footprint – External Transmission Line, and Indicative Development Footprint – Public Road Upgrades).
Conditions of Consent	• Update existing conditions related to micro-siting, Aboriginal cultural heritage, noise, traffic and transport, and visual impact to reflect the Proposed Modifications, the Modified Project layout, and to incorporate the key recommendations of the relevant technical assessments. • Update native vegetation and habitat clearance limits, where required to reflect the Modified Project layout including the public road upgrades (currently there are no clearance limits for public road upgrades specified in Development Consent SSD 6696). The native vegetation and habitat clearance limits are based on a detailed assessment of the Indicative Development Footprints (Wind Farm, External Transmission Line, and Public Road Upgrades). • Modify existing conditions to clarify that biodiversity offsets may be delivered in stages in accordance with any potential staged delivery of the Project. • Amend existing Conditions of Consent to allow for micro-siting of wind turbines to within 250 m of their approved locations (and wholly contained within the Modified Development Corridor) (currently a micro-siting limit of 100 m is specified).
Statement of Commitments	• Update the Statement of Commitments prepared as part of the EIS to align with Development Consent SSD 6696 and reflect the Modified Project.
Subdivision of Land	• Include consideration of the subdivision of additional land to create a new lot for the connection and collector substations, and associated ancillary facilities.

While it has not formed part of the Modified Project design, nor incorporated into this biodiversity assessment, the Modified Project is perfectly located to connect with the Central-West Orana (CWO) Renewable Energy Zone (REZ) high voltage transmission line currently being proposed by EnergyCo. EnergyCo are a NSW Government statutory authority responsible for the delivery of the Electricity Infrastructure Roadmap, and are currently completing the necessary assessments and investigations to support the Environmental Impact Statement (EIS) for the project.

The alignment of the proposed transmission line has not been finalised, however the Proponent has actively consulted with EnergyCo and understand there an opportunity to connect into the proposed transmission line north of the Golden Highway may become available in the future. Should this alternate connection point be realised and adopted by the Liverpool Range Wind Farm project, the External Transmission Line currently considered for the Modified Project (which generally extends from the Golden Highway south to Ulan) would become redundant and no longer be required. All potential impacts to biodiversity values associated with the External Transmission Line, including approximately 216 ha of impact to PCTs and approximately 97 ha of impact to NSW Box Gum Woodland CEEC, would therefore be avoided.



Legend

Approved Project
- Approved Site Boundary
- Approved Development Corridor
- Approved Wind Turbines
- Approved Transmission Lines

Modified Project
- Modified Site Boundary
- Modified Wind Turbines
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 1.1

Approved Project (SSD6696) and Modified Project Turbine Layout and Development Corridor

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

1.3 Location

The Project is located on a series of ridgelines, near the townships of Coolah and Cassilis, NSW (refer to **Figure 1.2**). The Modified Development Corridor spans three Local Government Areas (LGAs), being Warrumbungle, Upper Hunter and Mid-western Regional LGAs. The Modified Development Corridor covers an area of approximately 12,601.7 ha, whilst the Indicative Development Footprints are proposed to impact an area of approximately 1,790.1 ha. Refer to **Table 1.4** for a summary of the location in the landscape.

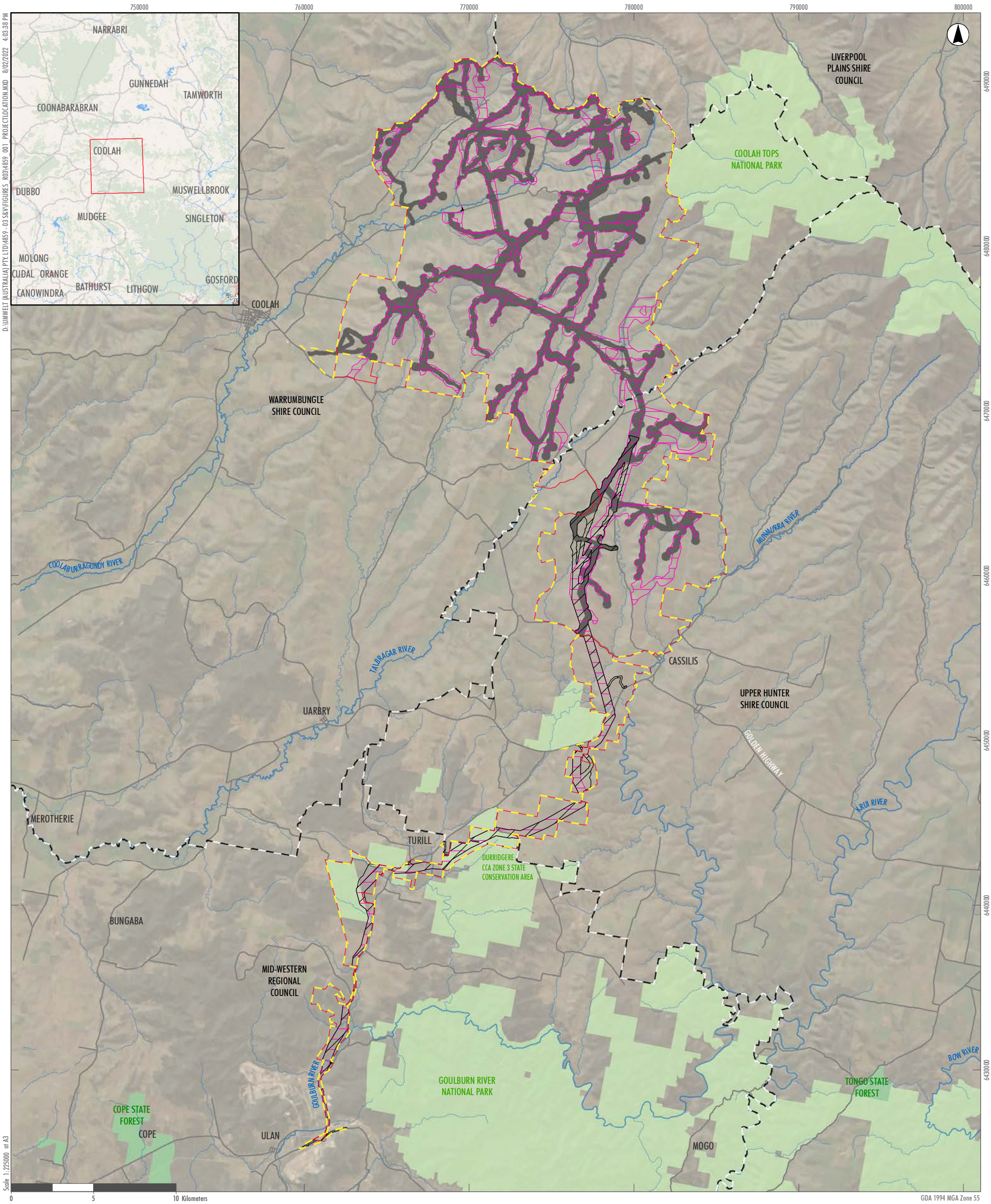
The locality is dominated by primary agricultural land on the valley floor and low rises, with cropping being the dominant activity. While agricultural practices extend onto the steeper slopes and tabletops, cropping is replaced with stock grazing, including cattle, sheep, and goats. Large patches of remnant vegetation are predominantly restricted to public land (including road reserves and conservation areas), upper slopes and gullies. Agricultural land use has dominated the local region historically. These practises have resulted in the extensive clearing of native vegetation, and those patches that do persist have been permanently degraded.

The key public roads that intersect with the Project include, Vinegaroy Road, Coolah Creek Road, Turee Vale Road, Rotherwood Road, Coolah Road and Ulan Road.

Table 1.4 Modified Development Corridor Location in the Landscape

Modified Development Corridor Location in the Landscape	
LGA	Warrumbungle (Wind Farm) Upper Hunter (Wind Farm and External Transmission Line) Mid-western Regional (External Transmission Line)
Modified Development Corridor	Total of 12,601.7 ha, comprised of two distinct and partially overlapping parts: 1. Modified Development Corridor – Wind Farm: 10,317.1 ha 2. Modified Development Corridor – External Transmission Line: 2,284.5 ha Note there is 621.7 ha of overlap between the Modified Development Corridor – Wind Farm and Modified Development Corridor – External Transmission Line.
Indicative Development Footprint	Total of 1,790.1 ha, comprised of: • approximately 1,367.4 ha of Indicative Development Footprint – Wind Farm • approximately 232 ha of Indicative Development Footprint – External Transmission Line • approximately 190.7 Indicative Development Footprint – Public Road Upgrades).

D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 S&V\FIGURES R03\4859_001_PROJECTLOCATION.MXD 8/02/2022 4:03:38 PM



Legend

Approved Project
- Approved Site Boundary
- Approved Development Corridor

Modified Project
- Modified Site Boundary

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line
- Local Government Boundary
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 1.2

Liverpool Range Wind Farm - Project Location

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

1.3.1 Approval History

The Project was originally assessed as a Major Project, under Part 3A of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). The Project was subsequently transitioned to a state significant development (SSD) under the EP&A Act by an order made on 21 March 2014. Development Consent SSD 6696 was granted on 27 March 2018 by the NSW Minister for Planning (DPIE 2018a) under Section 4.38 of the EP&A Act and 29 June 2018 under Sections 130(1) and 133 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In 2019, the Project was acquired by Tilt Renewables Limited (previously known as Trustpower Australia Limited).

An overview of the Approved Project is presented in **Figure 1.3**, and the tiled figure set is provided in **Appendix A**.

1.3.1.1 State Approved Development Consent

The Project (SSD 6696) was approved subject to conditions. Conditions 18 – 22 relate to clearing thresholds for threatened entities, construction management measures to reduce impacts on biodiversity and the preparation of relevant management plans to guide the operation of the wind farm. Key requirements of the consent include:

- a clearing limit of 200.85 ha of State listed box gum woodland CEEC
- minimisation of impacts to native vegetation and habitat, including threatened bird and bat populations and hollow-bearing trees
- updated vegetation and habitat mapping
- identification of biodiversity offset liability and provision of offsets within two years of the commencement of construction, and
- preparation of a Biodiversity Management Plan and a Bird and Bat Adaptive Management Plan.

Condition 9 of the Development Consent also allows for staging of the development.

This Biodiversity Development Assessment Report (BDAR) provides the outcomes of updated vegetation survey and mapping, threatened species survey and habitat mapping and the identification of the biodiversity offset liability for the Project, in accordance with BAM 2020.

Section 5.4 of the Determination Assessment Report (DPIE 2018b) states that the Approved Project was assessed under the NSW Offsets Policy using the FBA.

A preliminary calculation of the likely credit requirements for the Approved Project was undertaken by NGH Environmental using the FBA calculator as part of the Revised Offset Strategy, as presented in Appendix F of the Biodiversity Assessment Addendum (2017). This preliminary FBA assessment calculated the likely ecosystem and species offset requirements for the Approved Project as presented in Table 16 and Table 17 of the Determination Assessment Report (DPIE 2018b). It was noted in Section 2.1 of the Revised Offset Strategy (NGH Environmental February 2017) that these credits were only indicative and would be confirmed "using field collected plot data, and would be based on the final impact areas derived from civil construction drawings (not yet available)".

Consent Condition 19(b) (SSD 6696) required the Approved Project to calculate the biodiversity offset credit liabilities for the development in accordance with FBA. In 2016, the NSW TSC Act was repealed and replaced with the BC Act, which commenced 25 August 2017. The inception of the BC Act changed the assessment requirements for SSD projects in NSW with biodiversity impact assessment needing to meet the requirements of the BOS via the application of the BAM. Consultation with BCS and DPE as described in **Section 1.5** confirmed that the BAM would be the applicable assessment methodology for the Modified Project.

1.3.1.2 Federal EPBC Approval

The Project received federal approval under the EPBC Act on 29 June 2018. Key approval conditions relating to biodiversity include the following requirements:

- a clearing limit of:
    - 10.37 ha of *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC;
    - 234.7 ha of regent honeyeater potential habitat; and
    - 256.3 ha of swift parrot potential habitat
- preparation of a Vegetation Management Plan to mitigate the impacts of the Project on the regent honeyeater
- preparation of a biodiversity offset strategy to mitigate the impacts of the Project on the regent honeyeater, swift parrot and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* ecological community. The offset strategy should be approved prior to the commencement of the Project, to the satisfaction of the Minister of the Environment, and
- preparation of a Biodiversity Offset Management Plan (BOMP) that covers the direct offset sites identified in the approved Offset Strategy.

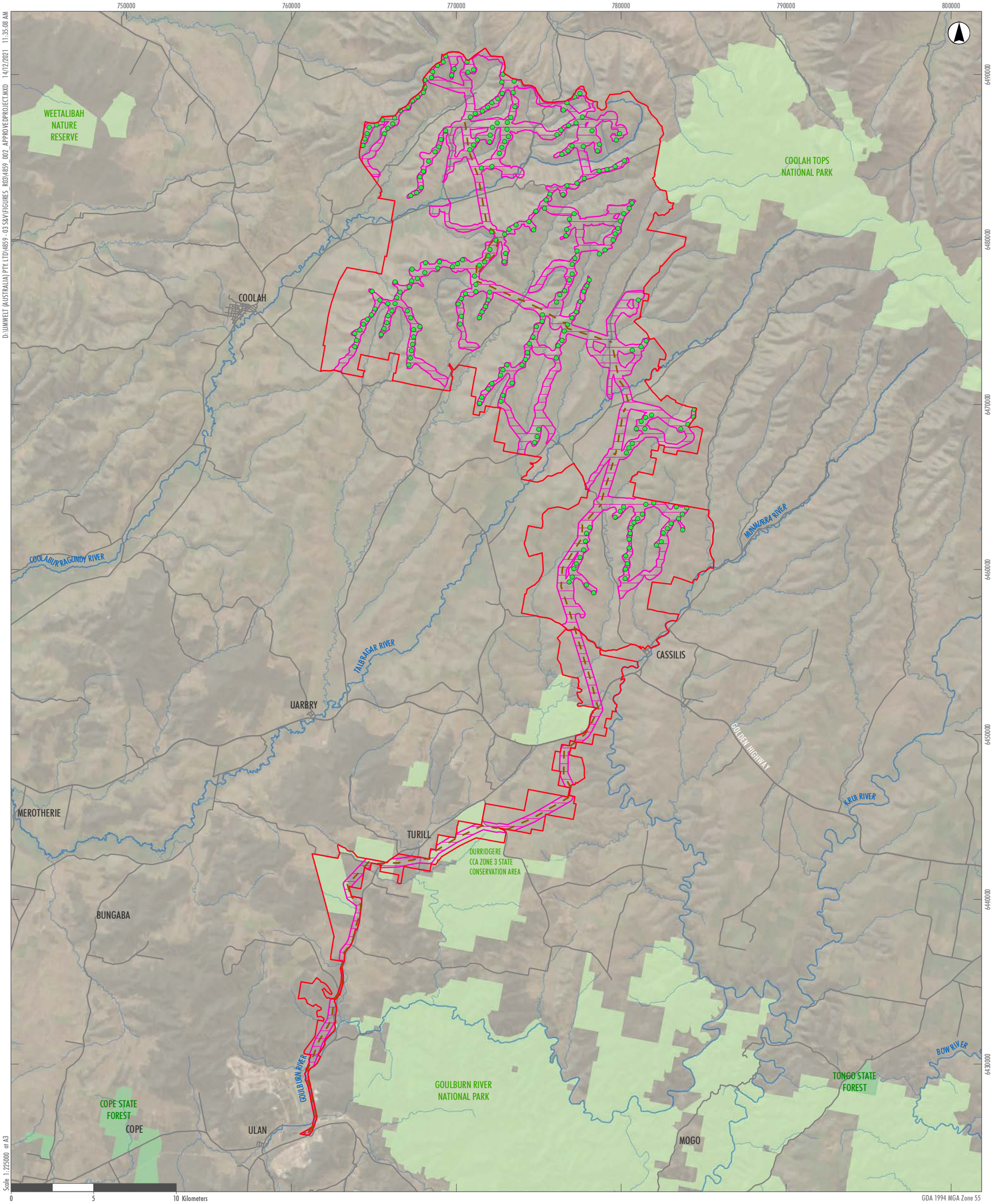


FIGURE 1.3

Liverpool Range Wind Farm
Approved Project (SSD6696)

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

1.4 Modified Development Corridor and Indicative Development Footprints

1.4.1 Modified Development Corridor Information

The Modified Development Corridor is 12,601.7 ha in area. As a heuristic device, the Modified Development Corridor has been divided into two distinct and partially overlapping areas, as follows (refer to **Figure 1.1**):

1. **Modified Development Corridor – Wind Farm (10,317.1 ha):** this portion of the Modified Development Corridor includes all wind farm related infrastructure including the portion of the internal transmission line north of the on-site collector substation located near Rotherwood Road. This portion of the Modified Development Corridor wholly contains the Indicative Development Footprint – Wind Farm (discussed further below).

2. **Modified Development Corridor – External Transmission Line (2,284.5 ha):** this portion of the Modified Development Corridor includes all infrastructure related to the portion of the transmission line between the on-site collector substation located near Rotherwood Road and the proposed point of connection at Ulan. This portion of the Modified Development Corridor wholly contains the Indicative Development Footprint – External Transmission Line (discussed further below).

Note: the combined area exceeds 12,601.7 ha due to partial overlap (621.7 ha) of the Wind Farm and External Transmission Line portions of the Modified Development Corridor. This overlapping section has been allocated to the Modified Development Corridor – Wind Farm in this Biodiversity Assessment.

To assist with the delivery of the Project by different contractors and assist with compliance during construction and operations phases the Modified Development Corridor has been divided into two separate and partially overlapping areas that each encompass the relevant land areas to deliver the wind farm and the external connection components, respectively.

Throughout this report the term Modified Development Corridor refers to both Modified Development Corridor – Wind Farm and Modified Development Corridor – External Transmission Line, unless otherwise stated.

The Modified Development Corridor assessed in this BDAR is considered to be broadly consistent to that which was approved (NGH Environmental 2013a, 2013b and 2017). The Approved Development Corridor totalled 12,405 ha.

It is understood that the proposed changes to the Approved Development Corridor have been made in response to the revised indicative design, to limit disturbance of particular biodiversity values and allow for avoidance of areas of sensitivity.

The Modified Development Corridor was surveyed in accordance with the BAM in relation to the collection of Vegetation Integrity plots, however targeted species credit surveys were restricted to those areas that were identified as being distinctly different, either through a large deviation/separation of the Modified Development Corridor from the Approved Development Corridor, or where the vegetation, habitat and/or condition was not consistent with the biodiversity values previously identified in the Approved Development Corridor. This approach is consistent with discussions with DPIE (30 January 2020) and BCS (13 February 2020).

1.4.2 Indicative Development Footprint Information

The Indicative Development Footprints will be subject to a range of disturbances as described in **Section 5.0**.

The total indicative impact zone (e.g. all ground disturbance and vegetation removal) associated with the wind farm components of the Project and the portion of transmission line north of the southern on-site collector substation, is termed Indicative Development Footprint – Wind Farm (1,367.4 ha) (refer to **Figure 1.4** and **Appendix A**).

The total indicative impact zone associated with the transmission line between the southern on-site collector substation and the point of connection at Ulan is termed Indicative Development Footprint – External Transmission Line (approximately 232.0 ha) (refer to **Figure 1.4**, **Appendix A**).

The total indicative impact zone associated with the anticipated public road upgrades is termed Indicative Development Footprint – Public Road Upgrades (approximately 190.7 ha) (refer to **Figure 1.4** and **Appendix A**).

Equivalent to the *Development Footprint* terminology in the BAM (DPIE 2020a), the Indicative Development Footprints (1,790.1 ha) is a combination of the *Indicative Development Footprint – Wind Farm*, the *Indicative Development Footprint – External Transmission Line,* and the *Indicative Development Footprint – Public Road Upgrades* and comprises the entirety of the Indicative Development Footprint for the Project. The Indicative Development Footprints are based on a detailed Project design that is a realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

A summary and description of all the components of the Indicative Development Footprints is provided below in **Table 1.5**. Late in the assessment process for the Modified Project, two unavoidable changes to the design occurred. In the north-west corner of the Modified Project, one landholder declined to be involved in the Project and as a result, three proposed wind turbines were removed and several minor modifications to associated infrastructure were required. The second change occurred within the external transmission line at the south of the Modified Project along Ulan Road. The original proposed design included a section of the external transmission line that spanned the entrance to the parking area for the 'Hands on the Rock' Aboriginal cultural heritage site near Ulan. There is approximately 2.5 km of the transmission line easement that is substantially different to the Approved Project, however less than 200 m occurs outside of the Development Corridor of the Approved Project.

The Applicant has made attempts to investigate alternate transmission line routes to minimise impacts, including discussions with a number of private and public landowners of adjacent land parcels. As an outcome of these discussions the Applicant proposes to shift the portion of the transmission line alignment just south of the Hands on Rock car park entrance to the east onto Crown land parcels Lot 7300/DP1136299 and Lot 7008/DP1030463 to completely avoid the broader land parcel that Hands on Rock cultural heritage site is located (Lot 751/DP1270886).

The Indicative Development Footprint – Public Road Upgrades has been identified separately as it was not previously considered as part of the existing approval (SSD 6696) process. All development footprints are indicative as they will be finalised through further detailed design once a turbine and preferred contractor(s) is selected. The Proponent is committed to further avoiding and minimising additional biodiversity values where feasible.

This BDAR focuses on the Indicative Development Footprints as per BAM (DPIE 2020a), however the consideration of biodiversity values and surveys completed have considered the wider Modified

Development Corridor. Due to the nature of wind farm projects, whereby their impact footprints are finalised at such late stages, understanding the values in surrounding land is essential to facilitating avoidance and minimisation measures through refinement and finalisation of the development footprints. Thus, where relevant to do so, this BDAR presents and discusses the extent of survey work, GIS Mapping and data analysis completed within the Modified Development Corridor.

The Indicative Development Footprint – Wind Farm and Indicative Development Footprint – External Transmission Line occur entirely within the Modified Development Corridor. Broadly speaking, components of the Indicative Development Footprints (Wind Farm and External Transmission Line) are consistent with the Biodiversity Assessments and Biodiversity Assessment Addendum (NGH Environmental 2013a, 2013b and 2017), comprising wind turbines, internal access tracks, transmission lines, underground cabling, and a range of associated infrastructure.

Given public road alignments are generally fixed and thus there are limited opportunities to micro-site them, the Indicative Development Footprint – Public Road Upgrades is not governed by the Modified Development Corridor and therefore extends beyond it in most locations.

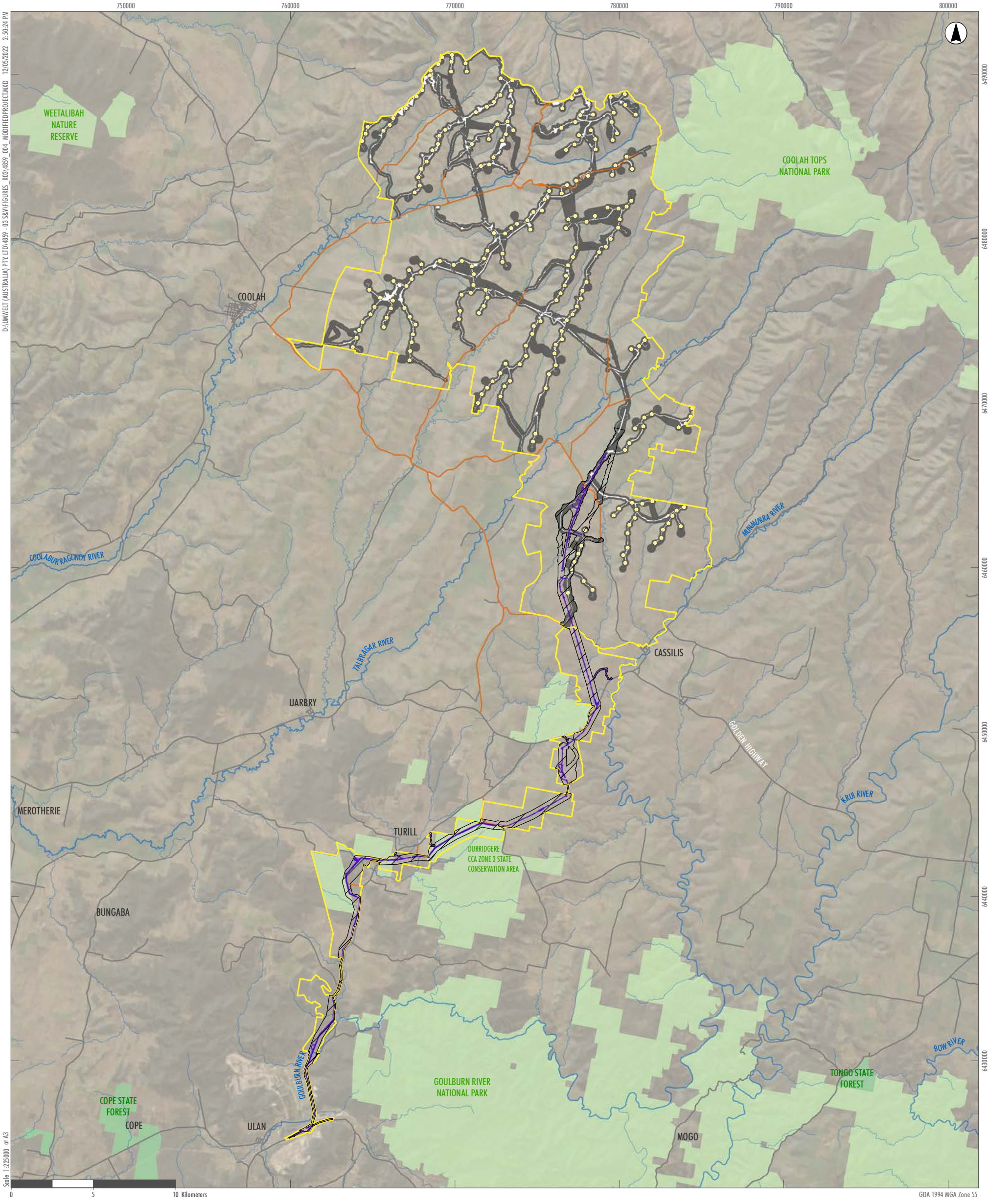
Table 1.5 Summary of Indicative Development Footprints of the Project

Ground Disturbance Category	Description

Indicative Development Footprint – Wind Farm	The total indicative ground disturbance associated with permanent and temporary infrastructure within the Wind Farm Site, including:
	• turbine hardstands
	• internal access tracks (preferred options only)
	• internal transmission line easement:
	  o internal access tracks, pole/tower locations, string pads
	  o clearance of trees with heights above 4 m at full maturity within the 60 m wide easement. Where no vegetation clearance is required, those areas are excluded.
	• 9 (of the 19) indicative locations for temporary construction compounds, laydown areas, and concrete batch plants
	• all 6 x indicative locations for permanent Operations & Maintenance (O&M) facility
	• 14 (of the 40) indicative locations for permanent met masts
	• 9 (of the 10) indicative locations for collector substations

Indicative Development Footprint – External Transmission Line	The total indicative ground disturbance associated with the external transmission line:
	• external transmission line easement (preferred options only):
	  o internal access tracks, pole/tower locations, string pads
	  o clearance of trees with heights above 4 m at full maturity within the approximately 60 m wide easement. Where no vegetation clearance is required, those areas are excluded.
	  o access tracks into easement from nearby public roads
	• potential strengthening works to TransGrid infrastructure at Ulan
	• indicative temporary construction compound/laydown area/concrete batch plant location near Cliffdale Road

Indicative Development Footprint – Public Road Upgrades	The total indicative ground disturbance associated with the anticipated upgrades to public roads proposed to be used by the Project, to the standards agreed with relevant councils.



Legend

Modified Project

- Modified Site Boundary

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line
- Modified Wind Turbines
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 1.4

Liverpool Range Wind Farm Modification:
Modified Development Corridor and
Indicative Development Footprints

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

1.5 Agency Consultation

The biodiversity assessment completed for the Project has been undertaken in consultation with relevant state and government agencies. At commencement of and throughout the preparation of the BDAR, the Proponent and Umwelt consulted with the Department of Planning and Environment (DPE), Biodiversity Conservation and Science Directorate – Dubbo Branch (BCS – Dubbo) and NSW - National Parks and Wildlife Service (NSW – NPWS); and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), as follows:

- DPIE – 30 January 2020
- BCS – Dubbo, 13 February 2020
- DCCEEW – 16 July 2020
- NSW – NPWS, 1 September 2020
- BCS – Dubbo, 22 October 2021
- DCCEEW – 30 November 2021 and
- BCS – Dubbo, 13 April 2022.

A key component of the agency consultation was to discuss the particular application of the BAM to the targeted threatened species survey strategy in light of the existing State and Federal approvals. Following consultation with DPIE and BCS, it was agreed that the application of BAM requirements for species-credit species would only be required within sections of the Modified Development Corridor where it occurred substantially outside the Approved Development Corridor. Meaning, species-credit species surveys and assessment is only required where the Modified Development Corridor is substantially different to the Approved Development Corridor.

It was agreed that where the Modified Development Corridor overlays with the Approved Development Corridor approved under (SSD) 6696, the BAM will be used to assess the species-credit species that were identified as being impacted by the existing Approved Project and documented in DPIE's Determination Assessment Report (DPIE, 2018b).

The BAM has been used to calculate ecosystem credits across the entire Modified Development Corridor.

1.6 Key Resources and Legislation

The following key resources, policies and documents were used during the preparation of this BDAR:

- Biodiversity Assessment Methodology 2020
- Biodiversity Assessment Method Operational Manuals – Stage 1 and Stage 2
- Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact
- NSW *Biodiversity Conservation Act 2016*
- Biodiversity Conservation Regulation 2018
- NSW *Local Land Services Act 2013*

- NSW *Environmental Planning and Assessment Act 1979*
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

1.7 Local Land Services Act 2013 – Land Category Mapping

Section 6.12 of the *Biodiversity Conservation Act 2016* (BC Act) requires a BDAR to be prepared in accordance with the BAM which is established under Section 6.8 of the BC Act.

Relevantly, section 6.8(3) of the BC Act provides:

> *(3) The biodiversity assessment method is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.*
>
> ***category 1-exempt land** means areas of the State to which this Part applies designated as category 1-exempt land on the native vegetation regulatory map.*
>
> ***category 2-regulated land** means areas of the State to which this Part applies designated as category 2-regulated land on the native vegetation regulatory map (including category 2-vulnerable regulated land that is so designated).*
>
> ***60E Purpose of native vegetation regulatory map***
>
> *The purpose of the native vegetation regulatory map is to designate areas of the State to which this Part applies—*
>
> *(a) where the clearing of native vegetation is not regulated under this Part (**category 1-exempt land**), and*
>
> *(b) where the clearing of native vegetation is regulated under this Part (**category 2-regulated land**), and*
>
> *(c) where the clearing of native vegetation is regulated under this Part but (because of its vulnerability) is subject to additional restrictions and extended to the clearing of dead and non-native plants (**category 2-vulnerable regulated land**).*

The Native Vegetation Regulatory Map has not been finalised and the mapping of Category 1 - exempt land has not been released to the public. As such, landholders are responsible for determining the categorisation of their land in accordance with the *Local Land Services Act 2013* (LLS Act).

This report provides mapping Category 1 – exempt land and Category 2 – regulated land within the Modified Assessment Corridor to support applications to assess the Modified Project.

1.7.1 Definition of Category 1 – Exempt Land

Category 1-exempt land is defined in Part 5A, Division 2 of the LLS Act. Subject to certain exceptions, Category 1-exempt land is broadly defined as being:

- land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990 (but before 25 August 2017)
- low conservation grasslands
- land containing only low conservation groundcover (not being grasslands)

- native vegetation identified as regrowth in a Property Vegetation Plan under the repealed *Native Vegetation Act 2003*
- land bio-certified under the BC Act.

Land meeting the above criteria is not considered to be Category 1-exempt land if certain exceptions apply. These exemptions are discussed further in the following sections below.

1.7.2 Meaning of 'cleared'

Based on the Land Categorisation Fact Sheet, clearing has been interpreted as any areas where there has been a lawful removal of all native vegetation (all strata) prior to the commencement of Part 5A of the LLS Act, being 25 August 2017.

114 Determining whether native vegetation has been significantly disturbed or modified (s 60J (2))

(1) Native vegetation that comprises grasslands or other non-woody vegetation is taken to have been significantly disturbed or modified (and therefore cleared) only if:

(a) there has been a detectable variation (from information obtained from aerial or satellite imagery) in the structure or composition, or both, of non-woody vegetation, and

(b) that variation is consistent with management of pasture or crops for agricultural purposes, and

(c) that variation has been sustained for at least 12 months on more than one occasion before the commencement of Part 5A of the Act, and

(d) that variation has not been caused only by grazing on the land, and

(e) that variation occurred (from information obtained from aerial or satellite imagery) between 1 January 1990 and the date of commencement of Part 5A of the Act.

(2) During the transitional period referred to in section 60F of the Act, the information that may be used for the purposes of this clause includes information obtained from a source other than from aerial or satellite imagery, but only if the landholder has prepared a record of the information and a map showing the areas to which it applies. The landholder is required to retain the record and map for at least 5 years after any clearing that is carried out in reliance on that information.

60B Meaning of "native vegetation"

*(1) For the purposes of this Part, **native vegetation** means any of the following types of plants native to New South Wales—*

(a) trees (including any sapling or shrub or any scrub),

(b) understorey plants,

(c) groundcover (being any type of herbaceous vegetation),

(d) plants occurring in a wetland.

(2) A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible.

(3) For the purposes of this Part, native vegetation extends to a plant that is dead or that is not native to New South Wales if—

(a) the plant is situated on land that is shown on the native vegetation regulatory map as category 2-vulnerable regulated land, and

(b) it would be native vegetation for the purposes of this Part if it were native to New South Wales.

(4) For the purposes of this Part, native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). A declaration under section 14.7 of the Biodiversity Conservation Act 2016 that specified vegetation is or is not marine vegetation also has effect for the purposes of this Part.

60C Meaning of "clearing" native vegetation

*For the purposes of this Part, **clearing** native vegetation means any one or more of the following—*

(a) cutting down, felling, uprooting, thinning or otherwise removing native vegetation,

(b) killing, destroying, poisoning, ringbarking, or burning native vegetation.

Clearing of native vegetation has been interpreted for the purposes of the mapping as being areas where complete removal of ground cover has occurred, namely:

- areas that were cropped/ploughed or significantly disturbed (see clause 114 of the LLS Regulation) for agricultural purposes
- areas disturbed by approved activities.

While it is reasonably straight forward to classify land that has had all vegetation removed since 1990 by identifying land where surface disturbance activities have taken place, the legislation provides little clarity on what is meant by 'cleared as at 1 January 1990'. This is particularly important in the present case where there is a long history of disturbance within the Modified Development Corridors associated with agriculture. This process is complicated in the present conditions by the absence of any high resolution aerial photography of the Project site in 1989/1990. The methodology for assessing areas 'cleared' of native vegetation is set out in **Section 2.1**.

1.8 Report Preparation

This BDAR was prepared by Bill Wallach (Principal Ecologist), with review and technical direction from Allison Riley (NSW Ecology Manager). Field surveys were undertaken by a range of suitably experienced and qualified Umwelt ecologists under the supervision of an accredited BAM Assessor and coordinated by Bill Wallach.

Table 1.6 below outlines the details of the Accredited BAM Assessors involved in the survey, calculations and reporting for the Project.

Table 1.6 Accredited BAM Assessors, Ecologists and their Role on this Project

Name	Assessor ID	Role
Allison Riley *NSW Ecology Manager*	BAAS17042	Review of BDAR, review of BAM calculator, technical direction, consultation with BCS and DPE, and targeted threatened species surveys.
Bill Wallach *Principal Ecologist*	BAAS17068	BDAR Preparation, BAM calculator application, field surveys (BAM Plots and targeted threatened species surveys) and consultation with BCS, DPE and DCCEEW
Ryan Parsons *Principal Ecologist*	BAAS17048	Preparation and review of BDAR and BAM calculator.
Philippa Fagan *Senior Ecologist*	BAAS18117	Field surveys (BAM Plots and targeted threatened species surveys) and PCT analysis
James Garnham *Senior Ecologist*	BAAS19021	Field surveys (BAM Plots and targeted threatened species surveys)
Belinda Howe *Ecologist*	BAAS21019	Field surveys (BAM Plots and targeted threatened species surveys), PCT analysis and BDAR Preparation.
Mark Allen *Ecologist*	N/A	Field surveys (BAM Plots and targeted threatened species surveys)
Monique Bates *Ecologist*	N/A	Field surveys (BAM Plots and targeted threatened species surveys)
Kyle Stimson *Ecologist*	N/A	Field surveys (BAM Plots and targeted threatened species surveys)

Because of the large size and linear nature of the Project, all detailed figures prepared as part of this BDAR have been prepared to a scale of 1:20,000 on A3. BCS-Dubbo confirmed that the amended figure scale was suitable for this Project. Throughout this BDAR, all detailed figures have a standalone figure within the text, covering the whole Project extent. The detailed tiled figures are provided within **Appendix A**.

2.0 Methods

2.1 Category 1 – Exempt Land Mapping

Category 1-exempt land areas were identified through the following process:

- Areas mapped within the *NSW Native Vegetation Extent* Map 2013 as being 'Category 1 – not native' were assigned Category 1 – exempt land status.
- Areas mapped within the *2013 Land use* Map as being 'Plantation forests – 3.1.0.', 'Cropping – 3.3.0.', 'Grazing Modified Pastures – 3.2.0', '3.2.5 Sown grasses', and 'Residential and Farm Infrastructure – 5.4.0' were assigned Category 1 – exempt land status as per Figure 7 in the NSW Government's 2017 *Native Vegetation Regulatory Map: Method Statement*.
- Aerial photography/satellite imagery was reviewed to assess historical cropping and tilling practices.
- Umwelt field surveys collecting flora data and photographs to show current condition.
- Areas which were identified as having been lawfully cleared/disturbed as set out above were then mapped as Category 1 – exempt land using geo-rectified imagery.

The methodology of identifying Category 1 – Exempt Land for the Modified Project was undertaken under the principal of land that had been 'Cleared as at 1990' or lawfully cleared/disturbed thereafter. This was interpreted as areas where there is clear evidence of the complete removal of all vegetation or evidence of compositional change in the grassland and in which shrubs or trees had not regrown.

Complete removal of native vegetation has been interpreted for the purposes of the mapping as being areas where complete removal of ground cover has occurred, namely:

- areas that were cropped/ploughed or significantly disturbed (see clause 114 of the LLS Regulation) for agricultural purposes
- areas disturbed by approved activities.

The presence of remnant paddock trees in paddocks that have been cleared and cropped does not preclude these areas from being assessed as having been cleared (subject to restriction around the treatment of remnant paddock trees themselves). Only areas that retain trees in relatively close proximity to each other such that they may still be characterised as being a patch of woodland or open woodland have been considered as not being cleared where there is evidence of removal of vegetation in and around these trees. Aerial photo interpretation of groundcover texture, as well as site surveys, have been used to inform the assessment of likely disturbance, with a comparison of grassland 'texture' in areas of uncertainty compared to areas where past disturbance is clear to inform the mapping of 'cleared areas'.

2.2 Ecology Surveys as Part of the Existing Approval

Extensive ecological surveys were completed for the Approved Project across multiple seasons and years (NGH Environmental 2013a, 2013b and 2017). The timing and nature of each survey is summarised below .

These surveys were considered in the preparation of this BDAR and are summarised in **Table 2.1** for context.

Table 2.1 Summary of Previous Survey Effort

Date	Flora	Fauna
8 – 19 October 2012	Random meanders, including targeted searches for all potential species	Habitat assessment, including hollow-bearing tree survey
		Bird survey
		Herpetofauna search
		Bird utilisation survey
	Inspection searches	Extended herpetofauna search
		Nocturnal survey, including stag watching/ evening listening, spotlighting (on foot and vehicle based) and call playback.
		Anabat
1 – 9 October 2013	Random meanders, including targeted searches for all potential species	Habitat assessment, including hollow-bearing tree survey
		Bird survey
		Herpetofauna search
		Bird utilisation survey
	Inspection searches	Extended herpetofauna search
		Nocturnal survey, including stag watching/ evening listening, spotlighting (on foot and vehicle based) and call playback.
		Anabat
		Remote Infrared Survey Camera
20 – 23 March 2015	Flora plots / random meanders	Habitat assessment and hollow-bearing tree survey
		Bird utilisation survey
	Biometric plots	Nocturnal survey, including spotlighting (on foot), call playback
		Anabat
4 – 6 October 2016	Rapid vegetation assessments and survey points	Key habitat feature assessment
	Random meanders	

2.3 Landscape Features and Site Context

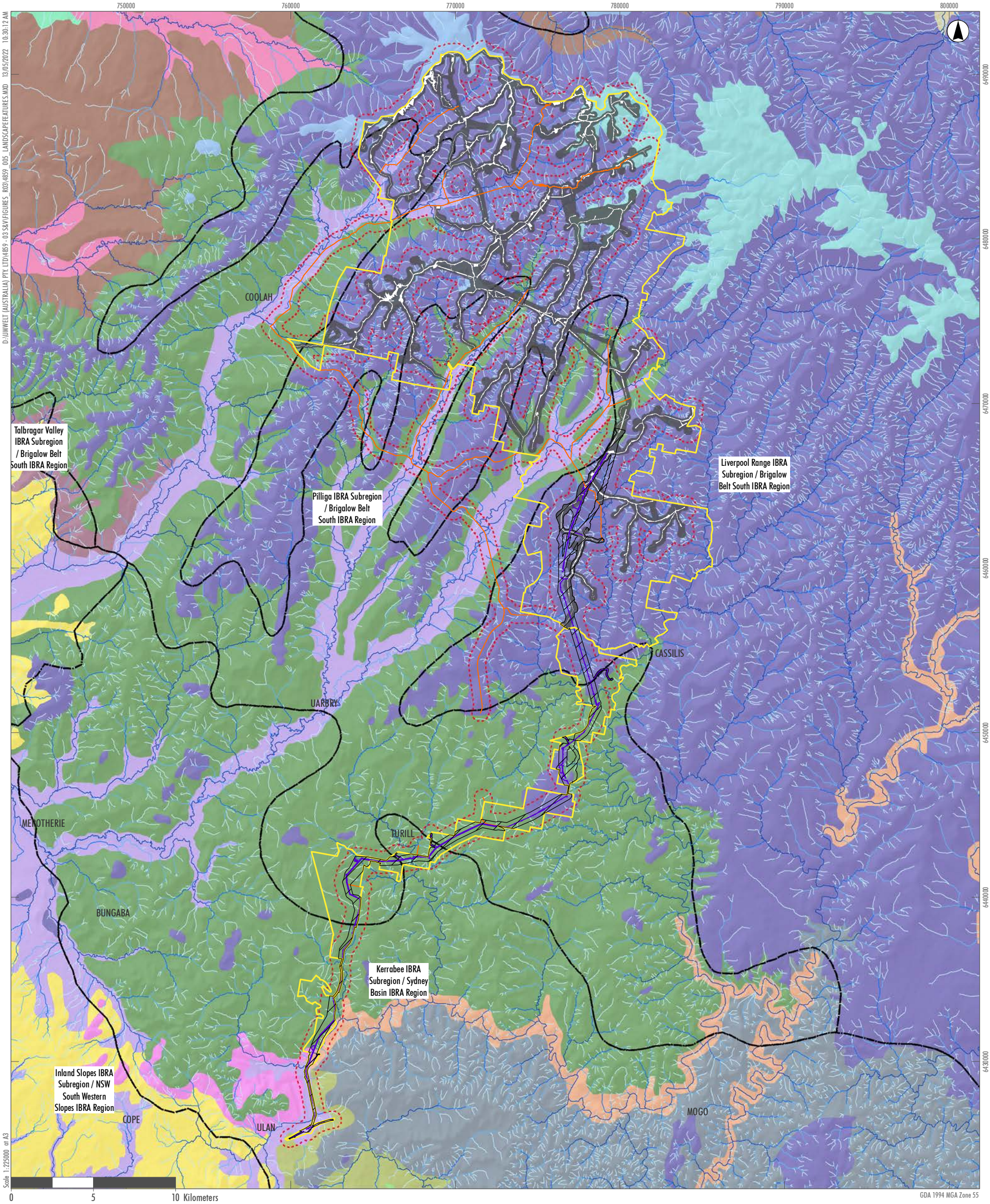
Landscape features such as IBRA bioregions, IBRA subregions, NSW Mitchell Landscape regions, native vegetation extent within a 500 m buffer area, cleared areas, rivers, streams, wetlands and connectivity features were identified within the Modified Development Corridor, in accordance with Section 3.1 of the BAM (DPIE 2020a). Refer to **Figure 2.1** for an overview and **Appendix A** for the detailed figure set.

The Project meets the definition of a Linear-shaped Development under BAM (DPIE 2020a), being "*development that is generally narrow and extends across the landscape…*". The extent of the Project spans approximately 66 kilometres from its northern to southern tip with the majority of the Modified Development Corridor consisting of linear corridors.

Determining the 'Site Context' of the Indicative Development Footprints was calculated by assessing the native vegetation cover and patch size within the Indicative Development Footprints in accordance with Section 4.33 of the BAM (DPIE 2020a).

The 500-metre buffer area was determined based on the outer extent of the Indicative Development Footprints because a centreline was not applicable for the Project as per Section 3.1.2 of the BAM (DPIE 2020a). The buffer covers the full extent of all works associated with the Project and includes the full extent of the Modified Development Corridor. Native vegetation cover was mapped within the buffer area using several regional vegetation mapping products in combination with manual GIS mapping updates to ensure consistency. Regional vegetation mapping products used in this process are:

- State Vegetation Type Map – Border Rivers Gwydir / Namoi Region Version 2.0 VIS 4467 (State Government of NSW and DPIE, 2015)
- State Vegetation Type Map – Central West / Lachlan Region Version 1.4 VIS 4468 (State Government of NSW and DPIE, 2015),
- State Vegetation Type Map – Upper Hunter v1.0 VIS 4894 (State Government of NSW and DPIE, 2019c), and
- State Vegetation Type Map – Central Tablelands Region Version 1.0 VIS 4778 (State Government of NSW and DPIE, 2017).



Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- 500m Buffer
- IBRA Subregion / Region

Stream Order:
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- 5th Order Stream or Higher

Mitchell Landscapes
- Cassilis Slopes
- Coolah Tops
- Cope Hills Granite
- Goulburn River Channels and Floodplains
- Goulburn River Gorges
- Gulgong Ranges
- Lees Pinch Foothills
- Liverpool Alluvial Plains
- Liverpool Range Valleys and Footslopes
- Liverpool Tops
- Merrygoen Hills and Slopes
- Mollyan Hills
- Talbragar - Upper Macquarie Terrace Sands and Gravels
- Trinkey Plateau
- Upper Castlereagh Alluvial Plains
- Upper Goulburn Valleys and Escarpment

FIGURE 2.1

Liverpool Range Wind Farm – Landscape Features

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

2.3.1 Landscape Features

The Indicative Development Footprints (refer to **Figure 1.4** and **Appendix A**) are collectively 1,790.1 ha in size. Refer to **Table 2.2** for a summary of the other relevant landscape features that pertain to the BAM assessment.

An overview of the relevant landscape features are shown in **Figure 2.1**, and the tiled figure set is provided in **Appendix A**.

Table 2.2 Landscape Features within the Liverpool Range Wind Farm Modified Development Corridor

Landscape Features	Modified Development Corridor
IBRA Bioregion	Brigalow Belt South Sydney Basin
IBRA Subregion	Brigalow Belt South – Liverpool Range Brigalow Belt South – Pilliga Sydney Basin - Kerrabee
NSW Mitchell Landscapes	Liverpool Range Valleys and Footslopes Talbragar – Upper Macquarie Terrace Sands and Gravels Coolah Tops Cassilis Slopes Goulburn River Channels and Floodplains Goulburn River Gorges Liverpool Tops Upper Goulburn Valleys and Escarpment
Native Vegetation Cover	Assessed within a 500m buffer of the Indicative Development Footprints.
Strahler Streams	Coolaburragundy River (3rd Stream Order) Gundare Creek (2nd Stream Order) Turee Creek (2nd Stream Order) Talbragar River (3rd Stream Order) Four Mile Creek (2nd Stream Order) Goulburn River (2nd Stream Order) Murrumbline Creek (2nd Stream Order) Curryall Creek (2nd Stream Order) Bobadeen Creek (2nd Stream Order)
Important and Local Wetlands	Nil

2.4 Native Vegetation Assessment

2.4.1 Literature and Database Review

A review was undertaken of public databases, and previous documents and reports prepared for the vegetation relevant to the Indicative Development Footprints (refer to **Section 1.5**). The information obtained was used to inform survey design and assist in the assessment of native vegetation and threatened ecological communities (TECs).

Government Guidelines and Resources

- Biodiversity Assessment Method (DPIE, 2020a)
- Biodiversity Assessment Method Operational Manual (Stage 2) (DPIE 2019a)
- Biodiversity Assessment Method Calculator
- Surveying threatened plants and their habitats, NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b)
- Draft Survey Guidelines for Australia's Threatened Orchids (DoEE 2013)
- *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019b).
- BioNet Atlas of NSW Wildlife database and mapping tool (DPIE 2021a), accessed November 2021
- Threatened Biodiversity Data Collection (TBDC) (DPIE 2021b), accessed November 2021
- Vegetation Information System (VIS) Classification Database (DPIE 2021c), accessed November 2021
- Department of Agriculture, Water and the Environment, Protected Matters Search Tool, accessed October 2021 (DAWE 2021)
- Draft Koala Habitat Protection Guideline and Koala Habitat Protection SEPP (DPIE 2020c).

Project Assessments

- Liverpool Range Wind Farm Environmental Assessment (Epuron 2014)
- Biodiversity Assessment, Liverpool Range Wind Farm – Wind Farm Study Area (NGH Environmental 2013a)
- Biodiversity Assessment, Liverpool Range Wind Farm – Transmission Line Study Area (NGH Environmental 2013b)
- Biodiversity Addendum Report, Liverpool Range Wind Farm and Transmission Line Project (NGH Environmental 2017)
- Liverpool Range Wind Farm, Response to Submissions Report (Epuron, 2017)

Approved Project Documentation

- Development Consent (SSD 6696) (DPIE 2018a)
- State Significant Development Assessment, Liverpool Range Wind Farm: Assessment Report (DPIE 2018b)
- Liverpool Range Wind Farm Federal Approval, EPBC 2014/7136 (DoEE 2017).

2.4.2 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) was viewed prior to and after the vegetation surveys to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment, and vegetation community mapping of the Project site.

Vegetation communities in the site were mapped on-screen overlaying the high resolution aerial photographs. Mapping was undertaken using the Manifold System 8.0 Enterprise Edition GIS in a 32 bit mode.

2.4.3 Floristic and Vegetation Integrity Survey

A total of 85 vegetation integrity plot surveys were conducted within the Modified Development Corridor (or in proximity to it) in accordance with the BAM (DPIE 2020a) including within the approved Project footprint. An overview of the location of these BAM Vegetation Integrity Plots is provided in **Figure 2.2**, and the tiled figure set is provided in **Appendix A.** These surveys were undertaken over the following survey periods:

- 4 to 8 May 2020
- 15 to 19 June 2020
- 14 August 2020
- 18 to 22 January 2021
- 10 to 14 May 2021
- 20 to 24 September 2021.

Reference was made to the VIS Classification Database to identify Plant Community Types (PCTs), as well as reviews of other regional and local vegetation mapping and reporting (refer to **Section 2.3.1**) when designing the field survey. The site's PCTs were stratified into condition states following the initial field survey to determine the appropriate number of transect/plots required in accordance with the BAM (DPIE 2020a).

Table 2.3 below outlines the adequacy of the plot flora survey with respect to the BAM (DPIE 2020a).

Table 2.3 Adequacy of BAM Vegetation Integrity Plots for the Project

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Modified Project - Area within Indicative Development Footprints				No. Floristic and Vegetation Integrity Plots		
		Indicative Development Footprint – Wind Farm (ha)	Indicative Development Footprint – External Transmission Line (ha)	Indicative Development Footprint – Public Road Upgrades (ha)	Total Indicative Development Footprints (ha)	Required[1]	Plots	Total Completed
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good*	6.5	-	1.6	**8.1**	3	20, 43, 58	3
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good*	0.7	12.0	0.7	**13.4**	3	38, 44, 45, 59	4
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good*	149.2	41.8	6.3	**197.3**	7	8, 17, 21, 23, 24, 28, 29, 31	8

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Modified Project - Area within Indicative Development Footprints				No. Floristic and Vegetation Integrity Plots		
		Indicative Development Footprint – Wind Farm (ha)	Indicative Development Footprint – External Transmission Line (ha)	Indicative Development Footprint – Public Road Upgrades (ha)	Total Indicative Development Footprints (ha)	Required[1]	Plots	Total Completed
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good*	-	19.1	0.7	**19.8**	3	36, 63, 75	3
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good*	-	12.7	-	**12.7**	3	35, 64, 65	3
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good*	23.3	5.4	-	**28.7**	4	2, 22, 30, 42, 46, 62	6
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low*	191.3	39.2	10.9	**241.4**	7	6, 12, 27, 40, 61, 78, 79	7

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Modified Project - Area within Indicative Development Footprints				No. Floristic and Vegetation Integrity Plots		
		Indicative Development Footprint – Wind Farm (ha)	Indicative Development Footprint – External Transmission Line (ha)	Indicative Development Footprint – Public Road Upgrades (ha)	Total Indicative Development Footprints (ha)	Required[1]	Plots	Total Completed
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	322.8	2.3	73.4	**398.5**	7	5, 7, 25, 26, 41, 60, 77, 85	8
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	95.9	-	-	**95.9**	5	3, 13, 51, 66, 68, 70, 71	7
10	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good-Shrubby*	0.5	-	-	**0.5**	1	55, 56	2
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low*	152.2	-	4.9	**157.1**	6	1, 9, 11, 50, 52, 53, 54, 57, 67, 72, 73	11

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Modified Project - Area within Indicative Development Footprints				No. Floristic and Vegetation Integrity Plots		
		Indicative Development Footprint – Wind Farm (ha)	Indicative Development Footprint – External Transmission Line (ha)	Indicative Development Footprint – Public Road Upgrades (ha)	Total Indicative Development Footprints (ha)	Required[1]	Plots	Total Completed
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion Exotic	364.4	-	10.0	**374.4**	7	4, 10, 18, 81, 82, 83, 84	7
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	11.0	-	-	**11.0**	3	14, 19, 80	3
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	7.3	-	-	**7.3**	3	15, 16, 69	3
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate/Good*	-	52.9	0.3	**53.2**	5	33, 34, 37, 39, 47, 48	6
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin *Moderate/Good*	-	30.6	0.4	**31.0**	4	32, 49, 74, 76	4

Veg. Zone	Plant Community Type (PCT) *Condition Class*	Modified Project - Area within Indicative Development Footprints				No. Floristic and Vegetation Integrity Plots		
		Indicative Development Footprint – Wind Farm (ha)	Indicative Development Footprint – External Transmission Line (ha)	Indicative Development Footprint – Public Road Upgrades (ha)	Total Indicative Development Footprints (ha)	Required[1]	Plots	Total Completed
-	Nil (incl. roads, tracks and waterbodies)	14.1	4.1	79.2	**97.4**	N/A	N/A	N/A
-	Category 1 – Exempt Land	28.2	11.6	2.3	**42.1**	N/A	N/A	N/A
Total		**1,367.4**	**231.9**	**190.7**	**1,790.0**	**71**	**N/A**	**85**

[1] Calculated against the Total Indicative Development Footprints

Note: minor rounding discrepancies associated with area totals.

2.4.3.1 Floristic Data Collected

At each plot data was recorded in accordance with BAM guidelines (DPIE 2020a).

This involved setting out a 20 x 20 m plot and a 20 x 50 m plot with a 50 m transect. The location of each quadrat was recorded using a hand-held GPS with accuracy of ± 5 m. The Map Grid of Australia (MGA) coordinate system was used.

At each plot, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 m plot. Searches of each 20 x 20 m plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which consistently supported well over half of the species present. Effort was made to search the tree canopy and tree trunks for mistletoes, vines, and epiphytes.

For each flora species recorded in the plot, the following data was collected in accordance with BAM guidelines (DPIE 2020a):

- scientific name and common name of the species
- whether the species is native, exotic, or high threat exotic
- the growth form to which the species belongs
- cover and abundance of the species.

At each vegetation integrity plot the following attributes were recorded in accordance with the BAM (DPIE 2020a) to determine the condition of the vegetation zone:

- ***Composition*** - native plant species richness by growth form (within the 20 x 20 m plot).
- ***Structure*** – estimate foliage cover of native and exotic species by growth form (within the 20 x 20 m plot).
- ***Function*** (within the 20 x 50 m plot) including, number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five 1 x 1 m plots), number of trees with hollows and high threat exotic cover.

2.4.4 Meandering Transects

Meandering transects were walked across vast areas of the Modified Development Corridor and Indicative Development Footprints where they occurred substantially outside of the Approved Development Corridor. An overview of these transects is presented in **Figure 2.2**, and the tiled figure set is provided in **Appendix A**

Meandering transects typically involve two surveyors who walk in parallel 10 metres apart. Opportunistic sampling of vegetation was undertaken along these transects, particularly searches for threatened and otherwise significant species, endangered populations and TECs. Meandering transects enable floristic sampling across a much larger area than plot-based survey. Records along transects supplemented floristic sampling carried out in plots, however the data collected are in the form of presence records, rather than semiquantitative cover abundance scores. Where meandering transects revealed significant variation within a vegetation unit, or a potential new vegetation community, additional plot survey was undertaken.

Meandering transects provided invaluable information on spatial patterns of vegetation that informed vegetation community mapping of the Modified Development Corridor and Indicative Development Footprint – Public Road Upgrades.

740000 750000 760000 770000 780000 790000

6490000 6480000 6470000 6460000 6450000 6440000 6430000

WEETALIBAH NATURE RESERVE
COOLAH TOPS NATIONAL PARK
COOLAH
COOLABURRAGUNDY RIVER
MUNMURRA RIVER
LEADVILLE
TALBRAGAR RIVER
CASSILIS
UARBRY
GOLDEN HIGHWAY
KRUI RIVER
MEROTHERIE
TURILL
DURRIDGERE CCA ZONE 3 STATE CONSERVATION AREA
BUNGABA
GOULBURN RIVER
GOULBURN RIVER NATIONAL PARK
TONGO STATE FOREST
COPE
COPE STATE FOREST
STUBBO
ULAN
MOGO

Scale 1 : 230000 at A3

0 5 10 Kilometers

GDA 1994 MGA Zone 55

Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

BAM Plots

Flora Survey Tracks
- April - 2020
- May - 2020
- June - 2020
- August - 2020
- October - 2020
- January - 2021
- April - 2021
- September - 2021

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 2.2

Liverpool Range Wind Farm,
BAM Vegetation Integrity Plots and Tracks

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

2.4.5 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2021).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

For herbaceous and graminoid species, such as those belonging to the families Asteraceae, Orchidaceae, Cyperaceae and Poaceae, the allocation of specimens to sub-specific levels was at times affected by the availability of adequate flowering or fruiting material.

2.4.6 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Modified Development Corridor and Indicative Development Footprint – Public Road Upgrades. Vegetation mapping involved the following key steps:

- consideration and analysis of the extensive existing ecological work completed through the existing approval processes, particularly:
    - Biodiversity Assessment, Liverpool Range Wind Farm – Wind Farm Study Area (NGH Environmental 2013a)
    - Biodiversity Assessment, Liverpool Range Wind Farm – Transmission Line Study Area (NGH Environmental 2013b).
- review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone, and colour, as well as topography
- review of the modelled distribution of vegetation communities as part of the following four State Vegetation Type Maps:
    - State Vegetation Type Map – Border Rivers Gwydir / Namoi Region Version 2.0 VIS 4467
    - State Vegetation Type Map – Central West / Lachlan Region Version 1.4 VIS 4468
    - State Vegetation Type Map – Upper Hunter v1.0 VIS 4894
    - State Vegetation Type Map – Central Tablelands Region Version 1.0 VIS 4778
- predicting the distribution of particular vegetation communities based on understanding the distribution of Biometric vegetation types and plant communities
- preparation of a draft vegetation community map based on interpretation of digital airborne imagery and preliminary delineation of vegetation community floristics
- ground-truthing of the vegetation map based on survey effort
- revision of vegetation community floristic delineations based on plot data, and
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata.

2.4.7 Threatened Ecological Community Delineation Techniques

Vegetation communities identified in the Modified Development Corridor were compared to TECs listed under the NSW BC Act and Commonwealth EPBC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice was undertaken. The following approach was used:

- full-floristic quadrat assessment, rapid assessments, and meandering survey to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of 'important species' as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee
- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth DCCEEW and the NSW DPIE
- comparison with other assessments of TECs in the region.

Where vegetation communities were mapped through the existing approval process, the TEC analysis that was completed as part of this process were carefully considered. During the assessment for the Approved Project, this included multiple ecological surveys, vegetation community mapping, TEC analysis against the respective determinations and listing/conservation advice, review from regulatory agencies and subsequent revision through the Response to Submission (RTS) process. As a result, material changes to the outcomes of the TEC analysis of the existing approval were only completed by Umwelt where there was clear evidence to do so, such as conflicting field data, changes to vegetation community allocation and changes in condition.

2.4.8 Plant Community Type (PCT) Allocation

The PCTs listed and described within this BDAR considered those presented in the Biodiversity Assessments (NGH Environmental 2013a, 2013b and 2017) and Determination Assessment Report (DPIE 2018) that were prepared for the Approved Project. This approach was taken in recognition of the extensive field surveys and regulatory review/assessment that were completed as part of that approval. Field surveys completed by Umwelt as part of this modification throughout the Modified Development Corridor considered these PCTs and ensured they were accurately assigned and appropriate. PCT allocation was updated where appropriate to do so, a process which was based on the analysis of data collected as part of the extensive BAM Vegetation Integrity Plot program. **Table 2.4** summarises the outcome of this PCT analysis.

PCTs were reviewed and considered against information in the VIS Classification Database (DPIE 2021c). Specifically, each PCT described in the Modified Development Corridor was assessed against the profiles for each possible PCT in relation to the floristic, structure, soil, landform, and distribution details.

Table 2.4 Summary of PCT Allocation Between Approved Project and Modified Project

SSD-6696 (NGH Environmental 2013a, 2013b and 2017)	Modified Project	Reasoning
PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 467 – Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	While vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community of the original assessments (NGH 2013a, 2013b and 2017), Umwelt consider PCT 479 to be a better allocation for the described vegetation. Based on the canopy and ground stratum descriptions of the PCT profile on the VIS Classification Database (DPIE 2021c). Furthermore, PCT467 is restricted in its distribution, and is unlikely to overlap with the Project.
PCT 477 – Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin	While vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community of the original assessments (NGH 2013a, 2013b and 2017), Umwelt consider PCT 1675 to be a better allocation for the described vegetation. Based on the description of the PCT profile, specifically the canopy and ground layer on the VIS Classification Database (DPIE 2021c). Importantly, PCT1675 is recognised as occurring in the Durridgere SCA and western Goulburn River NP in the profile (DPIE 2021c) as well as within the regional mapping product SVTM – Central Tablelands Region VIS 4778.

SSD-6696 (NGH Environmental 2013a, 2013b and 2017)	Modified Project	Reasoning
PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 480 – Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion	PCT 1661 - Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	While vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community of the original assessments (NGH 2013a, 2013b and 2017), Umwelt consider PCT 1661 to be a better allocation for the described vegetation. Based on the description of the PCT profile on the VIS Classification Database (DPIE 2021c). Importantly, PCT1675 is recognised as occurring in the Durridgere SCA within the regional mapping product SVTM – Central Tablelands Region VIS 4778. Additionally, the VIS Profile describes the vegetation as occurring in the sandstone hills in the Cassilis and Merriwa area (DPIE 2021c).
PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).
PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).

SSD-6696 (NGH Environmental 2013a, 2013b and 2017)	Modified Project	Reasoning
PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion	No change	Vegetation surveyed in this PCT as part of the current assessment aligns with the description of the same vegetation community provided in the original assessments (NGH 2013a, 2013b and 2017); it also aligns with the PCT profile as described in the VIS Classification Database (DPIE 2021c).

Further detail regarding this allocation for the individual PCTs is outlined in **Section 3.2.1**.

2.5 Threatened Species

2.5.1 Literature and Database Review

A review of previous documents and reports relevant to threatened species that potentially occur at the Project site was undertaken. The information obtained was used to inform survey design and assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents included:

- Threatened Biodiversity Data Collection (TBDC) (DPIE 2021b)
- BioNet Atlas of NSW Wildlife (DPIE 2021a)
- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species (Botanic Gardens Trust (2021)
- DAWE Protected Matters Search Tool for known/predicted EPBC Act-listed species (DAWE 2021).

A preliminary assessment using the TBDC was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of these database searches, literature review and TBDC review were used to design the appropriate survey requirements for species-credit species.

2.5.2 Ecosystem-credit Species

Ecosystem-credit species are those threatened species that can be predicted by vegetation surrogates and landscape features. Ecosystem-credit species are not required to be specifically targeted during field surveys, however an assessment of the suitability of habitat in the Modified Development Corridor and Indicative Development Footprint – Public Road Upgrades was undertaken to determine whether or not particular habitat constraints for particular species were present or otherwise in the vegetation zones identified. **Appendix B** outlines the ecosystem credit species predicted by the BAM calculator or identified in the literature review. The following information is also presented:

- Listing status
- Which BAM-C assessment (IBRA subregion) they pertain to
- Sensitivity to gain
- Habitat constraints
- Geographic limitations, and

- PCT prediction and any relevant deselection.

2.5.3 Species-credit Species

An assessment of candidate species-credit species was completed in accordance with Section 5 of the BAM (DPIE 2020a). For those candidate species considered to have the potential to occur within Modified Development Corridor, targeted survey and opportunistic searches were undertaken. **Appendix C** outlines the species credit species predicted by the BAM calculator or identified in the literature review.

Extensive species-credit species survey programs were undertaken by Umwelt including:

- 8 and 9 April 2020
- 4 to 8 May 2020
- 15 to 19 June 2020
- 14 August 2020
- 17 to 21 August 2020
- 7 to 9 October 2020
- 18 to 22 January 2021
- 10 to 14 May 2021
- 20 to 24 September 2021.

Additional species-credit species surveys were undertaken by NGH Environmental as part of the original approval and are described in detail within the Biodiversity Assessments and Biodiversity Assessment Addendum (NGH Environmental 2013a, 2013b and 2017). A list of dates for each program are provided below:

- 8 – 19 October 2012
- 1 – 9 October 2013
- 20 – 23 March 2015, and
- 4 – 6 October 2016.

2.5.3.1 Target Species Credit Species Surveys

Table 2.5 below outlines the dates, methods and species targeted during the surveys. **Figure 2.3** presents an overview of the survey locations of all species credit surveys, including those undertaken by Umwelt as well as by NGH Environmental (2013a, 2013b and 2017). The tiled figure set is provided in **Appendix A.**

Table 2.5 Species Credit Species Survey Methodology and Timing

Survey Date	Method	Species Targeted
Umwelt Surveys		
8 – 9 April 2020	Rapid vegetation assessments Parallel walked transects General meandering transects	Australian bustard bush-stone curlew brush-tailed rock wallaby Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) *Dichanthium setosum* glossy black-cockatoo *Homoranthus darwinioides* koala *Tylophora linearis* scant pomaderris
17 April 2020	Rapid vegetation assessments Parallel walked transects General meandering transects	Australian bustard bush-stone curlew brush-tailed rock wallaby Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) *Dichanthium setosum* glossy black-cockatoo *Homoranthus darwinioides* koala *Tylophora linearis* scant pomaderris
4 – 8 May 2020	BAM vegetation integrity plots Rapid vegetation assessments Parallel walked transects General meandering transects	Australian bustard bush-stone curlew brush-tailed rock wallaby Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) *Dichanthium setosum* glossy black-cockatoo koala scant pomaderris *Tylophora linearis*
	Habitat surveys	barking owl eastern bent-wing bat eastern cave bat glossy black-cockatoo large-eared pied bat masked owl powerful owl
	Bird and Bat Utilisation Surveys (BBUS)	Australian bustard eastern bent-wing bat

Survey Date	Method	Species Targeted
		eastern cave bat grey falcon large-eared pied bat little eagle red goshawk southern myotis square-tailed kite white-bellied sea-eagle
25 – 29 May 2020	Forest owl stag-watching	barking owl masked owl powerful owl
	Call playback	barking owl greater glider koala masked owl powerful owl squirrel glider
	Nocturnal spotlighting	barking owl brush-tailed phascogale greater glider koala masked owl powerful owl squirrel glider
15 – 19 June 2020	BAM vegetation integrity plots	Australian bustard bush stone-curlew brush-tailed rock wallaby Capertee stringybark glossy black-cockatoo koala scant pomaderris
	Rapid vegetation assessments	
	Parallel walked transects	
	General meandering transects	
17 -21 August 2020	Winter bird surveys, including call playback	regent honeyeater swift parrot
	Bird utilisation surveys	Australian bustard grey falcon little eagle red goshawk square-tailed kite white-bellied sea-eagle
	General meandering transects	Ausfeld's wattle Australian bustard bush stone-curlew brush-tailed rock wallaby *Commersonia procumbens* (now known as *Androcalva procumbens*) glossy black-cockatoo
	Rapid vegetation assessments	

Survey Date	Method	Species Targeted
		large-leafed monotaxis little eagle koala Major Mitchell's cockatoo scant pomaderris white-bellied sea-Eagle
7 October – 9 Oct 2020	Parallel walked transects Rapid vegetation assessments General meandering transects	Ausfeld's wattle Australian bustard black-breasted buzzard bush stone-curlew brush-tailed rock-wallaby Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) gang-gang cockatoo grey-headed flying-fox koala large-leafed monotaxis little eagle pine donkey orchid white-bellied sea-eagle Major Mitchell's cockatoo scant pomaderris silky swainson-pea square-tailed kite superb parrot *Tylophora linearis*
	Remote camera surveys	brush-tailed phascogale eastern pygmy-possum squirrel glider
18 - 22 January 2021	BAM vegetation integrity plots Rapid vegetation assessments Parallel walked transects General meandering transects	Ausfeld's wattle Australian bustard Austral toadflax brush-tailed rock-wallaby bush stone-curlew Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) *Dichanthium setosum* finger panic grass gang-gang cockatoo koala large-leafed monotaxis square-tailed kite scant pomaderris *Tylophora linearis*

Survey Date	Method	Species Targeted
10 – 14 May 2021	BAM vegetation integrity plots	Australian bustard bush-stone curlew brush-tailed rock wallaby Capertee stringybark *Commersonia procumbens* (now known as *Androcalva procumbens*) *Dichanthium setosum* glossy black-cockatoo koala scant pomaderris *Tylophora linearis* white-bellied sea-eagle
	Rapid vegetation assessments	
	Parallel walked transects	
	General meandering transects	
	Remote sensor cameras	brush-tailed phascogale eastern pygmy-possum squirrel glider
	Koala SAT searches	koala
	Call playback and spotlighting	koala powerful owl masked owl barking owl squirrel glider
20 to 24 September 2021	BAM vegetation integrity plots	Ausfeld's wattle Australian bustard black-breasted buzzard brush-tailed rock-wallaby bush-stone curlew *Commersonia procumbens* (now known as *Androcalva procumbens*) large-leafed monotaxis little eagle koala Major Mitchell's cockatoo pine donkey orchid superb parrot scant pomaderris silky-swainson pea *Tylophora linearis* white-bellied sea-eagle
	Rapid vegetation assessments	
	Parallel walked transects	
	General meandering transects	

2.5.4 Weather Conditions and Limitations

Table 2.6 below outlines the weather conditions for the surveys. Data is derived from the Merriwa weather station (061287) from the Bureau of Meteorology (2021). The township of Merriwa is located approximately 40 kilometres east of the Project site. The weather station of Coolah (64025) does not provide daily weather observations (Bureau of Meteorology 2021). Weather conditions experienced during surveys are considered to be appropriate to ensure the detection of target species.

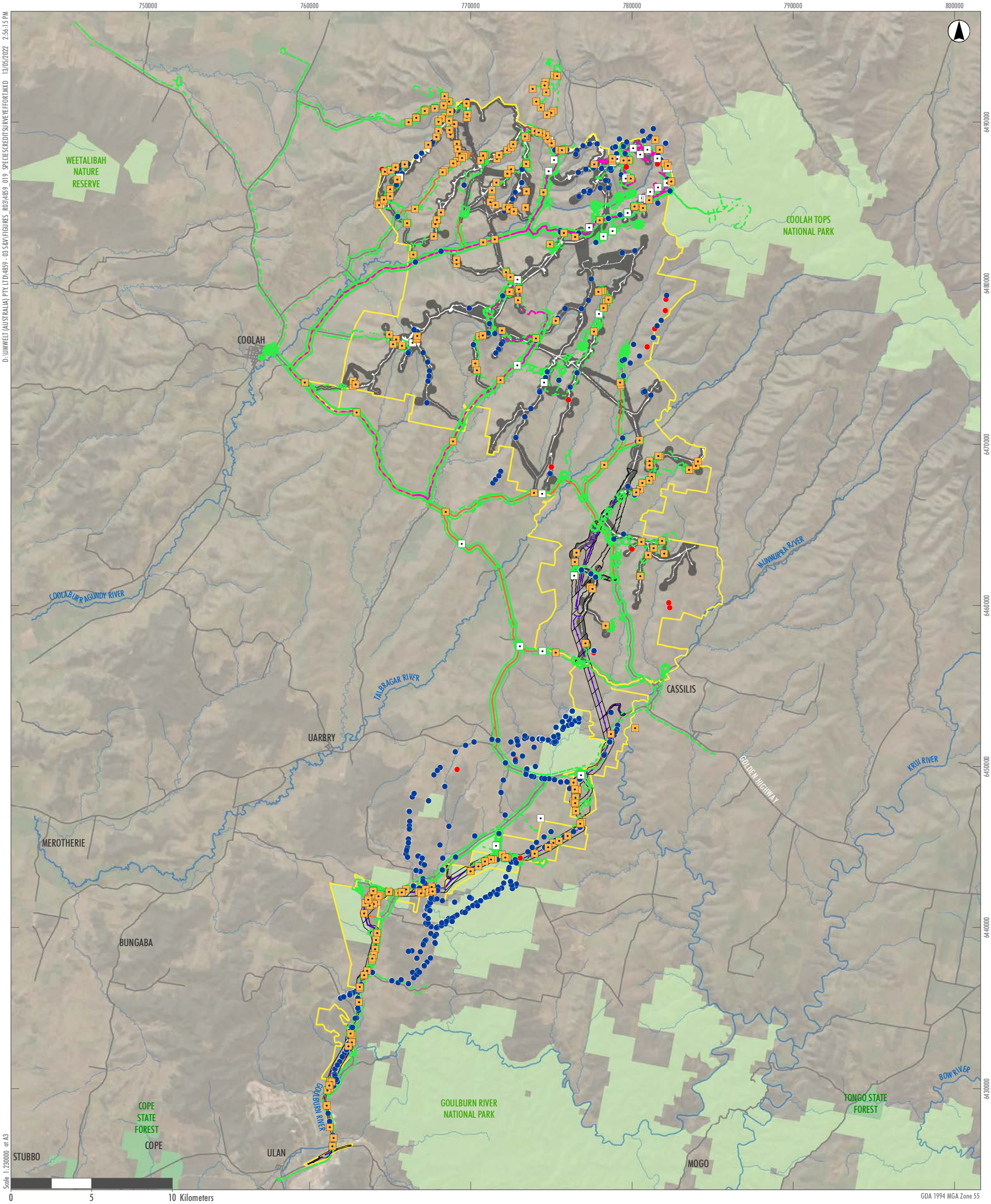
Table 2.6 Weather Conditions for Species-credit Surveys

Date	Daily Data		Monthly Data	
	Min-Max Temp. (°C)	Rainfall (mm)	Min-Max Temp (mean) (°C)	Rainfall (total) (mm)
8 April 2020	11.5 – 19.9	0	9.8 – 22.9	84.2
9 April 2020	13.4 – 18.7	0		
17 April 2020	14.7 – 23.9	0		
4 May 2020	1.6 – 18.1	0.2	4.8 – 18.2	11.8
5 May 2020	2.9 – 17.5	0		
6 May 2020	8.4 – 21.0	0		
7 May 2020	4.1 – 22.0	0		
8 May 2020	5.6 – 24.2	0		
25 May 2020	1.6 – 15.9	0		
26 May 2020	7.5 – 18.2	5.4		
27 May 2020	3.9 – 17.5	0.2		
28 May 2020	3.3 – 20.0	0		
29 May 2020	3.1 – 18.6	0		
15 June 2020	4.5 – 17.1	0.2		
16 June 2020	2.6 – 18.2	0	4.3 – 16.3	26.6
17 June 2020	2.7 – 17.7	0.2		
18 June 2020	9.2 – 16.9	0.2		
19 June 2020	2.3 – 17.2	0		
14 August 2020	2.1 – 12.5	0	2.2 – 16.5	26.0
17 August 2020	6.4 – 16.1	0.4		
18 August 2020	4.0 – 19.0	0.8		
19 August 2020	3.4 – 19.3	0.2		
20 August 2020	6.7 – 14.7	0.4		
21 August 2020	4.6 – 16.1	0.6		
7 October 2020	13.9 – 24.1	0	8.6 – 24.8	125.6
8 October 2020	13.9 – 26.9	1.4		
9 October 2020	6.3 – 20.6	0		
24 November 2020	11.3 – 27.2	1.4	11.5 – 28.6	25.6
December 2020	n/a	n/a	14.7 – 27.5	149.2
18 January 2021	13.3 – 31.1	0	14.7 – 28.8	46.0
19 January 2021	14.8 – 29.4	0		
20 January 2021	15.4 – 24.2	0		
21 January 2021	10.0 – 29.8	0		
22 January 2021	13.1 – 35.3	0		
10 May 2021	6.7 – 21.9	1.8	4.9 – 19.6	22.0
11 May 2021	9.0 – 20.1	1.0		
12 May 2021	2.5 – 19.4	0		

Date	Daily Data		Monthly Data	
	Min-Max Temp. (°C)	Rainfall (mm)	Min-Max Temp (mean) (°C)	Rainfall (total) (mm)
13 May 2021	8.1 – 20.5	0		
14 May 2021	7.4 – 16.9	0		
20 September 2021	0.3 – 23.5	0	4.0 – 21.8	35.6
21 September 2021	4.8 – 14.7	0		
22 September 2021	0.5 – 19.8	0.2		
23 September 2021	3.4 – 23.6	0		
24 September 2021	5.3 – 24.7	0		

The surveys were influenced by seasonal factors; however, this was limited as much possible by the spread of survey effort for the Project across multiple programs, spanning multiple seasons. Survey programs were completed in all four seasons.

For herbaceous and graminoid species, such as those belonging to the families Asteraceae, Orchidaceae, Cyperaceae and Poaceae, the allocation of specimens to sub-specific levels was affected by the availability of adequate flowering or fruiting material. In this case specimens were forwarded to the National Herbarium of New South Wales if they were of potential significance or importance.



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Umwelt Flora Plots
- Umwelt Fauna Survey
- Umwelt Flora Survey Tracks
- Umwelt Fauna Survey Tracks
- NGH Environmental Flora Plots
- NGH Environmental Fauna Survey
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 2.3

Liverpool Range Wind Farm,
Species-credit Survey Effort
(Umwelt and NGH Environmental)

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), (NGH Environmental 2013a, 2013b and 2017)

3.0 Results

3.1 Category 1 – Exempt Land Mapping

The Category 1 – Exempt Land mapping process undertaken for the Modified Project identified that the majority of the Modified Development Corridors met the definition of Category 2 – Regulated Land and was therefore assessed as part of this Biodiversity Assessment.

Identification of Category 1 – Exempt Land was restricted to valley floors within the Modified Development Corridors, where agricultural practices were most intensive and regular. These land uses are extensive in the local region, however their occurrence within the Modified Development Corridors is limited.

There were also circumstances where land that had been legally cleared as part of development approvals. This is particularly relevant along Ulan Road at the southern extent of the Modified Development Corridor – External Transmission line where Ulan and Moolarben Coal Mine have resulted in extensive clearance of native vegetation.

The extent of Land Category 1 – Exempt Land Mapping is presented below in **Figure 3.1**. This mapping is also shown in detail on each of the figure sets within **Appendix A**. A total of 479.4 ha of Category 1 – Exempt Land Mapping was identified within the Modified Development Corridors, of which 42.1 ha was mapped within the Indicative Development Footprints:

- 28.2 ha occurred within the Indicative Development Footprint – Wind Farm
- 11.6 ha occurred within the Indicative Development Footprint – External Transmission Line, and
- 2.3 ha occurred within the Indicative Development Footprint – Public Road Upgrades.

Examples of Category 1 – Exempt Land identified during the ecological field surveys are presented in **Plates 3.1 – 3.5**.

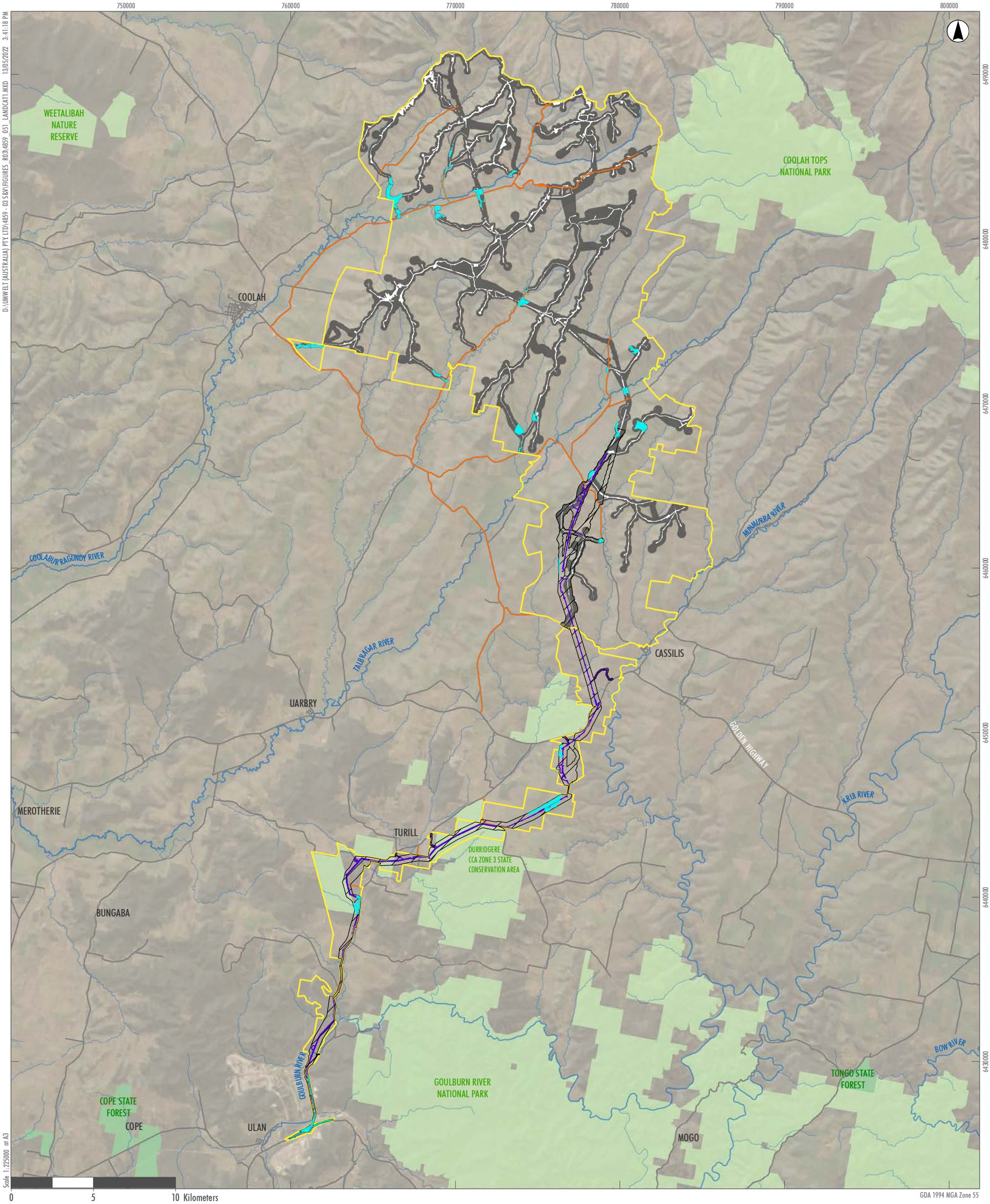
Plate 3.1 Example 1 of Category 1 – Exempt Land Mapping within the Modified Development Corridors

Plate 3.2 Example 2 of Category 1 – Exempt Land Mapping within the Modified Development Corridors

Plate 3.3 Example 3 of Category 1 – Exempt Land Mapping within the Modified Development Corridors

Plate 3.4 Example 4 of Category 1 – Exempt Land Mapping within the Modified Development Corridors

Plate 3.5 Example 5 of Category 1 – Exempt Land Mapping within the Modified Development Corridors



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.1

Liverpool Range Wind Farm
Category 1 – Exempt Land Mapping

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

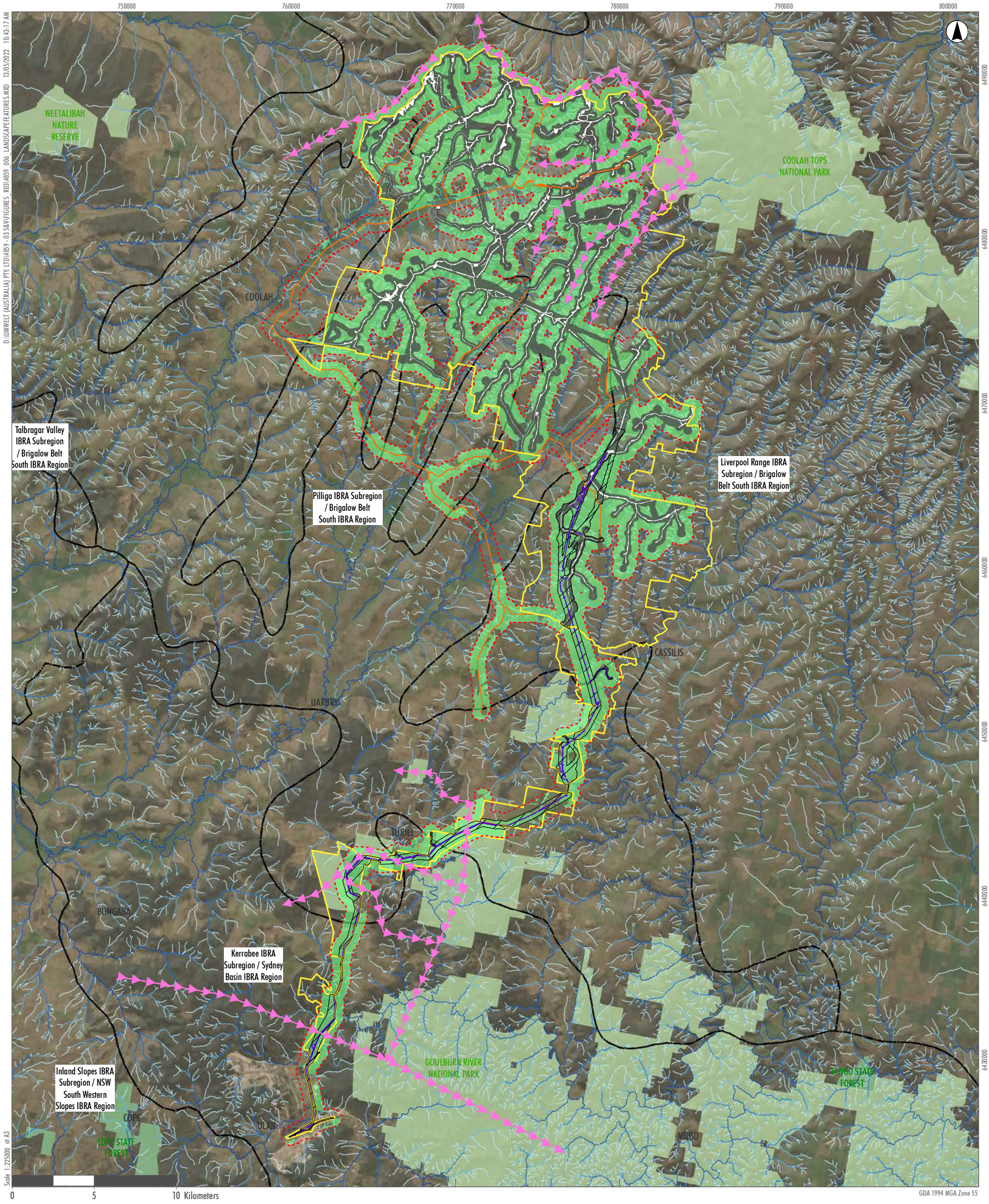
3.2 Landscape Value

The 500 m buffer area of the Indicative Development Footprints contains a range of landscape features. An overview of the landscape features is shown in **Figure 3.2** and outlined in relation to the Indicative Development Footprints in **Table 3.1** below. The tiled figure set is provided in **Appendix A.**

Table 3.1 Landscape Features in the Indicative Development Footprints

Landscape Features		Broadly Consistent with Approved Project
IBRA Bioregions	Brigalow Belt South Sydney Basin	✓
IBRA Subregions (Bioregions)	Brigalow Belt South – Liverpool Range Brigalow Belt South – Pilliga Sydney Basin – Kerrabee	✓
Mitchell Landscapes	**Liverpool Range Valleys and Footslopes (1,108 ha – 62%) – Dominant Mitchell Landscape** Cassilis Slopes (235 ha – 13%) Coolah Tops (200 ha – 11%) Liverpool Tops (161 ha – 9%) Talbragar – Upper Macquarie Terrace Sands and Gravels (78 ha – 4%) Goulburn River Channels and Floodplains (5 ha – <0%) Goulburn River Gorges (3 ha – <0%) Upper Goulburn Valleys and Escarpment (1 ha - <0%)	✓
Rivers, Streams, Estuaries[1]	Coolaburragundy River (3rd Stream Order) Gundare Creek (2nd Stream Order) Turee Creek (2nd Stream Order) Talbragar River (3rd Stream Order) Four Mile Creek (2nd Stream Order) Goulburn River (2nd Stream Order) Murrumbline Creek (2nd Stream Order) Curryall Creek (2nd Stream Order) Bobadeen Creek (2nd Stream Order)	✓
Wetlands (within, adjacent to and downstream)	Nil	✓
Native Vegetation Covers	500 metre buffer totals 47,310 ha, supporting 37,198 ha (79%) of native vegetation (**Figure 3.2**). A breakdown of this per IBRA Sub-region is provided below. **Brigalow Belt South – Liverpool Range IBRA Sub-region** 26,705 ha of native vegetation was mapped in the 500m buffer area (56%) **Brigalow Belt South – Pilliga IBRA Sub-region** 8,656 ha of native vegetation was mapped in the 500m buffer area (18%) **Sydney Basin – Kerrabee IBRA Sub-region** 1,837 ha of native vegetation was mapped in the 500m buffer area (4%)	✓

Landscape Features		Broadly Consistent with Approved Project
Areas of Geological Significance or Soil Hazard Features	None identified	✓
Areas of Outstanding Biodiversity Value	None identified	✓
Cleared Areas	139.5 ha within the Indicative Development Footprints (including both the Indicative Development Footprint – Wind Farm, Indicative Development Footprint – External Transmission Line and the Indicative Development Footprint – Public Road Upgrades). This comprises 42.1 ha of Category 1 – Exempt Land and 97.4 ha of roads, tracks and waterbodies.	✓
Connectivity Features	Broad habitat connectivity corridors have been identified and are presented in **Figure 3.2.**	✓



D:\UMWELT (AUSTRALIA) PTY. LTD\4859 - 03 S&V\FIGURES_R03\4859_006_LANDSCAPEFEATURES.MXD 13/05/2022 10:43:17 AM

FIGURE 3.2

Liverpool Range Wind Farm – Landscape Features

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

3.3 Native Vegetation within the Indicative Development Footprints

3.3.1 Plant Community Types and Vegetation Zones

Surveys of the Modified Development Corridor and Indicative Development Footprint – Public Road Upgrades identified 11 PCTs across 16 condition classes.

These PCTs were aligned with types described as part of the VIS database. The PCTs were then categorised into vegetation zones (refer to **Figure 3.3** for an overview, the tiled figure set is provided in **Appendix A**). Information on these vegetation zones is provided in **Table 3.2** and sections below. Refer to **Appendix D** for flora species list.

Detailed descriptions of each of the PCTs and vegetation zones is provided in **Section 3.2.1.1** to **Section 3.2.1.16**.

Table 3.2 Summary of Vegetation Zones in Modified Development Corridor and Indicative Development Footprints

Vegetation Zone	Current PCT and Condition	Total Area in Modified Development Corridor (ha)	Modified Project - Area in Indicative Development Footprint – Wind Farm (ha)	Modified Project - Area in Indicative Development Footprint – External Transmission Line (ha)	Modified Project - Area in Indicative Development Footprint – Public Road Upgrades (ha)	Modified Project - Total Area in Indicative Development Footprints (ha)
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good*	**109.9**	6.5	-	1.6	**8.1**
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good*	**82.7**	0.7	12.0	0.7	**13.4**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good*	**2,150.5**	149.2	41.8	6.3	**197.3**
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good*	**130.7**	-	19.1	0.7	**19.8**
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good*	**74.3**	-	12.7	-	**12.7**

Vegetation Zone	Current PCT and Condition	Total Area in Modified Development Corridor (ha)	Modified Project - Area in Indicative Development Footprint – Wind Farm (ha)	Modified Project - Area in Indicative Development Footprint – External Transmission Line (ha)	Modified Project - Area in Indicative Development Footprint – Public Road Upgrades (ha)	Modified Project - Total Area in Indicative Development Footprints (ha)
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good*	**279.8**	23.3	5.4	-	**28.7**
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low*	**2,037.3**	191.3	39.2	10.9	**241.4**
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	**2,498.6**	322.8	2.3	73.4	**398.5**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	**532.4**	95.9	-	-	**95.9**
10	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good-Shrubby*	**4.6**	0.5	-	-	**0.5**
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low*	**1,132.6**	152.2	-	4.9	**157.1**
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Exotic*	**2,150.6**	364.4	-	10.0	**374.4**

Vegetation Zone	Current PCT and Condition	Total Area in Modified Development Corridor (ha)	Modified Project - Area in Indicative Development Footprint – Wind Farm (ha)	Modified Project - Area in Indicative Development Footprint – External Transmission Line (ha)	Modified Project - Area in Indicative Development Footprint – Public Road Upgrades (ha)	Modified Project - Total Area in Indicative Development Footprints (ha)
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	**102.5**	11.0	-	-	**11.0**
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	**170.6**	7.3	-	-	**7.3**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate*	**338.1**	-	52.9	0.3	**53.2**
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin *Moderate*	**224.3**	-	30.6	0.4	**31.0**
-	Nil (incl. roads, tracks and waterbodies)	**102.7**	14.1	4.1	79.2	**97.4**
-	Category 1 – Exempt Land	**479.4**	28.2	11.6	2.3	**42.1**
Total (ha)		**12,601.6**	**1,367.4**	**231.9**	**190.7**	**1,790.0**

Note: minor rounding discrepancies associated with area totals.

3.3.1.1 PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good* – Vegetation Zone 1

PCT Name	**River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion**	
Condition	**Moderate/Good**	
Vegetation Class	Eastern Riverine Forests	
Total Area of Impact	8.1 ha	
Percent Cleared	40.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	20, 43 and 58	
General Description	The primary forest vegetation occurring along all minor, moderate and major watercourses within the Indicative Development Footprint – Wind Farm. It is characterised by a remnant and native forest canopy and midstorey structure. The understorey is highly disturbed as a result of the majority of stands not being fenced to prevent stock grazing.	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum	*Casuarina cunninghamiana* *Callistemon sieberi*
	Mid Stratum	*Callistemon sieberi*
	Ground Stratum	*Phalaris aquatica** *Ehrharta erecta** *Casuarina cunninghamiana* *Bromus catharticus** *Urtica incisa* *Dactylis glomerata** *Microlaena stipoides* *Cynodon dactylon* *Salvia verbenaca** *Echinochloa crus-galli** *Hypericum perforatum** *Rumex brownii* *Trifolium glomeratum** *Solanum seaforthianum** *Trifolium repens**
		Amaranthus spp. *Lepidium africanum** *Salvia reflexa** *Senna clavigera* *Xanthium spinosum** *Paspalum dilatatum** *Anagallis arvensis** *Sigesbeckia australiensis* *Polygonum aviculare** *Rubus fruticosus** *Cirsium vulgare** *Geranium solanderi* *Apium tenuifolium* *Solanum chenopodioides** *Einadia nutans*
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.	
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.	

3.3.1.2 PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good* – Vegetation Zone 2

PCT Name	**Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion**	
Condition	**Moderate/Good**	
Vegetation Class	Western Slopes Grassy Woodland	
Total Area of Impact	13.4 ha	
Percent Cleared	67.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	38, 44, 45 and 59	
General Description	A disturbed open forest occurring on the low alluvial plains in proximity to several watercourses in the locality. The majority of this vegetation zone occurs along the Indicative Development Footprint – External Transmission Line of the project, particularly along Ulan Road in the Project's south. The vegetation zone persists in a disturbed state as a result of historic and ongoing agricultural land uses that are associated with fertile alluvial soils.	

Structure and Floristics

Characteristic Species (* denotes introduced species)		
Upper Stratum	*Eucalyptus blakelyi* *Eucalyptus melliodora* *Angophora floribunda*	*Eucalyptus albens* *Amyema miquelii*
Mid Stratum 1	*Swainsona sp.*	
Mid Stratum 2	*Brachychiton populneus*	
Ground Stratum	*Aristida personata* *Austrostipa verticillata* *Austrostipa scabra* *Conyza bonariensis** *Calotis cuneifolia* *Calotis lappulacea* *Verbena bonariensis** *Bromus catharticus** *Hypericum perforatum** *Rytidosperma setaceum* *Themeda australis* *Conyza* spp.* *Eragrostis leptostachya* *Urtica incisa* *Geranium solanderi* *Geranium homeanum* *Rytidosperma bipartitum* *Lomandra longifolia* *Hydrocotyle laxiflora*	*Cheilanthes sieberi* *Einadia trigonos* *Eragrostis brownii* *Lepidium africanum** *Panicum effusum* *Asperula conferta* *Dichondra repens* *Oxalis perennans* *Apium tenuifolium* *Dichopogon fimbriatus* *Einadia nutans* *Senecio bathurstianus* *Fimbristylis dichotoma* *Petrorhagia nanteuilii* *Glycine tabacina* *Schenkia australis* *Euchiton involucratus* *Plantago debilis*

PCT Name	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
Condition	Moderate/Good
BC Act Status	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC
EPBC Act Status	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

3.3.1.3 PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good* – Vegetation Zone 3

PCT Name	Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	
Condition	Moderate/Good	
Vegetation Class	Western Slopes Grassy Woodland	
Total Area of Impact	197.3 ha	
Percent Cleared	0.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	8, 17, 21, 23, 24, 28, 29 and 31	
General Description	The derived native grassland mapping unit recorded within the Indicative Development Footprints, occurring within the Wind Farm, Public Road Upgrades and External Transmission Line sites. The vegetation zone supports scattered mature canopy trees across its extent but is not considered to support distinct patches of treed vegetation. Historical and ongoing stock grazing has resulted in the vegetation zone being heavily disturbed, with native flora species being dominated by hardier species that can withstand such pressures. Introduced flora species co-dominant this vegetation zone.	

<table>
<tr><td>PCT Name</td><td colspan="3">Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region</td></tr>
<tr><td>Condition</td><td colspan="3">Moderate/Good</td></tr>
<tr><td>Structure and Floristics</td><td colspan="3">
<table>
<tr><td colspan="3">Characteristic Species (* denotes introduced species)</td></tr>
<tr><td>Upper Stratum</td><td colspan="2">Scattered occurrences of Eucalyptus melliodora</td></tr>
<tr><td>Mid Stratum</td><td colspan="2">Cassinia arcuata</td></tr>
<tr><td>Ground Stratum 1</td><td>Austrostipa verticillata
Microlaena stipoides
Aristida ramosa
Digitaria sanguinalis*
Lomandra multiflora
Medicago arabica*
Bothriochloa macra
Sporobolus creber
Eragrostis cilianensis*
Lolium perenne*
Austrostipa scabra
Panicum effusum
Dichanthium sericeum
Trifolium repens*
Rytidosperma spp.</td><td>Malva parviflora*
Trifolium glomeratum*
Calotis lappulacea
Chloris ventricosa
Austrostipa scabra subsp. scabra
Phalaris aquatica*
Cyperus gracilis
Lomandra filiformis
Silybum marianum*
Rytidosperma racemosum
Eleusine tristachya*
Erodium cicutarium*
Aristida spp.
Austrostipa aristiglumis
Polygonum arenastrum*</td></tr>
<tr><td>Ground Stratum 2</td><td colspan="2">Echium plantagineum*</td></tr>
</table>
</td></tr>
<tr><td>BC Act Status</td><td colspan="3">A portion of this Vegetation Zone conforms with White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC
Only portions that were identified as being derived from a community which also conforms with the CEEC was identified as the CEEC.</td></tr>
<tr><td>EPBC Act Status</td><td colspan="3">This vegetation zone is not consistent with any TEC listed under the EPBC Act.</td></tr>
</table>

3.3.1.4 PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good* – Vegetation Zone 4

PCT Name	**Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion**
Condition	**Moderate/Good**
Vegetation Class	Western Slopes Dry Sclerophyll Forest
Total Area of Impact	19.8 ha
Percent Cleared	40.0%
Patch Size Class	101
	
BAM Vegetation Integrity Plots	36, 63, 75
General Description	This vegetation zone occurs as forests and its location is restricted to the External Transmission Line Site along Ulan Road. The vegetation occurs within a large expanse of continuous forest and woodland habitat either side of the transmission line on National Park and State Forest estate and private land.

Structure and Floristics

Characteristic Species (* denotes introduced species)

Upper Stratum	*Callitris endlicheri* *Eucalyptus fibrosa* *Eucalyptus nubilis* *Allocasuarina littoralis*	
Mid Stratum	*Acacia longifolia* *Dillwynia retorta* *Leucopogon juniperinus* *Leucopogon lanceolatus* *Leucopogon microphyllus* *Brachyloma daphnoides* *Cassinia quinquefaria* *Acacia buxifolia*	*Acacia* spp. *Dodonaea viscosa* *Grevillea* spp. *Hibbertia acicularis* *Leucopogon ericoides* *Pultenaea spp.* *Styphelia tubiflora*
Ground Stratum	*Pomax umbellata* *Brachyscome angustifolia* *Poranthera microphylla* *Cheilanthes sieberi* subsp. *sieberi* *Dianella revoluta* *Epaltes australis* *Gonocarpus teucrioides* *Hypochaeris radicata** *Lepidosperma laterale*	*Dianella longifolia* *Haloragis aspera* *Wahlenbergia* spp. *Aristida ramosa* *Gahnia aspera* *Goodenia paniculata* *Patersonia* spp. *Poranthera microphylla* *Schoenus apogon*

PCT Name	**Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion**
Condition	**Moderate/Good**
	Lomandra filiformis *Lomandra longifolia* *Macrozamia spp.* *Microlaena stipoides* *Plantago debilis* *Phyllanthus hirtellus*
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

3.3.1.5 PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good* – Vegetation Zone 5

PCT Name	**Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region**
Condition	**Moderate/Good**
Vegetation Class	North Coast Dry Sclerophyll Forest
Total Area of Impact	12.7 ha
Percent Cleared	28.0%
Patch Size Class	101
	
BAM Vegetation Integrity Plots	35, 64 and 65
General Description	This vegetation zone occurs as forests and its location is restricted to the External Transmission Line Site along Ulan Road. The vegetation occurs within a large expanse of continuous forest and woodland habitat either side of the transmission line on National Park and State Forest estate and private land.

PCT Name	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	
Condition	Moderate/Good	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum	*Angophora floribunda* *Eucalyptus blakelyi* *Eucalyptus crebra* *Eucalyptus sparsifolia*
	Mid Stratum	*Cassinia quinquefaria* *Astroloma humifusum* *Hibbertia acicularis* *Brachyloma daphnoides* *Baeckea diosmifolia* *Acacia spp.* *Styphelia tubiflora* *Grevillea triternata* *Hibbertia linearis* *Phyllanthus hirtellus* *Grevillea* spp. *Leucopogon ericoides*
	Ground Stratum	*Haloragis heterophylla* *Schoenus apogon* *Microlaena stipoides* *Pomax umbellata* *Arundinella nepalensis* *Haloragis aspera* *Echinopogon caespitosus* *Cheilanthes sieberi subsp. sieberi* *Calotis cuneifolia* *Lomandra filiformis* *Poranthera microphylla* *Aristida vagans* *Cymbopogon refractus* *Aristida ramosa* *Lomandra longifolia* *Opercularia diphylla*
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.	
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.	

3.3.1.6 PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good* – Vegetation Zone 6

PCT Name	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	
Condition	Moderate/Good	
Vegetation Class	Western Slopes Grassy Woodland	
Total Area of Impact	28.7 ha	
Percent Cleared	90.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	2, 22, 30, 42, 46 and 62	

PCT Name	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	
Condition	Moderate/Good	
General Description	This vegetation zone is uncommon as it only occurs in restricted pockets within the Modified Development Corridor where historical and current agricultural land use have not substantially removed the canopy. As it occurs in proximity to ongoing agricultural activities the ground layer is somewhat disturbed. However, the canopy and mid-storey remain generally present.	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum	*Eucalyptus albens* *Brachychiton populneus* *Eucalyptus melliodora*
		Eucalyptus blakelyi *Eucalyptus moluccana* *Eucalyptus albens*
	Mid Stratum	*Acacia implexa* *Cassinia arcuata* *Solanum cinereum* *Acacia paradoxa*
		Acacia decora *Acacia leucoclada* *Astroloma humifusum* *Bursaria spinosa*
	Ground Stratum	*Microlaena stipoides* *Teucrium betchei* *Vittadinia muelleri* *Calotis lappulacea* *Marrubium vulgare** *Dichondra repens* *Austrostipa ramosissima* *Glycine latifolia* *Einadia trigonos* *Hydrocotyle laxiflora* *Lepidium africanum** *Rumex brownii* *Veronica plebeia* *Lomandra multiflora* *Glycine tabacina* *Goodenia hederacea* *Dichopogon fimbriatus* *Petrorhagia nanteuilii** *Solanum nigrum** *Cirsium vulgare** *Conyza bonariensis**
		*Hypochaeris radicata** *Eragrostis curvula** *Plantago debilis* *Einadia nutans* *Plantago lanceolata** *Chenopodium album** *Ammi majus** *Solanum seaforthianum** *Foeniculum vulgare** *Setaria parviflora** *Lolium perenne** *Medicago arabica** *Modiola caroliniana** *Bidens Pilosa** *Trifolium repens** *Trifolium subterraneum** *Austrostipa verticillata* *Austrostipa scabra* *Tagetes minuta* *Urtica incisa*
BC Act Status	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC	
EPBC Act Status	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	

3.3.1.7 PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low* – Vegetation Zone 7

<table>
<tr><td>PCT Name</td><td colspan="2">Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley</td></tr>
<tr><td>Condition</td><td colspan="2">Low</td></tr>
<tr><td>Vegetation Class</td><td>Western Slopes Grassy Woodland</td><td rowspan="4">  </td></tr>
<tr><td>Total Area of Impact</td><td>241.4 ha</td></tr>
<tr><td>Percent Cleared</td><td>90.0%</td></tr>
<tr><td>Patch Size Class</td><td>101</td></tr>
<tr><td>BAM Vegetation Integrity Plots</td><td colspan="2">6, 12, 27, 40, 61, 78, 79</td></tr>
<tr><td>General Description</td><td colspan="2">This vegetation zone occurs as a thinned woodland with a degraded understorey. Remnant canopy trees remain, however patches with interconnected canopies is rare. The mid-storey is absent, other than recruiting canopy species on rare occasions. The understorey is highly degraded, dominated by introduced flora while still supporting a reasonable number of native grasses and forbs, albeit in low cover.</td></tr>
<tr><td>Structure and Floristics</td><td colspan="2">
<table>
<tr><th></th><th colspan="2">Characteristic Species (* denotes introduced species)</th></tr>
<tr><td>Upper Stratum</td><td>Eucalyptus albens
Eucalyptus laevopinea</td><td>Eucalyptus melliodora
Eucalyptus nortonii</td></tr>
<tr><td>Mid Stratum</td><td>Styphelia triflora
Acacia spectabilis</td><td>Bursaria spinosa</td></tr>
<tr><td>Ground Stratum</td><td>Salvia verbenaca*
Marrubium vulgare*
Bidens pilosa*
Silybum marianum*
Mentha satureioides
Xanthium spinosum*
Stellaria media*
Rumex brownii
Trifolium repens*
Eleusine tristachya*
Urtica incisa*
Hydrocotyle laxiflora
Eragrostis cilianensis*
Microlaena stipoides
Bromus catharticus*</td><td>Medicago arabica*
Digitaria ramularis
Brassica rapa*
Austrostipa verticillata
Rytidosperma racemosum
Austrostipa spp.
Rytidosperma spp.
Trifolium angustifolium*
Asperula conferta
Carthamus spp.*
Isolepis spp.*
Mentha diemenica
Austrostipa verticillata
Tagetes minuta*</td></tr>
</table>
</td></tr>
<tr><td>BC Act Status</td><td colspan="2">White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC</td></tr>
<tr><td>EPBC Act Status</td><td colspan="2">This vegetation zone is not consistent with any TEC listed under the EPBC Act</td></tr>
</table>

3.3.1.8 PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic* – Vegetation Zone 8

PCT Name	**Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley**
Condition	**Exotic**
Vegetation Class	Western Slopes Grassy Woodland
Total Area of Impact	398.5 ha
Percent Cleared	90.0%
Patch Size Class	

BAM Vegetation Integrity Plots	5, 7, 25, 26, 41, 60, 77, 85
General Description	This vegetation zone occurs as a highly degraded derived grassland. Remnant canopy trees occur, but at very low densities across its entire mapping unit. The mid-storey is absent. The understorey is highly degraded, dominated by introduced flora, native species are almost entirely restricted to the hardier grasses and forbs.

Structure and Floristics

Characteristic Species (* denotes introduced species)		
Upper Stratum	*Angophora floribunda*	*Eucalyptus melliodora*
Mid Stratum	*Bursaria spinosa*	
Ground Stratum	*Silybum marianum**	*Mentha satureioides*
	Urtica incisa	*Oxalis perennans*
	*Malva parviflora**	*Paronychia brasiliana**
	*Marrubium vulgare**	*Plantago debilis*
	Rumex brownii	*Salvia verbenaca**
	Portulaca oleracea	*Bothriochloa macra*
	*Stellaria media**	*Chloris ventricosa*
	Dichondra repens	*Einadia nutans*
	*Xanthium spinosum**	*Cyperus gracilis*
	*Hypochaeris radicata**	*Rumex acetosella*
	Microlaena stipoides	*Chenopodium album**
	*Trifolium glomeratum**	*Einadia hastata*
	*Trifolium repens**	*Chenopodium pumilio*
	*Capsella bursa-pastoris**	*Medicago spp.**
	*Digitaria sanguinalis**	*Austrostipa aristiglumis*
	*Modiola caroliniana**	*Hirschfeldia incana**
	*Eragrostis cilianensis**	*Plantago lanceolata**
	Austrostipa verticillata	*Paspalum dilatatum**
	*Medicago arabica**	*Austrostipa ramosissima*
	*Lolium perenne**	*Trifolium arvense**
	*Centaurea solstitialis**	

BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

3.3.1.9 PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good* – Vegetation Zone 9

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion**	
Condition	**Moderate/Good**	
Vegetation Class	New England Grassy Woodland	
Total Area of Impact	95.9 ha	
Percent Cleared	50.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	3, 13, 51, 66, 68, 70 and 71	
General Description	This vegetation zone is uncommon as it only occurs in restricted pockets within the Modified Development Corridor where historical and current agricultural land use have not substantially removed the canopy. As it occurs in proximity to ongoing agricultural activities the ground layer is somewhat disturbed. However, the canopy and mid-storey are present.	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum	*Eucalyptus nortonii* *Angophora floribunda* *Eucalyptus laevopinea* *Brachychiton populneus* *Eucalyptus moluccana* *Eucalyptus praecox* *Eucalyptus melliodora*
	Mid Stratum	*Olearia elliptica subsp. elliptica* *Pimelea strigose* *Notelaea microcarpa* *Bursaria spinosa* *Cassinia quinquefaria* *Olearia viscosa*
	Ground Stratum	*Microlaena stipoides* *Carthamus lanatus** *Rytidosperma bipartitum* *Oxalis perennans* *Pandorea pandorana* *Bidens Pilosa** *Echium plantagineum** *Medicago arabica** *Hydrocotyle laxiflora* *Cyperus gracilis* *Poa sieberiana* var. *sieberiana* *Rytidosperma racemosum* var. *racemosum* *Geranium homeanum* *Pimelea curviflora* *Cassinia arcuate* *Lomandra multiflora* *Urtica incisa* *Geranium solanderi* *Dichondra repens* *Polygonum aviculare* *Stellaria media** *Marrubium vulgare** *Cirsium vulgare** *Hypericum perforatum** *Sigesbeckia australiensis* *Rumex brownii* *Solanum nigrum** *Daucus glochidiatus* *Swainsona galegifolia* *Wahlenbergia stricta* subsp. *stricta* *Silybum marianum**

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion**	
Condition	**Moderate/Good**	
	Elymus scaber *Bothriochloa macra* *Poa labillardierei*	*Austrostipa scabra*
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.	
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.	

3.3.1.10 PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South *Moderate/Good-Shrubby* – Vegetation Zone 10

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South**	
Condition	**Moderate/Good-Shrubby**	
Vegetation Class	New England Grassy Woodland	
Total Area of Impact	0.5 ha	
Percent Cleared	50.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	55 and 56	
General Description	This vegetation zone occurs at one location with the Project site, in the north west section of the Modified Development Corridor (near Gundare Road) on a western facing slope.	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum *Eucalyptus nortonii* *Angophora floribunda*	
	Mid Stratum *Cassinia arcuata* *Acacia stenophylla* *Dodonaea viscosa*	
	Ground Stratum *Sigesbeckia australiensis* *Poa sieberiana* *Cymbopogon refractus* *Lomandra filiformis* *Rhytidosperma bipartitum* *Bidens pilosa** *Urtica incisa* *Geranium solanderi*	 *Microlaena stipoides* *Carthamus lanatus** *Dichondra repens* *Hypericum perforatum** *Cyperus gracilis* *Dichanthium sericeum* *Lomandra longifolia* *Asperula conferta*

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South**
Condition	**Moderate/Good-Shrubby**
	Lachnagrostis filiformis *Mentha satureioides* *Poa* spp. *Hydrocotyle laxiflora* *Solanum nigrum** *Marrubium vulgare** *Plantago debilis* *Bromus catharticus** *Lobelia purpurascens* *Lomandra multiflora* *Salvia verbenaca** *Solanum seaforthianum**
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

3.3.1.11 PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low* – Vegetation Zone 11

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion**	
Condition	**Low**	
Vegetation Class	New England Grassy Woodland	
Total Area of Impact	157.1 ha	
Percent Cleared	50.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	1, 9, 11, 50, 52, 53, 54, 57, 67, 72 and 73	
General Description	This vegetation zone occurs as a thinned woodland with a degraded understorey. Remnant canopy trees remain; however patches of interconnected canopies are rare. The mid-storey is absent, other than recruiting canopy species in rare occasions. The understorey is highly degraded, dominated by introduced flora while still supporting a reasonable number of native grasses and forbs, albeit in low cover.	

PCT Name	Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	
Condition	Low	
Structure and Floristics	**Characteristic Species (* denotes introduced species)**	
	Upper Stratum	*Eucalyptus nortonii* *Eucalyptus laevopinea* *Brachychiton populneus* *Eucalyptus melliodora* *Eucalyptus albens* *Angophora floribunda*
	Mid Stratum	*Notelaea macrocarpa* *Acacia implexa* *Callistemon sieberi*
	Ground Stratum	*Silybum marianum** *Marrubium vulgare** *Urtica incisa* *Xanthium spinosum** *Einadia nutans* *Echium plantagineum** *Einadia hastata* *Medicago arabica** *Rumex brownii* *Bidens pilosa** *Carduus pycnocephalus** *Dichondra repens* *Galium aparine** *Hydrocotyle laxiflora* *Oxalis perennans* *Solanum nigrum** *Tagetes minuta** *Trifolium campestre** *Trifolium repens** *Austrostipa scabra* *Carex inversa* *Bromus hordeaceus** *Lachnagrostis filiformis* *Echinopogon ovatus* *Elymus scaber* *Daucus carota** *Urtica urens** *Stellaria media** *Malva parviflora** *Bromus catharticus** *Geranium homeanum* *Pimelea curviflora* *Microlaena stipoides* *Cotula australis* *Lomandra multiflora* *Lomandra filiformis* *Poa sieberiana* *Rytidosperma setaceum* *Geranium solanderi* *Dactylis glomerata** *Mentha satureioides* *Sigesbeckia australiensis* *Acaena ovina* *Bromus diandrus** *Phalaris aquatica** *Wahlenbergia gracilis* *Plantago debilis* *Arthropodium sp. B* *Hypericum perforatum** *Lolium perenne** *Rytidosperma penicillatum* *Ehrharta erecta**
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.	
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.	

3.3.1.12 PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Exotic* – Vegetation Zone 12

PCT Name	**Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion**	
Condition	**Exotic**	
Vegetation Class	New England Grassy Woodland	
Total Area of Impact	374.4 ha	
Percent Cleared	50.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	4, 10, 18, 81, 82, 83, 84	
General Description	This vegetation zone occurs as a highly degraded derived grassland. Remnant canopy trees occur, but at very low densities across its entire mapping unit. The mid-storey is absent. The understorey is highly degraded, dominated by introduced flora, native species are almost entirely restricted to the hardier grasses and forbs.	

Structure and Floristics

Characteristic Species (* denotes introduced species)		
Upper Stratum	*Eucalyptus laevopinea*	
Ground Stratum	*Trifolium repens**	*Cucumis myriocarpus**
	Senecio microbasis	*Eleusine tristachya**
	*Echinochloa crus-galli**	*Silybum marianum**
	*Echium plantagineum**	*Urtica incisa*
	Rumex brownii	*Xanthium spinosum**
	Cynodon dactylon	*Microlaena stipoides*
	*Phalaris aquatica**	*Geranium homeanum*
	Pratia concolor	*Geranium retrorsum*
	*Medicago arabica**	*Mentha satureioides*
	*Bromus catharticus**	*Erodium cicutarium**
	*Malva parviflora**	*Aristida* spp.
	*Eragrostis cilianensis**	*Amaranthus spp.**

BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

3.3.1.13 PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good* – Vegetation Zone 13

PCT Name	**Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion**	
Condition	**Moderate/Good**	
Vegetation Class	New England Grassy Woodland	
Total Area of Impact	11.0 ha	
Percent Cleared	28.0%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	14, 19, 80	
General Description	This vegetation zone occurs as a tall moist open forest, restricted to the north eastern corner of the Project site. The canopy and mid-stories are present and generally intact. However, the ground layer has been substantially degraded as a result of the historic and current agricultural land use.	

Structure and Floristics

Characteristic Species (* denotes introduced species)		
Upper Stratum	*Eucalyptus laevopinea* *Eucalyptus dalrympleana* *Eucalyptus mannifera*	
Ground Stratum 1	*Urtica incisa* *Stellaria media** *Lomandra filiformis* *Aristida* spp. *Bromus catharticus** *Microlaena stipoides* *Poa labillardierei* *Geranium homeanum*	*Hydrocotyle laxiflora* *Erodium cicutarium** *Swainsona galegifolia* *Trifolium repens** *Geranium retrorsum* *Pteridium esculentum* *Solanum nigrum** *Galium aparine*
Ground Stratum 2	*Ajuga australis*	

BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

3.3.1.14 PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good* – Vegetation Zone 14

<table>
<tr><td>PCT Name</td><td colspan="2">Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion</td></tr>
<tr><td>Condition</td><td colspan="2">Moderate/Good</td></tr>
<tr><td>Vegetation Class</td><td>New England Dry Sclerophyll Forests</td><td rowspan="4">  </td></tr>
<tr><td>Total Area of Impact</td><td>7.3 ha</td></tr>
<tr><td>Percent Cleared</td><td>17.0%</td></tr>
<tr><td>Patch Size Class</td><td>101</td></tr>
<tr><td>BAM Vegetation Integrity Plots</td><td colspan="2">15, 16, 69</td></tr>
<tr><td>General Description</td><td colspan="2">This vegetation zone occurs as shrubby forest, restricted to protected slopes in the north of the Project site. The canopy and mid-stories are present and generally intact. However the ground layer has been substantially degraded as a result of the historical and current agricultural land use.</td></tr>
<tr><td>Structure and Floristics</td><td colspan="2">
<table>
<tr><th></th><th colspan="2">Characteristic Species (* denotes introduced species)</th></tr>
<tr><td>Upper Stratum</td><td colspan="2">Eucalyptus dalrympleana
Eucalyptus mannifera
Eucalyptus laevopinea</td></tr>
<tr><td>Mid Stratum 1</td><td colspan="2">Ozothamnus spp.
Acacia conferta</td></tr>
<tr><td>Ground Stratum 1</td><td>Stellaria media*
Urtica incisa
Galium aparine*
Bromus catharticus*
Aristida spp.
Hydrocotyle laxiflora
Phalaris aquatica*
Geranium homeanum
Trifolium repens*</td><td>Asperula conferta
Poa labillardierei
Pteridium esculentum
Dactylis glomerata*
Geranium solanderi
Acaena novae-zelandiae
Echinopogon caespitosus
Microlaena stipoides
Hypericum perforatum*</td></tr>
</table>
</td></tr>
<tr><td>BC Act Status</td><td colspan="2">This vegetation zone is not consistent with any TEC listed under the BC Act.</td></tr>
<tr><td>EPBC Act Status</td><td colspan="2">This vegetation zone is not consistent with any TEC listed under the EPBC Act.</td></tr>
</table>

3.3.1.15 PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate* - Vegetation Zone 15

PCT Name	**Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin**	
Condition	**Moderate**	
Vegetation Class	Western Slopes Dry Sclerophyll Forests	
Total Area of Impact	53.2 ha	
Percent Cleared	50%	
Patch Size Class	101	
BAM Vegetation Integrity Plots	33, 34, 37, 39, 47 and 48	
General Description	This vegetation zone occurs as a forest and its location is restricted to the External Transmission Line site along Ulan Road. The vegetation occurs within a large expanse of continuous forest and woodland habitat either side of the transmission line on National Park and State Forest estate and private land.	

Structure and Floristics

Characteristic Species (* denotes introduced species)		
Upper Stratum	*Eucalyptus crebra* *Eucalyptus macrorhyncha* *Eucalyptus microcarpa* *Callitris endlicheri* *Angophora floribunda* *Eucalyptus laevopinea* *Eucalyptus sideroxylon*	
Mid Stratum 1	*Callitris endlicheri* *Cassinia aculeata* *Cassinia arcuata* *Callitris glaucophylla*	*Allocasuarina gymnanthera* *Acacia implexa* *Persoonia linearis*
Mid Stratum 2	*Cassinia arcuata* *Dillwynia retorta* *Styphelia triflora* *Allocasuarina littoralis* *Amyema spp.* *Bursaria spinosa*	*Leucopogon muticus* *Acacia longifolia* *Baeckea brevifolia* *Leucopogon juniperinus* *Leucopogon lanceolatus*
Ground Stratum	*Microlaena stipoides* *Pomax umbellata* *Aristida vagans* *Lomandra multiflora* *Austrostipa scabra*	*Panicum sp.* *Lomandra filiformis* *Acaena echinata* *Aristata personata* *Chrysocephalum semipapposum*

PCT Name	**Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin**		
Condition	**Moderate**		
		Cymbonotus lawsonianus *Hypochaeris radicata** *Patersonia sericea* *Panicum effusum* *Cheilanthes sieberi* *Dianella caerulea* *Poranthera microphylla* *Rytidosperma bipartitum* *Rytidosperma setaceum* *Vittadinia sulcata*	*Dichondra repens* *Gahnia aspera* *Rytidosperma racemosum* *Lomandra longifolia* *Hydrocotyle tripartita* *Stellaria angustifolia* *Stuartina muelleri* *Hydrocotyle laxiflora* *Calotis lappulacea*
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.		
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.		

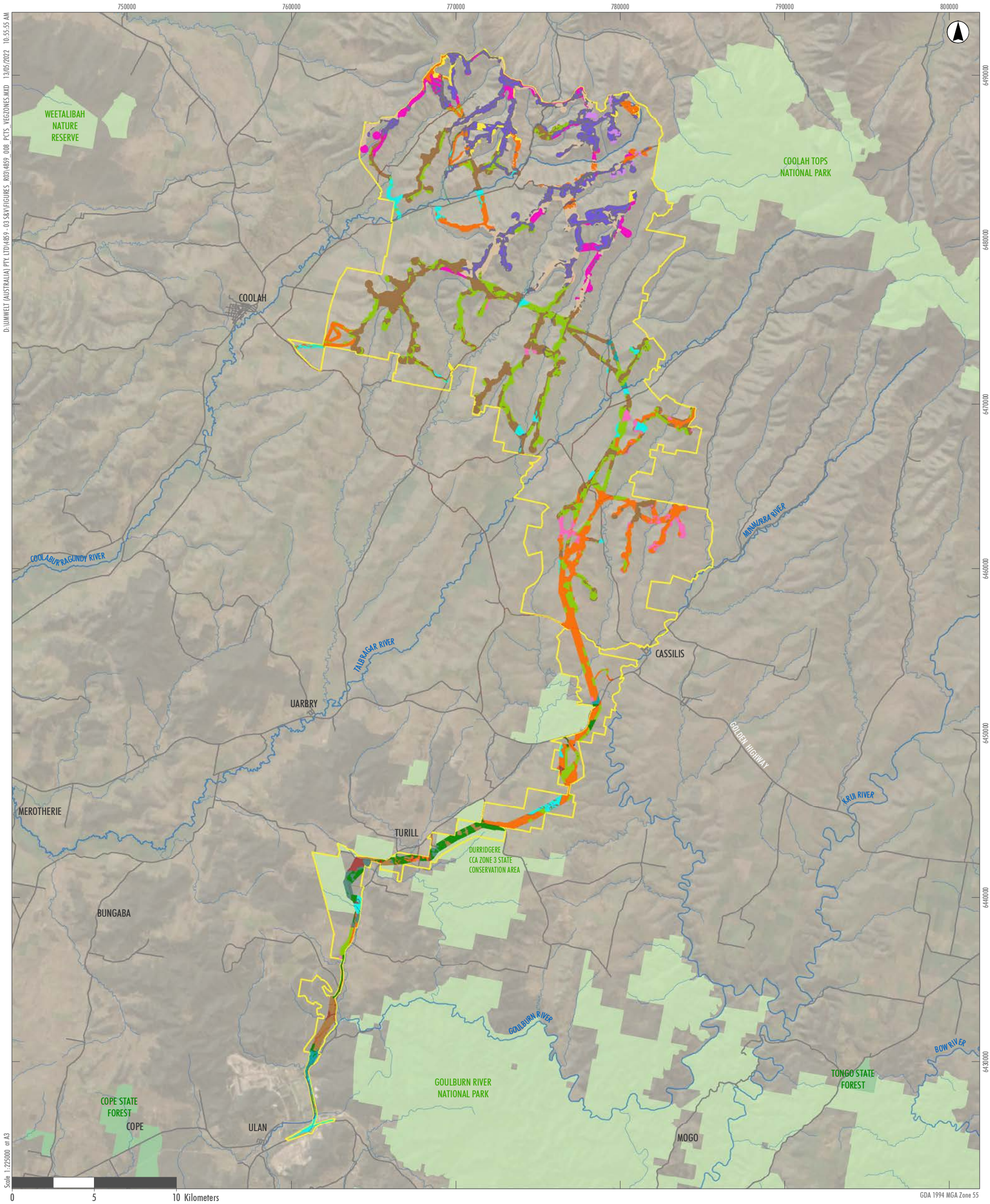
3.3.1.16 PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin *Moderate* – Vegetation Zone 16

PCT Name	**Scribbly Gum - Narrow-leaved Ironbark - *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin**	
Condition	**Moderate**	
Vegetation Class	South Coast Sands Dry Sclerophyll Forests	
Total Area of Impact	31.0 ha	
Percent Cleared	27%	
Patch Size Class		
BAM Vegetation Integrity Plots	32, 49, 74, 76	
General Description	This vegetation zone occurs as forests and its location is restricted to the External Transmission Line Site along Ulan Road. The vegetation occurs within a large expanse of continuous forest and woodland habitat either side of the transmission line on National Park and State Forest estate and private land.	

<table>
<tr><td>PCT Name</td><td colspan="3">Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin</td></tr>
<tr><td>Condition</td><td colspan="3">Moderate</td></tr>
<tr><td>Structure and Floristics</td><td colspan="3"><table>
<tr><td colspan="3">Characteristic Species (* denotes introduced species)</td></tr>
<tr><td>Upper Stratum</td><td colspan="2">Eucalyptus rossii
Eucalyptus laevopinea
Angophora floribunda</td></tr>
<tr><td>Mid Stratum 1</td><td colspan="2">Callitris endlicheri
Cassinia arcuata
Baeckea brevifolia
Bursaria spinosa
Callitris glaucophylla</td></tr>
<tr><td>Mid Stratum 2</td><td colspan="2">Leucopogon lanceolatus</td></tr>
<tr><td>Ground Stratum</td><td>Pomax umbellata
Gahnia aspera
Microlaena stipoides
Eucalyptus crebra
Echinopogon ovatus
Lepidosperma laterale
Poranthera microphylla
Lomandra filiformis
Lomandra multiflora
Cassinia arcuata</td><td>Austrostipa scabra
Leucopogon muticus
Rhytidosperma setaceum
Digitaria ramularis
Cheilanthes sieberi
Styphelia triflora
Tricoryne elatior
Conyza bonariensis*
Austrostipa densiflora
Hypochaeris radicata*</td></tr>
</table></td></tr>
<tr><td>BC Act Status</td><td colspan="3">This vegetation zone is not consistent with any TEC listed under the BC Act.</td></tr>
<tr><td>EPBC Act Status</td><td colspan="3">This vegetation zone is not consistent with any TEC listed under the EPBC Act.</td></tr>
</table>

3.3.2 Cleared Land

The Indicative Development Footprints contain 97.4 ha of cleared land, including roads, tracks, buildings and waterbodies.



Legend

Modified Project

- Modified Site Boundary

PCTs – Vegetation Zones within the Modified Development Corridor and Indicative Development Footprints

- Zone-1 - PCT-84 - ModerateGood
- Zone-2 - PCT-281 - ModerateGood
- Zone-3 - PCT-395 - ModerateGood
- Zone-4 - PCT-479 - ModerateGood
- Zone-5 - PCT-481 - ModerateGood
- Zone-6 - PCT-483 - ModerateGood
- Zone-7 - PCT-483 - Low
- Zone-8 - PCT-483 - Exotic
- Zone-9 - PCT-488 - ModerateGood
- Zone-10 - PCT-488 - ModerateGood-Shrubby
- Zone-11 - PCT-488 - Low
- Zone-12 - PCT-488 - Exotic
- Zone-13 - PCT-490 - ModerateGood
- Zone-14 - PCT-495 - ModerateGood
- Zone-15 - PCT-1661 - ModerateGood
- Zone-16 - PCT-1675 - ModerateGood
- Disturbed
- Land Category 1 - Exempt Land
- Water Body
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.3

Liverpool Range Wind Farm
PCTs and Condition Zones (Vegetation Zones)

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

3.3.3 Threatened Ecological Communities

Two threatened ecological communities (TECs) were identified as having the potential to occur within the Modified Development Corridor, being:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC (BC Act), referred to as White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (EPBC Act).

The following PCTs and vegetation zones recorded within the Modified Development Corridor were assessed for consistency with the abovementioned TECs:

- PCT281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
    - Moderate/Good (Vegetation Zone 2)
- PCT395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region
    - Moderate/Good (Vegetation Zone 3)
- PCT483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
    - Moderate/Good (Vegetation Zone 6)
    - Low (Vegetation Zone 7)
- PCT488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion
    - Moderate/Good (Vegetation Zone 9)
    - Moderate/Good – Shrubby (Vegetation Zone 10)
    - Low (Vegetation Zone 11).

Analysis of consistency with the scientific determinations considered the advice provided by the NSW Threatened Species Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the BC Act and EPBC Act respectively. Detailed analysis of the vegetation zones with respect to the NSW Threatened Species Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee determinations is provided below.

3.3.3.1 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act

White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a CEEC under the BC Act.

The analysis presented below has been completed against the Final Determination for the original CEEC community (NSW Scientific Committee 2020).

The community is known to occur from the Queensland border in the north, throughout much of New South Wales (NSW), to the Victorian border in the south. In NSW, it occurs in the tablelands and western slopes of NSW and is typically characterised by the presence or prior occurrence of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and/or Blakely's red gum (*Eucalyptus blakelyi*).

Table 3.3 is a summary of the process undertaken to analyse the relevant Vegetation Zones (2, 3, 6, 7, 8, 10 and 11) against the CEEC Final Determination (NSW Scientific Committee 2020). While **Table 3.4** identifies the criterion, and associated outcome, assessed across the Project site rather than at a Vegetation Zone level. A summary of the floristic assemblage assessment for each of the relevant Vegetation Zones is provided in **Table 3.5**.

Table 3.3 BC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC Assessment Process

Criterion		Measure or Approach
Assemblage of Species	Ensure native grasses and native herbs, and/or understorey sub-shrubs are present; assess against the 115 species as characterising the assemblage of species for *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC (NSW Scientific Committee 2020)	At least 20% of flora species in BAM – Vegetation Integrity plot are characteristic of the CEEC Measure proportion of understorey that is native and exotic Measure for each BAM – Vegetation Integrity plot and summarise across the Vegetation Zone Refer to **Table 3.5** for assessment outcome.
Particular Area	Must occur in one of the following IBRA Regions:	Assessed across the Project site Refer to **Table 3.4** for assessment outcome.
	Brigalow Belt South	
	Nandewar	
	New England Tableland	
	Sydney Basin	
	NSW North Coast	
	South Eastern Highlands	
	South East Corner	
	NSW South Western Slopes	
	Riverina Bioregion	

Criterion		Measure or Approach
Supplementary Descriptors	Hilly to undulating landscapes in areas with soils of moderate fertility derived from a range of lithologies, including alkaline and acid volcanics, granites, sediments, serpentinites and metamorphics	Assessed across the Project site Refer to **Table 3.4** for assessment outcome.
	Annual rainfall across its range is generally within the range 500 and 800 millimetres per annum, although the community may occur in areas receiving as little as 400 millimetres per annum and as high as 900 millimetres per annum	Assessed across the Project site Refer to **Table 3.4** for assessment outcome.
	Spans a range in elevation from approximately 170 metres ASL to approximately 1,200 metres ASL, although occurrences on the ranges are typically at lower elevations	Assessed across the Project site Refer to **Table 3.4** for assessment outcome.
	A canopy characteristically dominated by one or more of white box (*Eucalyptus albens*), yellow box (*E. melliodora*), and Blakely's red gum (*E. blakelyi*); while coastal grey box (*E. moluccana*) may be co-dominant in particular locations	Assess for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone Refer to **Table 3.5** for assessment outcome.
	Canopy projected foliage cover generally less than 30 %, ranging between 15 and 30 m in height	
	Understorey shrubs are typically sparse or absent	

Table 3.4 Criterion Assessed Across the Project Site

Criteria	Summary of the Project site	Outcome
IBRA Region	Brigalow Belt South and Sydney Basin	✓
Landscape	Hilly and undulating country dominated, while valley floors are also involved	✓
Rainfall[1]	Mean annual rainfall of 657.6mm	✓
Elevation	Approximately 400 - 700m ASL	✓

[1] Based on Bureau of Meteorological rainfall data from the Coolah weather station (64025)

Table 3.5 Summary of Species Assemblage and Floristic Supplementary Descriptors

	PCT281	PCT395	PCT483		PCT 488		
Species Assemblage	VZ 2	VZ 3	VZ 6	VZ 7	VZ 9	VZ 10	VZ11
Average proportion of CEEC characteristic species in BAM – Vegetation Integrity Plots (%)	30.4	23.3	28.3	26.8	31.1	27.6	22.7
Average proportion of native understorey cover in BAM – Vegetation Integrity Plots (%)	75.4	74.2	69.0	33.4	82.7	91.0	47.9
Supplementary Descriptors							
Proportion of BAM – Vegetation Integrity Plots supporting characteristic canopy species (%)	100	12.5	100	80	14.3	0	36.4

Note: Green cells – indicate where the result satisfies the assessed criterion;
Orange cells – indicate where the result does not satisfy the assessed criterion

Summary

The result of this detailed analysis against the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the BC Act found that Vegetation Zones 2, 3, 6 and 7 conform to the NSW Box Gum Woodland CEEC (**Table 3.6**).

The Indicative Development Footprints support a total of 427.0 ha of NSW Box Gum Woodland CEEC under the BC Act (see **Figure 3.4** for an overview, the tiled figure set provided in **Appendix A**), comprising:

- Vegetation Zone 2 (13.4 ha), of which 8.4 ha will be partially directly impacted and the remaining 5 ha will be fully impacted.
- Vegetation Zone 3 (143.5 ha), of which will be fully impacted.
- Vegetation Zone 6 (28.7 ha), of which 8.0 ha will be partially directly impacted and the remaining 20.7 ha will be fully impacted.
- Vegetation Zone 7 (241.4 ha), of which 65.2 ha will be partially directly impacted and the remaining 195.6 ha will be fully impacted.

It is important to note that the areas of NSW Box Gum Woodland CEEC above for Vegetation Zones 2, 6 and 7 represents the entire area of those Vegetation Zones within the Indicative Development Footprints. However, the area of NSW Box Gum Woodland CEEC above for Vegetation Zone 3 represents a proportion of that entire Vegetation Zone within the Indicative Development Footprints, approximately 73%. Vegetation Zone 3 has been assessed as PCT 395 which is Derived Native Grassland, as such Vegetation Zone 3 has only been identified as conforming with the NSW Box Gum Woodland CEEC where it occurs in proximity to PCT 483 as this was identified as conforming with the NSW Box Gum Woodland CEEC (Vegetation Zones 6 and 7). Where Vegetation Zone 3 occurred in proximity to PCT 488, which was assessed against the NSW Box Gum Woodland CEEC criteria, it was not found to align with the NSW Box Gum Woodland CEEC.

Impacts to the NSW Box Gum Woodland CEEC under the BC Act is approximately 2.1 x greater (**226.2 ha**) than the impact threshold of 200.85 ha for this TEC as identified in Condition 18(a) of the Development Consent. Given the Indicative Development Footprints are approximately 2.4 x larger in area than the Indicative Development Footprint assessed as part of the existing State Approval (SSD 6696), the increased impacts identified for the NSW Box Gum Woodland CEEC under the BC Act is considered to be proportionate with that assessment.

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

Of the 427.0 ha of impact identified to the NSW Box Gum Woodland CEEC under the BC Act, 81.7 ha (approximately 19%) will be partially directly impacted within the transmission line easements of the Modified Project. Further detail on the application of the partial impacts is provided in **Section 5.1.2**. Specific construction and post-construction management actions and monitoring programs will be implemented to ensure the NSW Box Gum Woodland CEEC persists in those areas of partial direct impacts.

Approximately 4,152 ha of NSW Box Gum Woodland CEEC under the BC Act was identified within the wider Modified Development Corridor. Therefore, 3,725.0 ha (or nearly 90%) of the NSW Box Gum Woodland CEEC in the Modified Development Corridor will not be impacted by the Project and considerable amounts of the NSW Box Gum Woodland CEEC occurs beyond the Modified Development Corridor in the local region. As described in **Section 4.0**, the Proponent has made a number of changes to their detailed design to avoid and minimise impacts to the NSW Box Gum Woodland CEEC.

Table 3.6 Summary of Assessment Outcome for the BC Act listed CEEC

	PCT281	PCT395	PCT483		PCT 488		
	VZ 2	VZ 3	VZ 6	VZ 7	VZ 9	VZ 10	VZ 11
Outcome	Conforms	Conforms	Conforms	Conforms	Does not conform	Does not conform	Does not conform
Reasoning	Canopy composition >20% CEEC species Predominantly native understorey	Failed canopy composition (within plots) >20% CEEC species Predominantly native understorey	Canopy composition >20% CEEC species Predominantly native understorey	Canopy composition >20% CEEC species	Failed canopy composition	Failed canopy composition Failed predominantly native understorey	Failed canopy composition Failed predominantly native understorey

Note: Green cells – indicate where the result satisfies the assessed criterion; Orange cells – indicate where the result does not satisfy the assessed criterion

3.3.3.2 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act

Commonwealth Box Gum Woodland is listed as a CEEC under the EPBC Act. This community occurs in and along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

Table 3.7 is a summary of the process undertaken to analyse the above-mentioned Vegetation Zones (2, 3, 6, 7, 8, 10 and 11) against the Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

Table 3.7 EPBC Act listed CEEC Assessment Process

Criterion		Measure or Approach
Particular Area	Must occur in one of the following IBRA Regions:	Assessed across the Project site
	Murray Darling Depression	
	Brigalow Belt South	
	Nandewar	
	New England Tableland	
	NSW North Coast	
	NSW South Western Slopes	
	Sydney Basin	
	South East Coastal Plain	
	South East Corner	
	South Eastern Highlands	
	South Eastern Queensland	
	Riverina	
	Victorian Midlands	
Additional Criteria – Phase 1	Is, or was previously, at least one of the most common overstorey species white box (*Eucalyptus albens*), yellow box (*E. melliodora*), or Blakely's red gum (*E. blakelyi*)?	Assessed for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone
	Does the patch have predominantly native understorey?	Assessed for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone
	Is the patch 0.1 hectare or greater in size?	Assess each patch within each Vegetation Zone
	Are there 12 or more native understorey species present (excluding grasses)?	Assessed for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone

Criterion		Measure or Approach
	Is there an important species present?	Assessed for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone
Additional Criteria – Phase 2	If a patch lacks the understorey diversity or important species:	
	Is the patch size at least 2 ha? AND	Assessed each patch of each VZ
	Are there at least 20 mature trees per hectare or natural regeneration of canopy species? Mature being circumference of 125cm / diameter of 40cm; regeneration requires saplings at least 15cm circumference / diameter of 5cm.	Assessed for each Vegetation Zone, considering average characteristics from all BAM – Vegetation Integrity Plots completed for the Vegetation Zone

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* (2006) the Indicative Development Footprints are situated within the Brigalow Belt South and Sydney Basin IBRA regions (refer to **Section 1.3.2**).

Additional Criteria

Detailed assessment of the vegetation communities described and mapped within the Indicative Development Footprints was undertaken to determine whether the vegetation present met the condition class thresholds identified in the Listing Advice (TSSC 2006). These thresholds have been incorporated into an identification flowchart for the Commonwealth Box Gum Woodland CEEC within the EPBC Act Policy Statement (DEH 2006) for the community which was also utilised during the assessment.

Table 3.8 and **Table 3.9** summarises the assessment, and associated outcome, against the criteria.

Table 3.8 Summary of Additional Criteria

	PCT281	PCT395	PCT483		PCT 488		
	VZ 2	VZ 3	VZ 6	VZ 7	VZ 9	VZ 10	VZ11
Additional Criteria – Phase 1							
Proportion of BAM – Vegetation Integrity Plots supporting characteristic canopy species (%)	100	12.5	100	80	14.29	0	36.4
Average proportion of native understorey cover in BAM – Vegetation Integrity Plots (%)	75	74.2	69.1	33.5	82.7	91.0	47.9
Average proportion of BAM – Vegetation Integrity Plots supporting 12 or more native understorey species present (excluding grasses) (%)	100	25	66.7	60	85.7	100	63.6
Average proportion of BAM – Vegetation Integrity Plots comprising an important species (%)	100	62.5	83.3	80	85.7	100	90.9
Average number of CEEC characteristic species in BAM – Vegetation Integrity Plots	21.5	8.5	17.7	10.4	16.3	24.5	14
Average proportion of CEEC characteristic species in BAM – Vegetation Integrity Plots (%)	46.1	33.4	51.1	38.0	50.1	50	37.8

	PCT281	PCT395	PCT483		PCT 488		
Additional Criteria – Phase 2							
Proportion of BAM – Vegetation Integrity Plots supporting at least 20 mature trees per hectare or natural regeneration of canopy species (%)	N/A	16.7	50	50	100	N/A	50

Note: N/A Indicates where the Phase 2 criteria does not need to be assigned as the vegetation satisfies the understorey diversity and important species presence
Green cells – indicate where the result satisfies the assessed criterion; Orange cells – indicate where the result does not satisfy the assessed criterion

Table 3.9 Summary of Assessment Outcome for the EPBC Act listed CEEC

	PCT281	PCT395	PCT483		PCT 488		
	VZ 2	VZ 3	VZ 6	VZ 7	VZ 9	VZ10	VZ 11
Outcome	Conforms	Does not conform	Conforms	Does not conform	Does not conform	Does not conform	Does not conform
Reasoning	Canopy composition Predominantly native understorey Understorey diversity and important species >40% CEEC species	Failed canopy composition <40% CEEC species Failed species diversity (despite important species) Failed mature tree density/regeneration	Canopy composition Predominantly native understorey Understorey diversity and important species >40% CEEC species	Canopy composition Failed predominantly native understorey, particularly when consideration of cover of perennial exotic species and excluding annual exotic species Understorey diversity and important species <40% CEEC species Patches were greater than 2 ha in size and/or 20 mature trees/ha	Failed canopy Failed predominantly native understorey	Failed canopy composition	Failed canopy Failed predominantly native understorey <40% CEEC species

Summary

Based on the detailed assessment described above, Vegetation Zones 2 and 6 were found to conform with Commonwealth Box Gum Woodland CEEC under the EPBC Act (**Table 3.9**).

The Indicative Development Footprints are considered to support 42.1 ha in total of Commonwealth Box Gum Woodland CEEC (refer to **Figure 3.4** for an overview, the tiled figure set is provided in **Appendix A**), comprising:

- Vegetation Zone 2 (13.4 ha), of which 8.4 ha will be partially directly impacted and the remaining 5 ha will be fully impacted.
- Vegetation Zone 6 (28.7 ha), of which 8 ha will be partially directly impacted and the remaining 20.7 ha will be fully impacted.

It is important to note that the areas of Commonwealth Box Gum Woodland CEEC above for Vegetation Zones 2 and 6 represents the entire area of those Vegetation Zones within the Indicative Development Footprints.

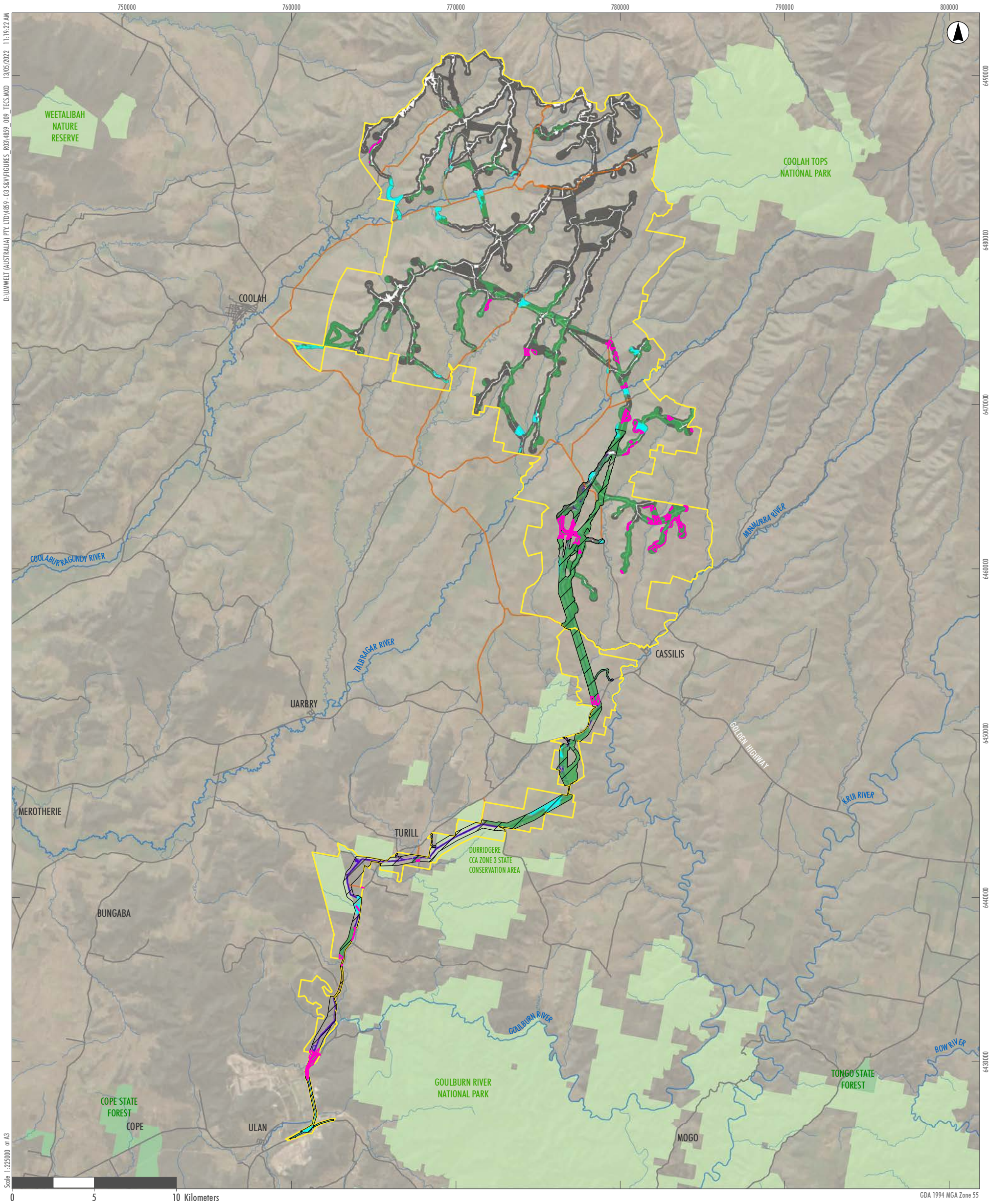
Impacts to the Commonwealth Box Gum Woodland CEEC under the EPBC Act is 31.7 ha greater than the impact threshold of 10.37 ha for this TEC as identified in Condition 1 of the existing Federal Approval (EPBC 2014/7136) and Condition 18(b) of the Development Consent.

The increase in identified impacts (31.7 ha) to the Commonwealth Box Gum Woodland CEEC under the EPBC Act associated with the Modified Project compared to the existing Federal Approval (EPBC 2014/7136) is not considered to be a result of the Modified Project impacting new areas or better patches of the Commonwealth Box Gum Woodland CEEC. Instead, Umwelt consider the primary reason for this change to be an outcome of the detailed analysis of extensive BAM Vegetation Integrity Plots undertaken for the Modified Project against the Listing Advice for the Commonwealth Box Gum Woodland CEEC (TSSC 2006).

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

Of the 42.1 ha of impact identified to the Commonwealth Box Gum Woodland CEEC under the EPBC Act, 16.4 ha (approximately 39%) will be partially directly impacted within the transmission line easements of the Modified Project. Further detail on the application of the partial impacts is provided in **Section 5.1.2**. Specific construction and post-construction management actions and monitoring programs will be implemented to ensure the Commonwealth Box Gum Woodland CEEC persists in those areas of partial direct impacts.

It is noted that approximately 362.5 ha of Commonwealth Box Gum Woodland CEEC under the EPBC Act was identified within the Modified Development Corridor. Therefore, 320.4 ha (or 88%) of the Commonwealth Box Gum Woodland CEEC will not be impacted by the Project and will persist within the wider Modified Development Corridor, and considerable amounts of the Commonwealth Box Gum Woodland CEEC occur beyond the Modified Development Corridor in the local region.



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line
- Land Category 1 - Exempt Land

BC Act

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

EPBC Act

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.4

Liverpool Range Wind Farm
Threatened Ecological Communities

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

3.3.3.3 Summary of TECs within the Indicative Development Footprints

Table 3.10 presents a summary of the Vegetation Zones that have been assessed as aligning with the BC Act and EPBC Act CEECs and their extent within the Indicative Development Footprints.

Table 3.10 Threatened Ecological Communities within the Indicative Development Footprint per PCT

PCT	Threatened Ecological Community (TEC)			
	BC Act	TEC Area (ha)	EPBC Act	TEC Area (ha)
281	NSW Box Gum Woodland CEEC	13.4	Commonwealth Box Gum Woodland CEEC	13.4
395		143.5		-
483		270.1		28.7
	Total (ha)	427.0	Total (ha)	42.1

3.3.4 Vegetation Integrity Score

Table 3.11, **Table 3.12** and **Table 3.13** below detail the vegetation integrity scores for the vegetation zones in the Indicative Development Footprints. As per the requirements of the BAM, separate assessments have been conducted for each of the IBRA subregions pertinent to the assessment. The vegetation integrity data for each of the vegetation zones is provided in **Appendix E**.

Table 3.11 Vegetation Zone Vegetation Integrity Scores (Brigalow Belt South – Liverpool Range)

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good*	43.4	51.6	24.1	✓	**37.8**
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good*	88.2	95.6	93.3	✓	**92.3**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good*	40.6	63.6	16.3	✖	**34.8**

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good*	84.3	97	77.1	✓	**85.7**
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low*	48.1	69.5	62.2	✓	**59.3**
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	20.2	16.8	35.7	✓	**23**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	69.8	88.2	94.4	✓	**83.4**
10	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good-Shrubby*	85.5	94.1	68.9	✓	**82.1**
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low*	54.4	85.4	55.2	✓	**63.5**
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Exotic*	11.9	9.6	3.3	✓	**7.2**
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	66.7	76.1	89	✓	**76.8**

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	53.4	45.5	63.3	✓	**53.6**

Table 3.12 Vegetation Zone Vegetation Integrity Scores (Brigalow Belt South – Pilliga)

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good*	43.4	51.6	24.1	✓	**37.8**
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good*	88.2	95.6	93.3	✓	**92.3**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good*	40.6	63.6	16.3	✖	**34.8**
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good*	80.6	68.8	96.7	✓	**81.2**
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good*	83.9	70.7	58.4	✓	**70.2**
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low*	48.1	69.5	62.2	✓	**59.3**

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	20.2	16.8	35.7	✓	**23**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	69.8	88.2	94.4	✓	**83.4**
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low*	54.4	85.4	55.2	✓	**63.5**
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Exotic*	11.9	9.6	3.3	✓	**7.2**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate/Good*	89.9	81.8	89	✓	**86.8**
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin Moderate/Good	80.4	81.5	99.1	✓	**86.6**

Table 3.13 Vegetation Zone Vegetation Integrity Scores (Sydney Basin – Kerrabee)

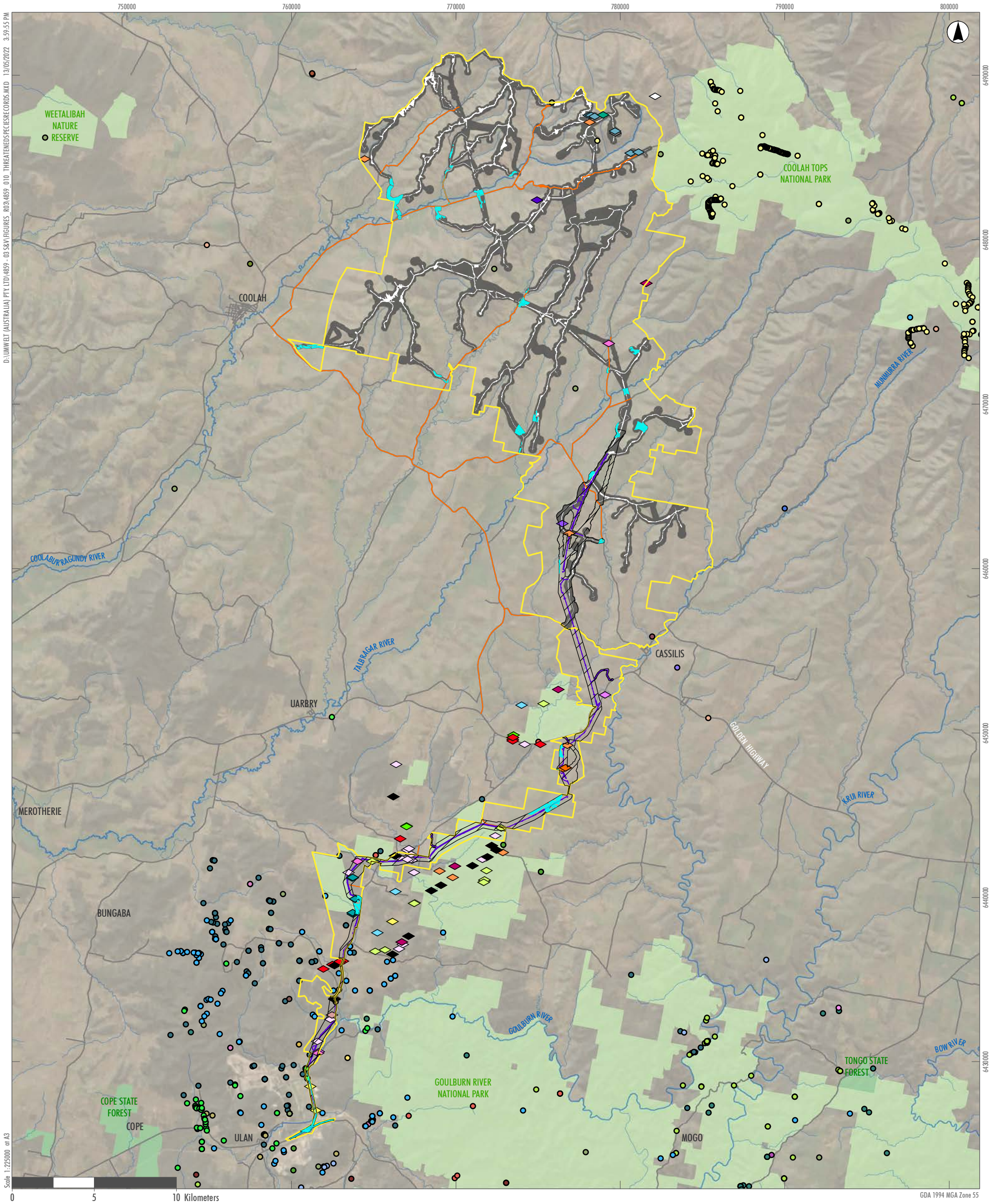
Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good*	78.7	91.7	92.2	✓	**87.3**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good*	33.4	58	7.9	✖	**24.8**
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good*	58.7	43.2	96.8	✓	**62.6**
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good*	65.3	61	53.1	✓	**59.6**
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good*	67.4	97.6	72.7	✓	**78.2**
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low*	38.6	68.4	53.1	✓	**52**
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	16.2	16.6	30.3	✓	**20.1**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate/Good*	71.2	53.2	89.3	✓	**69.7**

Veg Zone	PCT Name *Condition Class*	Composition	Structure	Function	Presence of Hollow Bearing Trees	Current Vegetation Integrity Score
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin Moderate/Good	74.5	70.2	79.4	✓	**74.6**

3.4 Threatened Species within the Indicative Development Footprints

3.4.1 Ecosystem-credit Species

A list of the ecosystem-credit species predicted to occur by the BAM Calculator and/or the literature review in the vegetation zones within the Indicative Development Footprints is provided in **Appendix B**. An overview of the records of the ecosystem-credit species in relation to the Project are shown in **Figure 3.5**, and the tiled figure set is provided in **Appendix A**.



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land

Umwelt and NGH TS Records

- *Acacia ausfeldii*
- *Swainsona sericea*
- Barking owl
- Black-chinned honeyeater
- Brown treecreeper
- Diamond firetail
- Eastern Cave Bat
- Glossy black-cockatoo
- Glossy black-cockatoo (chewed sheoak cones)
- Grey-crowned babbler
- Little lorikeet
- Painted Honeyeater
- Powerful Owl
- Scarlet Robin
- Silky Swainson-pea
- Speckled Warbler
- Spotted-tailed quoll
- Square-tailed kite
- Squirrel Glider
- Squirrel Glider (potential)
- Varied Sittella
- Yellow-bellied glider

NSW Bionet Atlas TS Records

- *Acacia ausfeldii*
- *Acacia pendula*
- *Commersonia procumbens*
- *Commersonia rosea*
- *Cynanchum elegans*
- *Dichanthium setosum*
- *Digitaria porrecta*
- *Eucalyptus cannonii*
- *Homoranthus darwinioides*
- *Leucochrysum albicans var. tricolor*
- *Pomaderris queenslandica*
- *Prasophyllum petilum*
- *Thesium australe*
- Brush-tailed Rock-wallaby
- Common Sandpiper
- Corben's Long-eared Bat
- Giant Barred Frog
- Greater Glider
- Koala
- Large-eared Pied Bat
- Malleefowl
- New Holland Mouse
- Painted Honeyeater
- Plains-wanderer
- Regent Honeyeater
- Spotted-tailed Quoll
- Superb Parrot
- Swift Parrot

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.5

Liverpool Range Wind Farm
Threatened Species Records

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)

3.4.2 Species-credit Species

Targeted species-credit surveys were undertaken across the Indicative Development Footprints as described in **Appendix C**, which presents all species predicted to occur by the BAM Calculator and/or the literature review**. Table 3.14** presents those species-credit species that were recorded within the Indicative Development Footprints.

Table 3.14 Species-credit Species

Species Name	Common Name	Sensitivity to Gain	Habitat and/or Geographic Constraint	Presence/Absence
Flora Species				
Acacia ausfeldii	ausfeld's wattle	High	-	**Present – Impacted:** The species was recorded at three locations, two along Golden Highway and one along Turill Bus Route Road. A total of three individuals were recorded (NGH 2013a, 2013b and 2017). All of these individuals are being avoided by the Modified Project. The species was not recorded during Umwelt surveys. There are 76 known records of this species within, or adjacent to the Modified Development Corridor (DPIE 2021a) near the entry to Ulan Mine. **A species polygon has been prepared.**
Swainsona sericea	silky swainson-pea	High	-	**Present – Impacted:** The species was recorded at one location as part of the original assessment (NGH 2013a, 2013b and 2017). The species was not recorded, or relocated during Umwelt surveys, despite targeted surveys in this locality. **A species polygon has been prepared.**
Fauna Species				
Calyptorhynchus lathami	glossy black-cockatoo (breeding)	High	Hollow bearing tree; Living or dead tree with hollow greater than 15cm diameter and greater than 5m above ground	**Present – Impacted:** A total of 28 records of the species were made (including 11 passive records i.e. chewed sheoak cones) along the transmission line as part of the original assessment (NGH 2013a, 2013b and 2017). However, **no breeding habitat has been recorded** as part of the original assessment or recent surveys by Umwelt. Hollow bearing trees were recorded and mapped in the vicinity of known habitat. The species was not recorded during Umwelt surveys. **Species polygon has been prepared.**
Chalinolobus dwyeri	large-eared pied bat	Very High	Cliffs; Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	**Present – Impacted:** The species was recorded at five locations as part of the original assessment, primarily within and adjacent to the Durridgere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017). Umwelt survey effort did not record this species despite extensive surveys. **A species polygon has been prepared.**

Species Name	Common Name	Sensitivity to Gain	Habitat and/or Geographic Constraint	Presence/Absence
Lophoictinia isura	Square-tailed Kite (Breeding)	Moderate	Nest trees	**Present – Impacted:** A breeding nest was recorded by NGH Environmental (NGH 2013a, 2013b and 2017) in proximity to the transmission line easement and an associated access track. The nest itself has been avoided by the Project, however native woody and non-woody vegetation within a 300m buffer of the nest does occur. **A species polygon has been prepared.**
Miniopterus orianae oceanensis	large bent-winged bat (Breeding)	Very High	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave; " observation type code "E nest-roost; " with numbers of individuals >500	**Present – Not Impacted:** Documentation of the NGH Environmental results is unclear whether the species recorded from these surveys was the threatened Large Bent-winged Bat or the non-threatened species Common bent-winged bat (*Miniopterus schreibersii*) (NGH 2013a, 2013b and 2017). Records of this species group occurred at seven locations across the entire Project (NGH 2013a, 2013b and 2017) and are all being treated as large bent-winged bat in accordance with the precautionary principle. Umwelt survey effort recorded this species to a possible or species group confidence. It was recorded at one location. Despite the records described above, no breeding habitat identified as cave, tunnel, mine, culvert or other structure in the TBDC has been identified. **A species polygon has not been prepared for this species.**
Myotis macropus	southern myotis	High	Hollow bearing trees within 200 m of riparian zone; Bridges, caves or artificial structures within 200 m of riparian zone; This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site	**Present – Not Impacted:** The species was not recorded through NGH Environmental survey effort. Umwelt survey effort recorded this species to a possible or species group confidence at one location. It was recorded at one location, on the north western ridgeline of the Project. The location does not support any suitable aquatic habitat for the species, with the nearest location of such habitat being some 1.5 kilometres to the south. **No PCTs identified for the Project are linked to the species. A species polygon has not been prepared for this species.**
Ninox connivens	barking owl (Breeding)	High	Hollow bearing trees; living or dead with hollows greater than 20cm diameter and greater than 4m above the ground	**Present – Not Impacted:** The species was not recorded as part of the original assessment (NGH 2013a, 2013b and 2017). Umwelt recorded one individual during surveys in May 2020. No breeding activity was recorded. **A species polygon has not been prepared for this species.**

Species Name	Common Name	Sensitivity to Gain	Habitat and/or Geographic Constraint	Presence/Absence
Ninox strenua	powerful owl (Breeding)	High	Hollow bearing trees; Living or dead trees with hollow greater than 20cm diameter	**Present – Not Impacted:** The species was recorded twice along the transmission line as part of the original assessment (NGH 2013a, 2013b and 2017). No breeding activity (including potential) was recorded. Umwelt did not record the species. **A species polygon has not been prepared for this species.**
Petaurus norfolcensis	squirrel glider	High	-	**Present – Impacted:** The species was recorded at two locations as part of the original assessment (NGH 2013a, 2013b and 2017). The species was recorded during the Umwelt May 2020 remote camera survey. It was recorded at two locations in proximity to each other. The species was recorded at a total of four locations. **A species polygon has been prepared.**
Tyto novaehollandiae	masked owl (Breeding)	High	Hollow bearing trees; Living or dead trees with hollows greater than 20cm diameter	**Present – Not Impacted:** The species was recorded along the transmission line as part of the original assessment (NGH 2013a, 2013b and 2017). No breeding activity has been recorded as part of the original assessment or recent surveys by Umwelt. **A species polygon has not been prepared for this species.**
Vespadelus troughtoni	eastern cave bat	Very High	Caves; Within 2km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2km of old mines, tunnels, old buildings or sheds.	**Present – Impacted:** The species was recorded at 7 locations, spanning the north of the Project to Durridgere State Conservation Area as part of the original assessment (NGH 2013a, 2013b and 2017). Umwelt recorded this species to a possible or species group confidence. It was recorded at one location. **A species polygon has been prepared.**

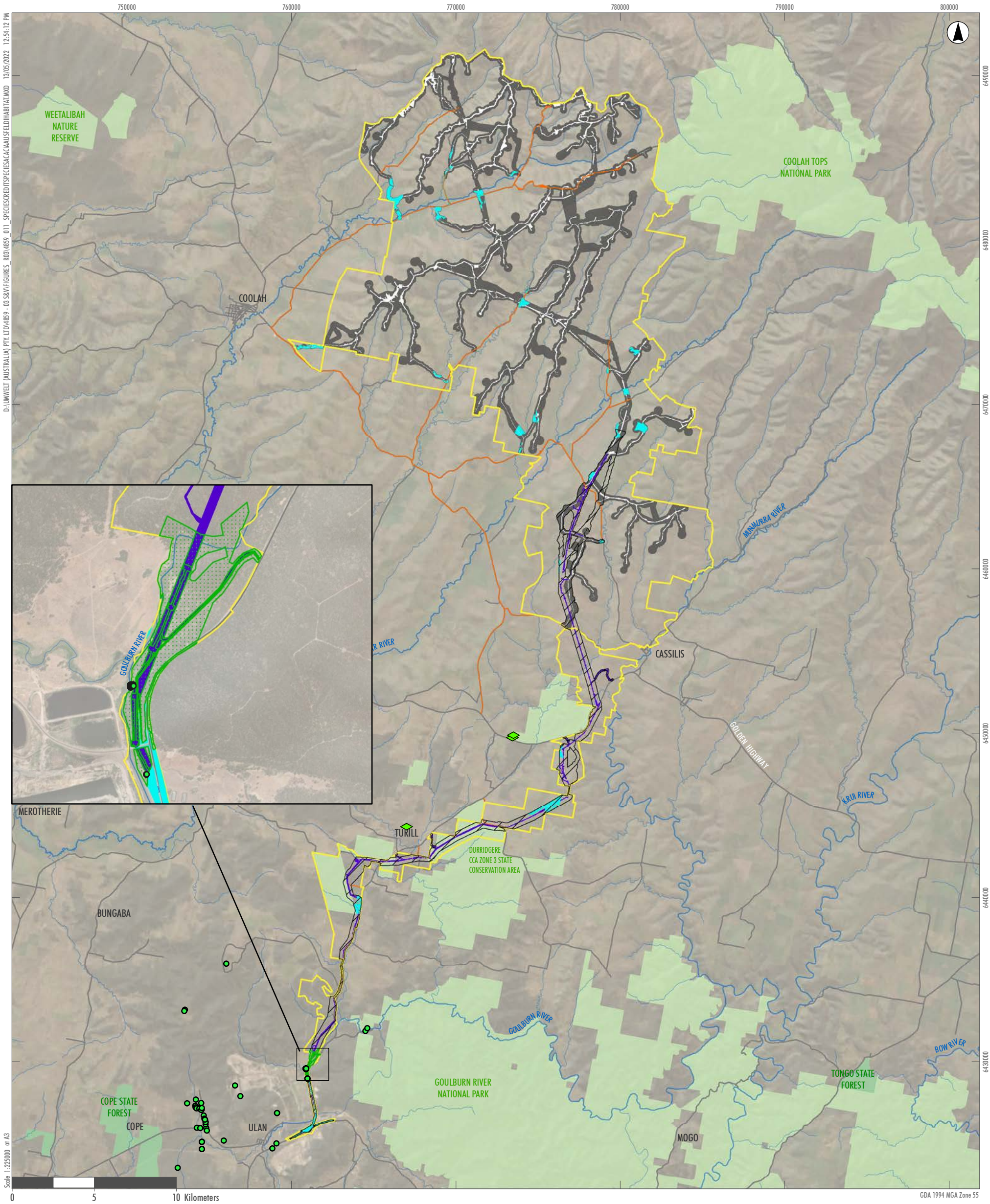
3.4.3 Species Habitat Polygons and Biodiversity Risk Weighting

Species polygons have been prepared for the species outlined in **Table 3.15** below. This table presents the extent of the species habitat considered as part of the original approval (NGH 2013a, 2013b and 2017), as well as the species habitat polygons assessed as part of the Modified Project. The current species habitat polygons are presented in **Table 3.15**, the detail of how much occurs in each particular IBRA-subregion is presented in **Section 5.0**. **Table 3.15** also identifies the relevant figure for each species, presented as **Figure 3.6** to **Figure 3.12**. Each species has a single overview figure, with the tiled figure set provided in **Appendix A** for relevant species.

Table 3.15 Species-credit Species Habitat Polygons and Risk Weightings

Species Name	Common Name	Biodiversity Risk Weighting	Total Species Habitat (ha) – Modified Development Corridor	Modified Project - Total Species Habitat Polygon (ha) – Indicative Development Footprints	Species Habitat Polygon Description	Figure Set
Acacia ausfeldii	Ausfeld's wattle	2.00	44.3	10.5	Suitable PCTs (281) as identified in the TBDC (DPIE 2021b) in proximity to the 76 known records of this species within, or adjacent to the Modified Development Corridor (DPIE 2021a) near the entry to Ulan Mine.	An overview of the species polygon is shown on **Figure 3.6**
Swainsona sericea	silky swainson-pea	2.00	336.7	19.4	Continuous patches of suitable PCTs (281, 395) as identified in the TBDC (DPIE 2021b), as well as the PCT in which the records were made (PCT483) in proximity to the three known records.	An overview of the species polygon is shown on **Figure 3.12**
Calyptorhynchus lathami	glossy black-cockatoo (breeding)	2.00	14.7	1.0	Suitable PCTs (395, 488, 495) as identified in the TBDC (DPIE 2021b) intersecting with 200m buffers of hollow bearing trees recorded in continuous habitat of the 28 records of the species made along the transmission line (NGH 2013a, 2013b and 2017).	An overview of the species polygon is shown on **Figure 3.8** with the tiled figure set provided in **Appendix A**
Chalinolobus dwyeri	large-eared pied bat	3.00	1,573.7	284.5	The intersection of suitable PCTs (281, 395, 495, 488) as identified in the TBDC (DPIE 2021b) within 2km of mapped rocky areas.	An overview of the species polygon is shown on **Figure 3.9** with the tiled figure set provided in **Appendix A**

Species Name	Common Name	Biodiversity Risk Weighting	Total Species Habitat (ha) – Modified Development Corridor	Modified Project - Total Species Habitat Polygon (ha) – Indicative Development Footprints	Species Habitat Polygon Description	Figure Set
Lophoictinia isura	square-tailed Kite (Breeding)	1.5	14.7	1.4	The species polygon for this species includes all woody and non-woody vegetation within a 300m buffer from the recorded nest.	An overview of the species polygon is shown on **Figure 3.10**
Petaurus norfolcensis	squirrel glider	2.00	2,143.5	243.4	Continuous patches of suitable PCTs (84, 281, 395, 488) as identified in the TBDC (DPIE 2021b) in proximity to the four known records; and continuous patches of PCTs 481 and 483 where a record was made. Not including Exotic Vegetation Zones due to their lack of intact canopy and mid-storey.	An overview of the species polygon is shown on **Figure 3.11** with the tiled figure set provided in **Appendix A**
Vespadelus troughtoni	eastern cave bat	3.00	1,592.4	286.6	The intersection of suitable PCTs (84, 281, 395, 495, 488) as identified in the TBDC (DPIE 2021b) within 2km of mapped rocky areas.	An overview of the species polygon is shown on **Figure 3.7** with the tiled figure set provided in **Appendix A**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 S&V\FIGURES_R03\4859_011_SPECIESCREDITSPECIESACACIAAUSFELDHABITAT.MXD 13/05/2022 12:54:12 PM

Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- *Acacia ausfeldii*

Umwelt and NGH TS Records
- *Acacia ausfeldii*

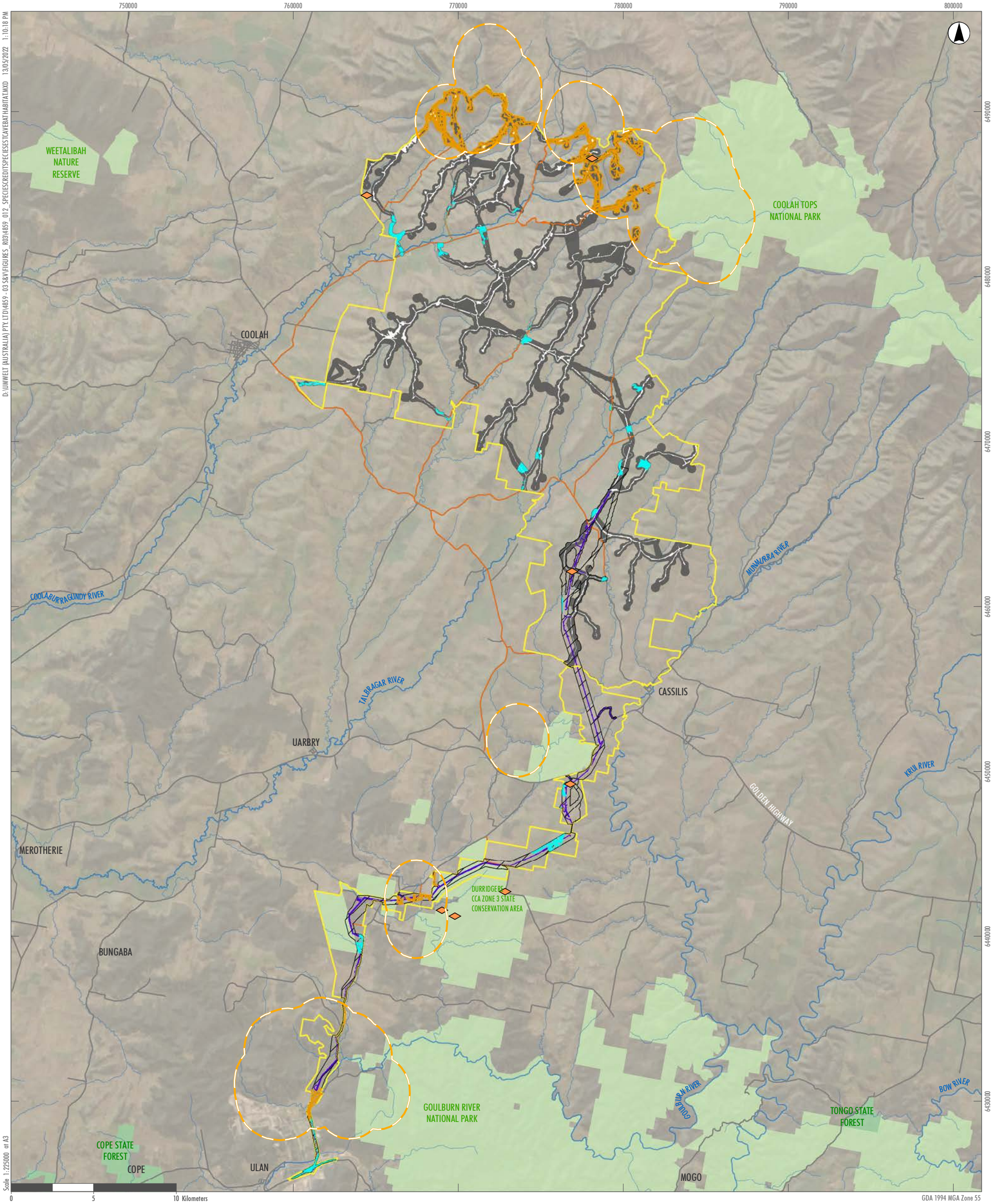
NSW Bionet Atlas TS Records
- *Acacia ausfeldii*

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.6

Liverpool Range Wind Farm
Acacia ausfeldii Records and Species Polygon

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- 2km buffer of rocky habitat
- Eastern Cave Bat

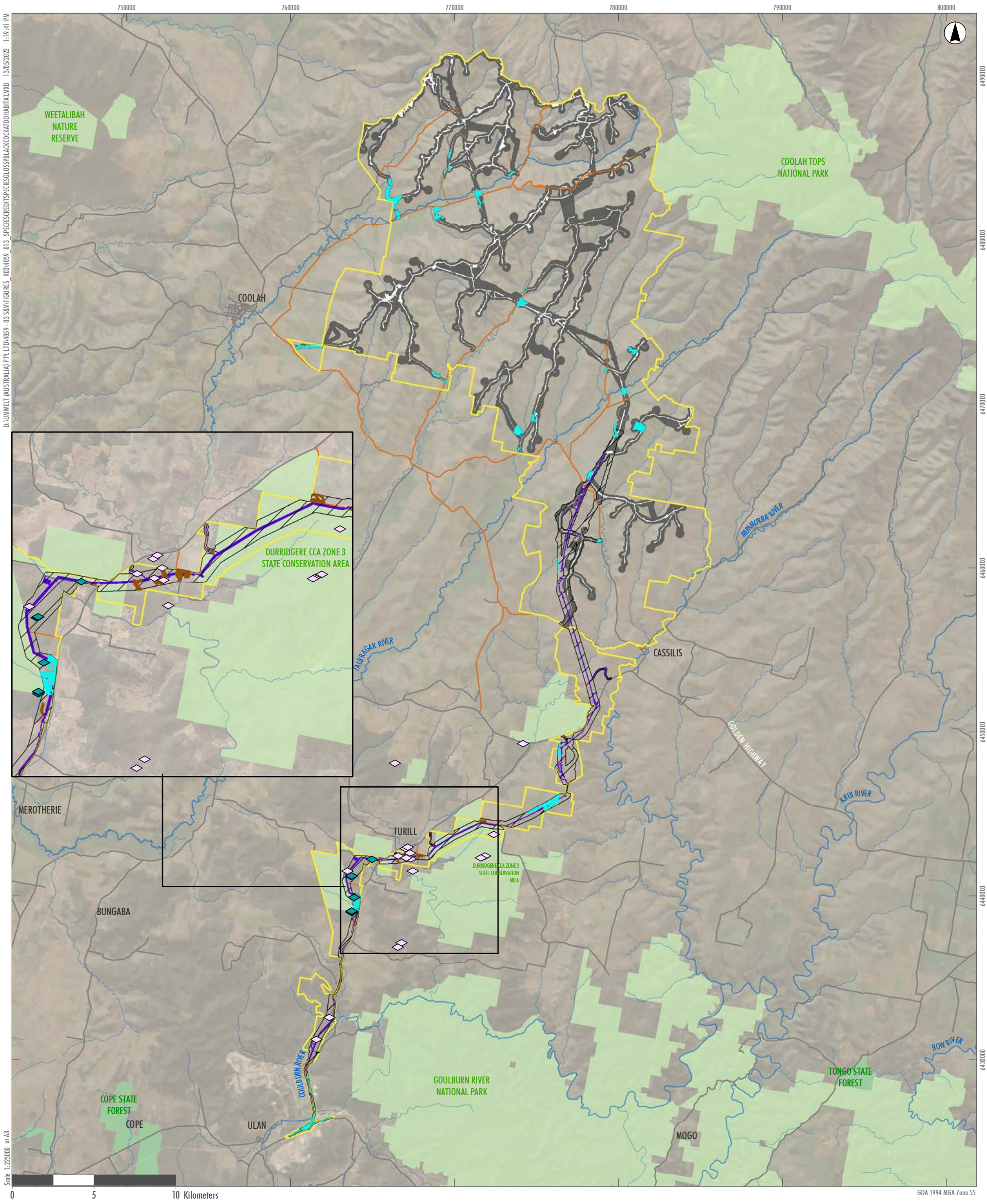
Umwelt and NGH TS Records

- Eastern Cave Bat

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.7

Liverpool Range Wind Farm
Eastern Cave Bat Records and Species Polygon



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line
- Land Category 1 - Exempt Land
- Glossy black-cockatoo

Umwelt and NGH TS Records

- Glossy black-cockatoo
- Glossy black-cockatoo (chewed sheoak cones)
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.8

Liverpool Range Wind Farm
Glossy black-cockatoo Records and Species Polygon

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), (NGH Environmental 2013a, 2013b and 2017)

750000 760000 770000 780000 790000 800000

6490000 6480000 6470000 6460000 6450000 6440000 6430000

WEETALIBAH NATURE RESERVE

COOLAH TOPS NATIONAL PARK

COOLAH

COOLABURRAGUNDY RIVER

TALBRAGAR RIVER

MUNMURRA RIVER

UARBRY

CASSILIS

KRUI RIVER

GOLDEN HIGHWAY

MEROTHERIE

DURRIDGERE CCA ZONE 3 STATE CONSERVATION AREA

BUNGABA

GOULBURN RIVER NATIONAL PARK

GOULBURN RIVER

BOW RIVER

TONGO STATE FOREST

COPE STATE FOREST

COPE

ULAN

MOGO

Scale 1:225000 at A3

0 5 10 Kilometers

GDA 1994 MGA Zone 55

Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- 2km buffer of rocky habitat
- Large-eared Pied Bat

NSW Bionet Atlas TS Records

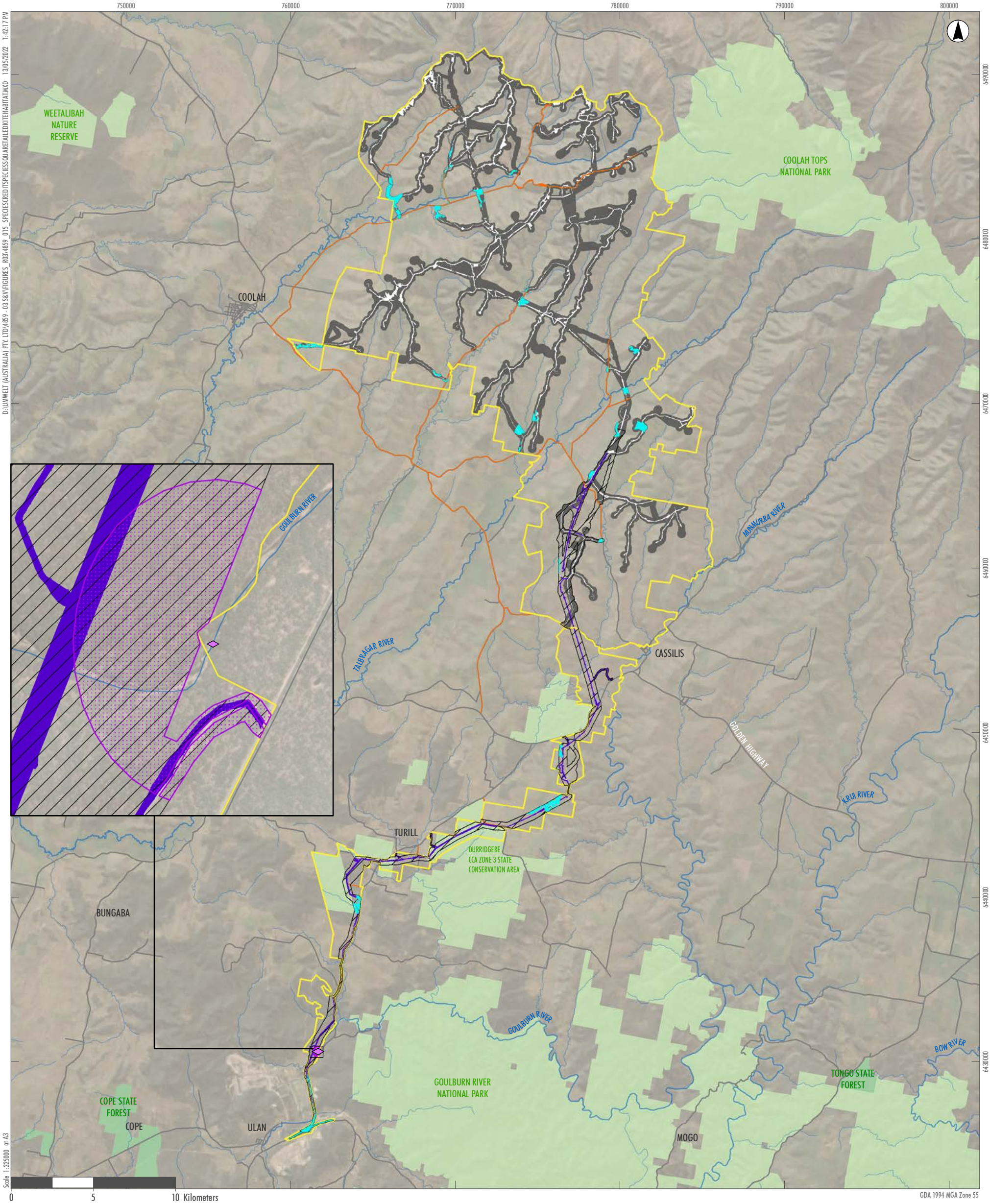
- Large-eared Pied Bat

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.9

Liverpool Range Wind Farm
Large-eared Pied Bat Records and Species Polygon

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)



Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

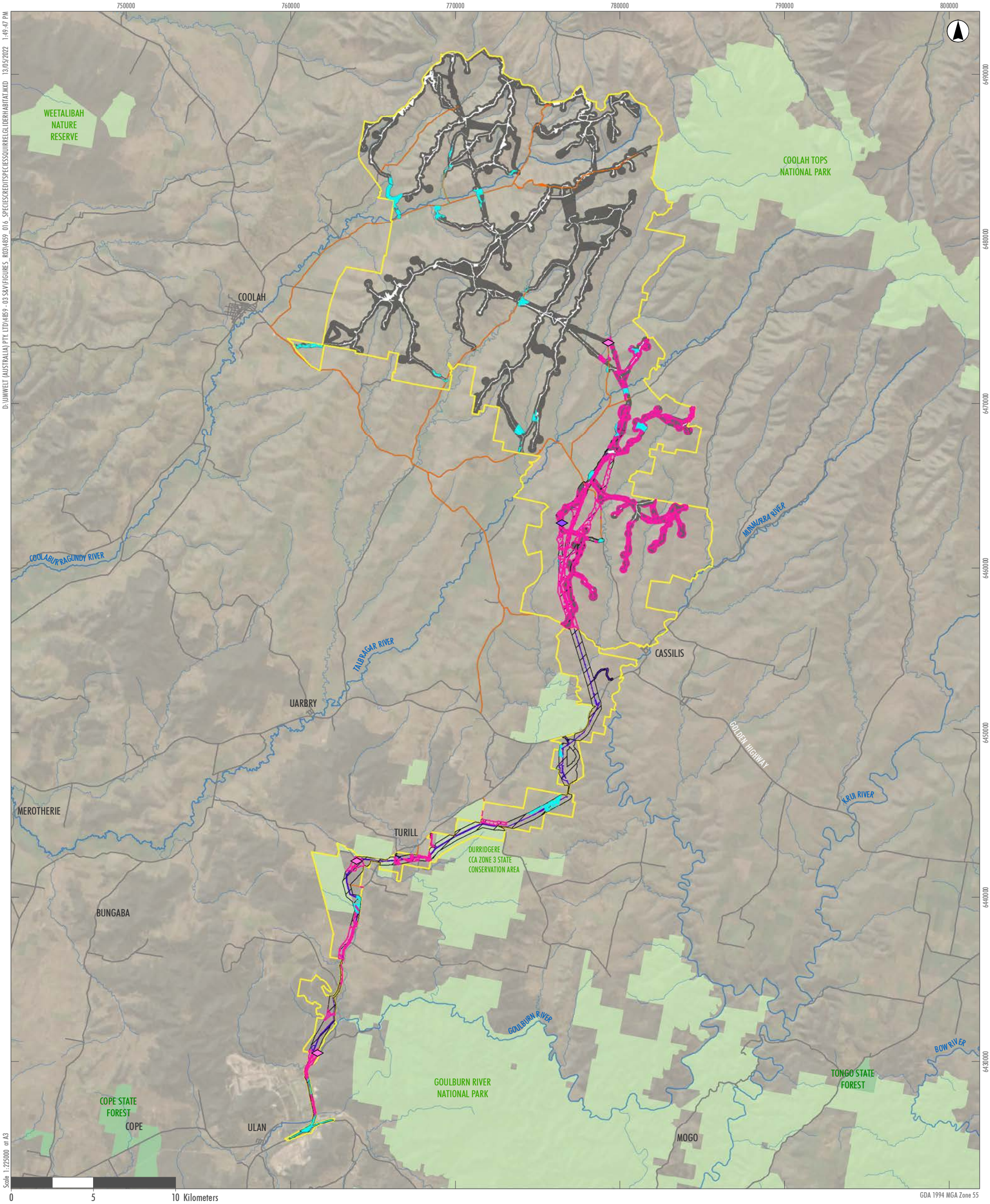
- Land Category 1 - Exempt Land
- Square-tailed Kite

Umwelt and NGH TS Records
- Square-tailed kite

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.10

Liverpool Range Wind Farm
Square-tailed Kite Records and Species Polygon



Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- Squirrel Glider

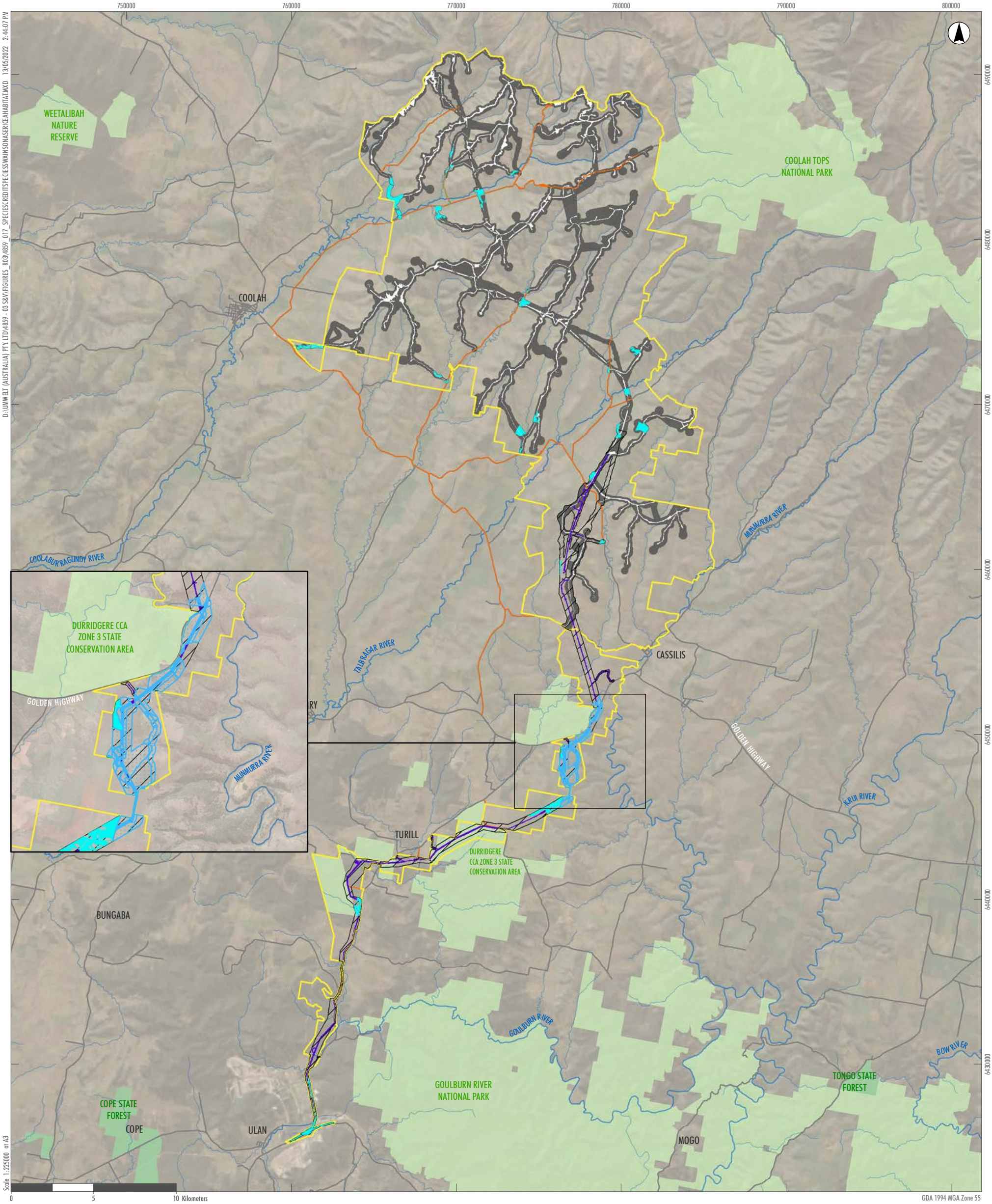
Umwelt and NGH TS Records
- Squirrel Glider
- Squirrel Glider (potential)

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.11

Liverpool Range Wind Farm
Squirrel Glider Records and Species Polygon

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), (NGH Environmental 2013a, 2013b and 2017)



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 S&V\FIGURES_R03\4859_017_SPECIESCREDITSPECIESSWAINSONASERICEAHABITAT.MXD 13/05/2022 2:44:07 PM

Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- *Swainsona sericea*
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 3.12

Liverpool Range Wind Farm
Swainsona sericea Records and Species Polygon

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)

4.0 Avoidance and Minimisation of Impacts

4.1 Avoidance and Minimisation of Native Vegetation and Habitat

The Project has undergone substantial design changes since project feasibility began in 2012, many of which have been the result of specific biodiversity avoidance measures as identified in Table 11.1 of the Biodiversity Assessment – Wind Farm (NGH Environmental 2013a), Table 9.1 of the Biodiversity Assessment – Transmission Line (2013b) and Table 8.2 of the Biodiversity Assessment Addendum (2017). Since Tilt Renewables took ownership of the Project in 2019, additional changes to the project design have been made with a focus on avoiding impacts to native vegetation and habitat where possible. A summary of these additional avoidance measures is provided below in **Table 4.1**. These measures are considered initial avoidance measures as they have occurred through early assessment of the Modification.

Key areas of Box Gum Woodland TECs (BC Act and EPBC Act), key threatened species habitat and habitat connectivity for barking owl, powerful owl and masked owl, have all been avoided by the Modified Project. Furthermore, the Proponent will continue to seek additional avoidance of these biodiversity values through finalisation of the detailed design once a turbine model and preferred contractor(s) are selected.

Table 4.1 Summary of Initial Avoidance Measures

Measure	Outcome
Reduction in the number of wind turbines	• The original Approved Project (SSD 6696) allowed for the construction and operation of up to 267 wind turbines. • The original biodiversity assessment stated the Project considered an application to construct and operate up to 417 wind turbines (NGH Environmental 2013a). • The Modified Project includes an application to construct and operate up to 220 wind turbines, a further reduction of 47 wind turbines from the Approved Project.
Turbine spacing	• Turbine spacing has been maximised to accommodate larger turbines, which in-turn gives birds and bats greater opportunity to move through the landscape between the wind turbines and potentially reduce bird and bat strike risk. In general, the turbines are a minimum of 500 m apart, the majority however are between 550 m and 600 m apart.
Avoidance of substantially altering the proposed transmission line	• It is recognised that this description isn't strictly 'avoidance', as the transmission line still impacts large areas of intact vegetation. However it is important to recognise the lack of modification to the original transmission line alignment south of Golden Highway where the extent and quality of the vegetation is the highest. • The Proponent recognises the intactness and quality of vegetation, threatened species records and potential habitat, and landscape connectivity the approved transmission line (SSD 6696) interacts with. • The Proponent deliberately avoided substantial alterations to the proposed transmission line south of Golden Highway to the switching station at Ulan, NSW. • The transmission line alignment proposed by the Modified Project almost remains unchanged from Approved Project south of the Golden Highway, with the exception of one minor change near Cliffdale Road (off Ulan Road), one section where the transmission line moves from the west side of Ulan Road to the east to avoid land associated with the 'Hands on Rock' Aboriginal cultural heritage site and the inclusion of a number of small access tracks from nearby public roads.

Measure	Outcome
Avoidance of Box Gum CEEC	• It is noted that the overall impacts on BC Act and EPBC Act listed Box Gum Woodland CEECs has increased as part of the Modified Project. This is not considered to be an outcome of the Modified Project expanding into new areas of the CEECs, rather, it is an outcome of: o The Modified Project undertaking a significant amount of design work that was informed by recent construction experience and detailed 3D terrain modelling to ensure the Project is constructable and associated impacts were accurately estimated and assessed. o The Modified Project identifying the necessary Public Road Upgrades required to facilitate the construction of the Project, which the Approved Project did not identify, survey or assess. o A new detailed analysis of current data collected from extensive BAM Vegetation Integrity Plots, current condition thresholds and assessment criteria which re-mapped areas not previously identified as the CEEC. • The Proponent consulted with and sought feedback from Umwelt following completion of extensive field surveys to understand the Box Gum Woodland CEEC constraints for the Project. Through this effort, the Modified Project has avoided better quality and larger patches of BC Act and EPBC Act listed Box Gum Woodland CEECs. • The 8 x relocated turbines within the North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61) avoids impacts to NSW Box Gum Woodland CEEC and Commonwealth Box Gum Woodland CEEC • Particular locations where the project design has avoided impacts to better quality patches of the CEECs are provided below: o The public road reserves in the Project locality support large areas of BC Act and EPBC Act listed Box Gum Woodland CEECs, for the most part substantial impacts to these stands of vegetation have been avoided. o Extensive patches of BC Act and EPBC Act listed Box Gum Woodland CEECs occur in private properties between Rotherwood Road and Coolah Road. While the Modified Project does interact with this vegetation, the Proponent has avoided impacts to the better quality and larger patches of the BC Act and EPBC Act listed Box Gum Woodland CEECs.
Avoidance of threatened species records	• The Proponent has avoided three records of *Acacia ausfeldii* that were recorded as part of the Approved Project. It is noted however that known records of the species occur within and directly adjacent to the transmission line easement near the entry to Ulan Mine. Mitigation measures have been specifically designed to avoid and minimise impacts to these records, refer to **Section 4.3**. • The Proponent has avoided direct impact of three records of *Swainsona sericea* that were recorded as part of the Approved Project. It is noted that the continuous patches of vegetation where the species was recorded were used to identify a species polygon. Detailed targeted surveys as part of proposed pre-clearance surveys (refer to Section 4.3) will ensure that *Swainsona sericea* are not impacted, where practicable.

Measure	Outcome
Avoidance of threatened species habitat and connectivity	• The Proponent consulted with and sought feedback from Umwelt regarding the potential to relocate wind turbines in the far north eastern portion of the Project site, near Coolah Tops National Park. • Following this consultation and feedback, the Proponent reduced the proposed number of relocated turbines in this area from 15 to 8 (North East Turbine Cluster). • Furthermore, the Proponent engaged Umwelt to undertake extensive habitat assessment and detailed targeted surveys for threatened species of forest owls and microbats, to determine whether or not breeding habitat was likely and/or present. • Following completion of these additional surveys, the Proponent altered the proposed location of several wind turbines to increase their distance from Coolah Tops National Park as well as other large patches of woodland and forests outside of the National Park. This recommendation and design change was a direct measure to avoid impacting habitat connectivity and proximity to high conservation value areas.

In addition to those initial avoidance measures described above, subsequent layout review and design optimisation process completed during early 2022 has resulted in a number of additional changes to the Approved Project infrastructure layout.

For the main part, the infrastructure layout including turbine locations, access track alignments and External Transmission Line alignment is generally consistent with the Approved Project. However, as described in **Section 1.2** and **Section 1.4** the Modified Project results in an increase in the extent of ground disturbance and associated native vegetation/habitat clearance, including to the Box Gum Woodland CEEC listed under the BC Act. The largest proportion of the increase to ground disturbance and associated impacts to the CEEC is attributable to the two following aspects of the development, which together account for nearly 85% of the additional ground disturbance:

- Wind farm access tracks and adjacent undergound cabling, which account for an additional ~604 ha of ground disturbance (or 64% of the total increase specifically relating to access tracks and adjacent underground cabling within the wind farm); and

- Internal and External Transmission Line access tracks, string pads, and pole/tower construction areas, which account for an additional 178 ha of ground disturbance (or 19% of the total increase specifically relating to access tracks and adjacent underground cabling within the wind farm).

It is critical to note that the increase in ground disturbance and associated impacts to native vegetation/habitat including to the Box Gum Woodland CEEC are due primarily to more accurate and realistic assumptions informed by recent construction experience and extensive use of detailed 3D terrain modelling, and not as a result of any major change in the proposed infrastructure layout.

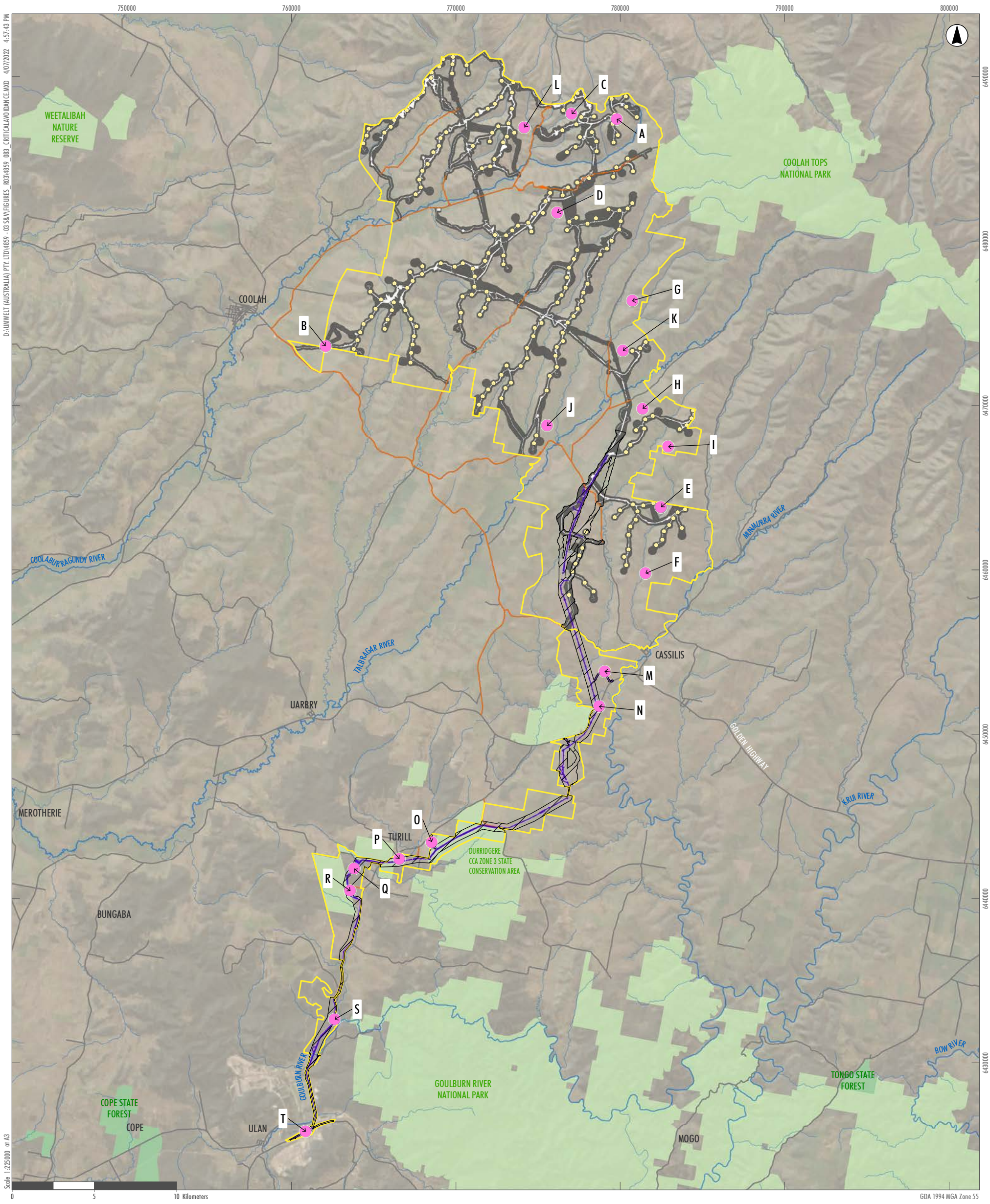
The key changes to the Approved Project infrastructure layout, in particular those proposed changes that result in either an increase or decrease in impacts to the Box Gum Woodland CEEC, are listed in **Table 4.2** below. The location of each key change is broadly shown in the overview plan in **Figure 4.1** below.

Table 4.2 Summary of Additional Avoidance Measures

Reference ID (see Figure 4.1)	Design Change/Avoidance/Minimisation Measure	Outcome
n/a	Multiple avoidance/minimisation measures implemented, as described in the Original EIS/RTS	• Development Consent SSD 6696 granted for up to 267 turbines.
n/a	Reduction of 47 turbines to accommodate larger turbines	• Increased ground disturbance based on extensive 3D terrain modelling and more realistic assumptions based on recent construction experience.
n/a	A previous turbine design layout included six wind turbines located on a neighbouring property in the far north western extent of the Modified Project.	• The removal of the three wind turbines avoids impacts to the identified 'habitat corridor' occurring along through that area. See detailed map on Sheets A2, A3 and B2 of **Figure 3.2** in **Appendix A**.
A	Eight turbines (Turbines C11, C14, C17, C19, C20, C21, D60, and D61) relocated in the north east portion of the Project site following extensive biodiversity surveys (North East Turbine Cluster)	• The relocation of 8 x turbines in the North East Turbine Cluster results in an additional ~29.5 ha of ground disturbance, and no additional impacts to Box Gum Woodland CEEC. See detailed map on Sheet A5 and B5 of **Figure 3.4** in **Appendix A**.
B	Removal of Approved Site Access Point #9 (located off Vinegaroy Road) and associated access track to Approved Project Turbine C6-5, and replacement with alternate Site Access Point #113/114 off Vinegaroy Road and associated access track to turbines in the D Cluster	• Increase of ~11.7 ha of ground disturbance and ~9 ha of additional impact to Box Gum Woodland CEEC. • See detailed map on Sheet A4 and B4 of **Figure 3.4** in **Appendix A**.
C	Removal of section of 33 kV overhead cabling in C Cluster east of Pandora Pass Road	• Avoids impact to ~6.5 ha of Box Gum Woodland CEEC. • See detailed map on Sheet A4, A5, B4 and B5 of **Figure 3.4** in **Appendix A**.
D	Removal of section of 33 kV overhead cabling in D Cluster south of State Forest Road	• Avoids impact to ~1.5 ha of Box Gum Woodland CEEC. • See detailed map on C and D Sheets of **Figure 3.4** in **Appendix A**.
E	Removal of 33 kV overhead cabling in F Cluster east of Rotherwood Road	• Avoids impact to ~15.6 ha of Box Gum Woodland CEEC. • See detailed map on Sheets D5, D6, E4 – 6 and F4 – 6 of **Figure 3.4** in **Appendix A**.
F	Removal of access track off Rotherwood Road to F Cluster	• Avoids impact to ~9 ha of Box Gum Woodland CEEC. • See detailed map on Sheets D5, D6, E4 – 6 and F4 – 6 of **Figure 3.4** in **Appendix A**.

Reference ID (see Figure 4.1)	Design Change/Avoidance/Minimisation Measure	Outcome
G	Removal of approved turbine G5-4 (near Bounty Creek Road north of the F Cluster) and associated access track and overhead 33 kV overhead cabling from Bounty Creek Road	• Avoids impact to ~4.5 ha of Box Gum Woodland CEEC. • See detailed map on Sheet C5 of **Figure 3.4** in **Appendix A**.
H	Removal of section of 33 kV overhead cabling in F Cluster east of Yarrawonga Road	• Avoids impact to ~6.3 ha of Box Gum Woodland CEEC. • See detailed map on Sheets C5, D5 and D6 of **Figure 3.4** in **Appendix A**.
I	Removal of section of access track in F Cluster east of Yarrawonga Road	• Avoids impact to ~1.0 ha of Box Gum Woodland CEEC. • See detailed map on Sheets C5, D5 and D6 of **Figure 3.4** in **Appendix A**.
J	Removal of section of access track off Norfolk Road to E Cluster and upgrades to Norfolk Road	• Avoids ground disturbance and vegetation/habitat impacts associated with ~1.3 km of wind farm access track and ~500 m of public road upgrades. • See detailed map on Sheets C4 – 5, D3 – 4, E3 – 4 of **Figure 3.3** in **Appendix A**.
K	Removal of section of 33 kV overhead cabling in the F Cluster east of Bounty Creek Road	• Avoids ground disturbance and vegetation/habitat impacts associated with ~1.2 km of 33 kV overhead cabling. • See detailed map on Sheet Sheets C5, D5 and D6 of **Figure 3.3** in **Appendix A**.
L	Removal of section of 33 kV overhead cabling between the B Cluster and C Cluster east of Bounty Creek Road, west of Pandora Pass Road	• Avoids ground disturbance and vegetation/habitat impacts associated with ~1.1 km of 33 kV overhead cabling. • See detailed map on Sheet A3 – 5 and B2 - 5 of **Figure 3.3** in **Appendix A**.
M	Inclusion of new access track off Golden Highway to construct and maintain the 330 kV External Transmission Line	• Increase of 2.62 ha of impact to Box Gum Woodland CEEC • See detailed map on Sheets G4 – 5 and H4 of **Figure 3.4** in **Appendix A**.
N	Inclusion of new access track off Golden Highway to construct and maintain the 330 kV External Transmission Line	• Increase of 1.32 ha of impact to Box Gum Woodland CEEC • See detailed map on Sheets G4 – 5 and H4 of **Figure 3.4** in **Appendix A**.
O	Inclusion of new access track off Ulan Road to construct and maintain the 330 kV External Transmission Line	• Increase of 0.49 ha of impact to Box Gum Woodland CEEC • See detailed map on Sheets G4 – 5 and H4 of **Figure 3.4** in **Appendix A**.
P	Inclusion of new access track off Ulan Road to construct and maintain the 330 kV External Transmission Line	• No impact to Box Gum Woodland CEEC • See detailed map on Sheets G4 – 5 and H4 of **Figure 3.4** in **Appendix A**.

Reference ID (see Figure 4.1)	Design Change/Avoidance/Minimisation Measure	Outcome
Q	Shift section of External Transmission Line west to minimise potential visual impact and minimise impact to Durridgere State Conservation Area further south, and inclusion of potential concrete batch plant/construction compound/laydown area	• Negligible change in ground disturbance and native vegetation/habitat impacts. • See detailed map on Sheets H4, I2, I3 and J2 of **Figure 3.3** in **Appendix A**.
R	Potential to shift section of External Transmission Line east to avoid impacts to Durridgere State Conservation Area in this location	• Avoid impacts to Durridgere State Conservation Area in this location. • See detailed map on Sheets H4, I2, I3 and J2 of **Figure 3.3** in **Appendix A**.
S	Shift External Transmission Line east to avoid impacts to the land parcel (Lot 751 / DP 1270886) within which Hands on Rock cultural heritage site is located	• Minimise impacts to the land upon which Hands on Rock is located. • See detailed map on Sheet J1 of **Figure 3.3** in **Appendix A**.
T	Inclusion of potential upgrade works to existing TransGrid towers and associated access tracks, as requested by TransGrid	• Increase in ground disturbance. No additional impacts to native vegetation/habitat.



Legend

- Reference IDs
- **Modified Project**
  - Modified Site Boundary
- **Modified Development Corridor**
  - Modified Development Corridor – Wind Farm
  - Modified Development Corridor – External Transmission Line
- Modified Wind Turbines
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 4.1

Liverpool Range Wind Farm: Key Design Changes, Critical Avoidance and Minimisation Measures

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

4.2 Avoidance of Prescribed Impacts

The following impacts are considered 'prescribed impacts' under the BC Regulation:

a. impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other geological features of significance, rocks, human-made structures or non-native vegetation

b. impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

c. impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

d. impacts of wind turbine strikes on threatened and protected animals

e. impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

As outlined in **Section 4.1** above, the Proponent has sought to avoid and minimise the potential impacts on a variety of ecological values primarily through the careful selection of infrastructure locations/alignments and through the detailed design phase once a turbine model and contractor(s) have been selected. The Proponent has sought to locate and design the Indicative Development Footprints within existing disturbed areas wherever possible. A detailed assessment of prescribed impact relating to wind turbine strike is provided in **Appendix G**.

Further detail on the assessment of prescribed impacts is presented in **Section 5.3**.

4.3 Mitigation Measures

Indicative Development Footprints will be finalised once a turbine model and contractor(s) are selected by the Proponent. In doing so, the Proponent will seek to further minimise impacts to biodiversity values. Furthermore, a comprehensive strategy to mitigate the unavoidable impacts of the Project will be prepared and implemented. These measures will be designed and described within the Biodiversity Management Plan (BMP) and Bird and Bat Adaptive Management Plan (BBAMP) that will be prepared in accordance with the relevant conditions of the Development Consent and Federal Approval for the Project (**Section 1.2.2**).

While these management plans have not yet been prepared, the following control measures are considered integral to the mitigation of impacts on the biodiversity features of the Indicative Development Footprints and surrounds and are likely to form part of the final management plans. Remaining consistent with the original assessments (NGH Environmental 2013a, 2013b and 2017) mitigation measures have been developed based on the following over-arching principles:

- avoid impacts where possible
- minimise impacts that could not be sufficiently avoided, and
- offset residual impacts.

Table 4.3 below summarises the potential mitigation measures proposed for the Modified Project including the timing, action, outcome, and responsibility of these measures. It is noted that these are preliminary measures at this point in time based on information currently available and all final mitigation measures will be developed through the detailed design phase. Mitigation measures will be finalised through the preparation and approval of the BMP, BBAMP and Construction Management Plan. As per the relevant approval conditions, all plans will be prepared to the satisfaction of the Secretary, and where required will be prepared in consultation with regulatory agencies and in accordance with all relevant State and

Commonwealth approvals and legislation. Each of these control measures will contribute to the maintenance of habitat quality adjacent to the final Development Footprint.

Appropriate environmental management measures will be undertaken as part of the construction and operation of the Project to minimise the potential for direct and indirect impacts, including:

- water management systems that seek to minimise the potential for damage to flora and fauna habitats from erosion and unnatural flooding events
- erosion and sedimentation control
- noise control systems
- traffic control and speed limits
- dust control measures
- in the event that aviation hazard lighting is required, implement appropriate lighting controls (e.g. use of red lights atop the turbines) to avoid attracting insects, birds and bats.

Table 4.3 Potential Mitigation Measures

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Demarcation of approved Development Footprints and Modified Development Corridors	Prior to clearance and during clearance activities	• Establish construction fencing or nightline (reflective bunting) around remnant vegetation in proximity to the construction footprint. • Particular attention should be made to ensuring that TECs and threatened species habitat that is to be retained is clearly demarcated.	• Ensuring the extent of clearance is understood and visible to all involved contractors. • Minimisation of unnecessary and accidental impacts to surrounding vegetation and habitats. • Ensuring impact thresholds identified for the Project are not compromised. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Supervisor
Back filling and management of underground cable trenches	Ideally on the day of trenching, or at the latest, the day of laying cabling within the trench	• Back-fill trenches using the soil removed for the trench. • Compact the soil following back-filling in accordance with the erosion and run-off controls. • Depending on the location of the trench, stabilise the back-filled soil. • Where the trench occurs within native vegetation, revegetate with local native grasses (i.e. Kangaroo Grass, Wallaby Grass or Spear Grass). • Where the trench occurs in exotic vegetation or disturbed lands, use mulch from chipped vegetation.	• Avoids inadvertent impact to fauna species by species being injured by the trench or trapped within the trench. • Ensures soil stabilisation and minimises risk of erosion and run-off. • Speeds up the recovery of the land. • Secures the stability of the site. • Reduces risk of erosion. • Reduces risk of weed species taking control. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer
Development of a works schedule	Prior to clearance activities	• Document key breeding and/or nursing periods for threatened species known or with high potential to occur in clearing areas. Avoid works causing high disturbance (i.e. vegetation clearing) during these periods where possible.	• Minimisation of impacts to threatened species during critical life cycle events. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Project Manager • Site Environmental Officer

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Installation of Safe Fish Passageway	Prior, during and following clearance activities	• Ensure any construction within or adjacent to the major waterways within the Modified Development Corridor, being Gundare Creek, Coolaburragundy River, Turee Creek, Starkeys Creek, Talbragar River and Goulburn River minimises impacts to fish habitat. • As per Section 3.2.2 of DPI's policy and guidelines for fish habitat conservation and management, the abovementioned waterways are likely to range between Class 1 and Class 3 definition (DPI 2013). • The DPI predicted distribution maps for threatened freshwater fish lists the following waterways within the Project Site as being within the distribution for the respective fish species: - Turill Creek, Darling River Hardyhead population of the Hunter River Catchment - Coolaburragundy River, Turee Creek, Talbragar River, Gundare Creek, Southern Purple Spotted Gudgeon - Coolaburragundy River, Turee Creek, Talbragar River, Eel tailed catfish • As per Section 4.2 of DPI's policy and guidelines for fish habitat conservation and management, construction across any of the abovementioned waterways will require a bridge, arch structure, tunnel, culvert or ford to avoid impacts to the threatened fish species (DPI 2013) listed above.	• Avoidance of impacts to aquatic species and habitats. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer • Site Supervisor

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Pre-clearance and tree-felling protocol for the removal of all key fauna habitat (i.e. hollow-bearing trees, termite mounds, large hollow logs, rock piles, large stick nests)	Prior to clearance and during clearance activities	• Develop and implement a pre-clearance and clearance protocol (incl. tree-felling) for the removal of all key fauna habitat (i.e. hollow-bearing trees, termite mounds, large hollow logs, rock piles, large stick nests). • Inspect all treed vegetation, including scattered paddock trees within final development footprint prior to clearance. • Mark up key fauna habitat (e.g. hollow-bearing trees, termite mounds, large hollow logs, rock piles, large stick nests), to be cleared under the supervision of an ecologist to capture and release fauna.	• Substantially minimise impacts to fauna species, including threatened and non-threatened fauna. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer • Ecologist(s)
Identification of any hollow bearing trees within 50 m of a proposed wind turbine blade tip	Prior to finalisation of development footprint	• Undertake detailed survey to record any hollow bearing trees within 50 m of a proposed wind turbine blade tip.	• Facilitate detailed micrositing, where possible. • Ensure that any micrositing does not move wind turbines closer to existing hollow bearing trees. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent. • Compliance with Condition 8c of the Development Consent, allowing for micrositing (without further approval) as long as the blade tip remains at least 50 m from a HBT.	• Site Environmental Officer • Ecologist(s)
Identification of all hollow bearing trees within and directly adjacent to the proposed external road upgrades design	Prior to finalisation of development footprint	• Undertake detailed survey to record all hollow bearing trees within and directly adjacent to the required public road upgrades design that are potentially impacted by the proposed upgrade works.	• Facilitate detailed avoidance measures, where possible. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer • Ecologist(s)

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Salvage key fauna habitat	During clearance activities	• Where key fauna habitat (e.g. hollow bearing trees, hollow logs, rock piles) occurs in the final Development Footprint but is not required to be impacted through construction work, if possible leave as is. • If it needs to be cleared, move into adjacent vegetation after felling, ensuring it remains within the Modified Development Corridor. • Allow regeneration of canopy and mid-storey flora species to a height permissible underneath the transmission line. • Avoid the mulching of fallen vegetation to avoid smothering of ground-layer flora species.	• Minimise additional impacts to fauna species. • Minimise the clearance of fauna habitat. • Facilitate the maintenance of biodiversity values within the easements. • Creation of fauna habitat. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer
Rehabilitation and revegetating temporary disturbance areas	Proceeding clearance activities	• Revegetate areas of temporary disturbance with previously collected native grasses, prioritising the use of several native grass species with seed locally sourced, ideally from within the Indicative Development Footprints during construction.	• Speeds up the recovery of the land. • Secures the stability of the site. • Reduces risk of erosion. • Reduces risk of weed species taking control. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Project Manager • Site Environmental Officer
Natural regeneration and recruitment of native flora species within the transmission line easement	Proceeding clearance activities	• Allow natural regeneration and recruitment of native flora species within the transmission line easement. • Complete post-construction monitoring within the transmission line easement to confirm regeneration and recruitment is occurring. • Vegetation will need to be maintained to a maximum height of 4 m.	• Facilitate the maintenance of biodiversity values within the easements. • Maintain some level of connectivity for flora and fauna species across the transmission line easement. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer • Ecologist(s)

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Install glider poles (or other suitable measures) within the squirrel glider species polygon where the Project introduces a new separation of remnant vegetation of 40 m or greater	Proceeding clearance activities	• Install glider poles (or other suitable measures) where the Modified Project introduces a new separation of remnant vegetation of 40 m or greater within an intersection of the identified Habitat Corridors (as presented in **Figure 3.2**) and the squirrel glider species polygon (as presented in **Figure 3.11**) . • This is likely to be most relevant in relation to the external transmission line easement, but potentially the wind farm components of the Modified Project.	• Minimises impacts of the Project on connectivity of habitat. • Minimised impacts of the Project on squirrel glider. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer • Ecologist(s)
Installation of artificial nest boxes (or similar habitat augmentation) within proximity to squirrel glider habitat assessed as part of the Project	Proceeding clearance activities	• Installation of artificial nest boxes (or similar habitat augmentation) within the squirrel glider species polygon assessed and impacted as part of the Project. • Artificial nest boxes (or similar habitat augmentation) are to be installed at a ratio of 1:4 for hollow bearing trees removed within the squirrel glider species polygon. Meaning, for every four hollow bearing tree removed within the squirrel glider species polygon, an artificial nest box (or similar habitat augmentation) will be installed.	• Minimises impacts of the Project on connectivity of habitat. • Minimised impacts of the Project on squirrel glider. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Ecologist(s)
Allow a buffer of 100 m between wind turbines and identified raptor nests	Prior to finalisation of the Development Footprint	• Allow a buffer of 100 m between wind turbine blade tips and identified raptor nests.	• Minimise impacts of the Project on raptor species, through limiting risk of turbine strike.	• Project Manager • Site Environmental Officer • Ecologist(s)

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Ausfeld's wattle (*Acacia ausfeldii*) removal and translocation	Prior to finalisation of the Development Footprint; and during construction	• Complete a detailed survey for Ausfeld's wattle (*Acacia ausfeldii*) within the mapped species polygon of the Indicative Development Footprint to determine if the species will be impacted. • If recorded, carefully remove individuals with machinery under supervision by an Ecologist and translocate them within the Modified Development Corridor, but outside of the Development Footprint.	• Avoid direct impacts to the species.	• Project Manager • Site Environmental Officer • Ecologist(s)
Weed management	Construction and operation	• Chemical and physical removal of invasive weed species in accordance with the *New South Wales Control Handbook* (DPI 2018). • Appropriate vehicle and machinery washing and hygiene protocols. • Avoid inadvertent damage or impacts to native species be ensuring all personnel are competent and experienced in the identification of native flora species.	• Minimisation of environmental and noxious weeds in the final Development Footprint. • Minimisation of weed spread from and into the wider locality. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Project Manager • Site Environmental Officer
Avoidance of construction work following heavy rainfall	During Construction	• Avoid construction work following heavy rainfall, particularly on the fine, heavy soils of the valley floor.	• Minimise direct and indirect impacts to soil, vegetation and waterways. • Minimise the risk of vehicles and/or machinery being bogged.	• Project Manager • Site Environmental Officer
Avoid construction within waterways when heavy rainfall is predicted to occur	During Construction	• Avoid construction within waterways when heavy rainfall is predicted to occur.	• Minimise direct and indirect impacts to soil and waterways.	• Project Manager • Site Environmental Officer

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Sediment and erosion control	During and proceeding construction	• Implement sediment and erosion control measures in accordance with best practice guidelines.	• Minimise sediment pollution. • Minimise erosion of soils. • Minimise impacts to waterways and habitats. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Site Environmental Officer
Chemical and pollutant spill plan	During and construction and operation	• Implement a spill plan to prevent chemical and pollutant run off.	• Minimise impacts to waterways.	• Site Environmental Officer
Fencing and access control	Construction and operation	• Fencing constructed for the Project will not include barbed wire on the top line of the fence, unless required by authorities.	• Provides for access control to avoid unwanted human interference and disturbance to non-operational areas. • Minimisation of impacts to native fauna species from the use of barbed-wire fences, particularly the squirrel glider.	• Project Manager • Site Supervisor
Bushfire management	Construction and operation	• Bushfire management will consider asset protection as well as the sensitivities of threatened species and threatened ecological communities.	• Protect life and property, while supporting appropriate conditions for the existing ecological features. • Facilitate addressing Condition 21 (Biodiversity Management Plan) of the Development Consent.	• Project Manager • Site Environmental Officer

Measure	Timing	Proposed Techniques	Outcome	Responsibility
Avifauna collision with transmission lines	Construction and operation	• This measure will be considered further during the preparation of the BBAMP and will only be considered should the current research and literature support the approach. • Install conspicuous markers on the transmission line wires where the proposed easement traverses through remnant forests and woodlands. • Installation of markers is not required where the transmission line occurs through grasslands.	• Minimise direct impacts to avifauna species known to be susceptible to injury/death caused by interaction with transmission line wire, in particular white-throated needletail.	• Project Manager • Site Supervisor • Transmission line operator
Proposed research and/or monitoring project to investigate impact mitigation measures in relation to the impact of blade strike on native bird and bat species	Operation	• These measures will be determined in consultation with BCD and industry bodies and will be prepared as part of the BBAMP.	• Potentially reducing the risk and rate of blade strike/barotrauma to avifauna species.	• Project Manager • Site Supervisor • Ecologist

It is not considered likely that any of these measures have a risk of failure if implemented correctly during the periods specified, or that significant residual impacts are likely to occur. The consequences of potential residual impacts (i.e., minor changes to habitat quality in surrounding areas) are considered to be low, due to the existing disturbed nature of the Modified Development Corridor and public road corridors through historic and current land management practices.

Further detail on the management strategies which are proposed for the BMP and BBAMP is provided in **Table 4.4.** Umwelt note that these methods and measures are preliminary in nature, and the final BMP and BBAMP will be subject to potential changes in the information provided below.

Table 4.4 Preliminary Methods and Actions for BMP and BBAMP

Feature	BMP	BBAMP
Baseline data	The BMP will utilise the following data: • Surveys and associated results of the original approval and Modified Project.	The BBAMP will utilise the following data: • Surveys and associated results of the original approval and Modified Project. • Baseline bird and bat surveys should be completed following consultation with BCS.
Seasonal changes	The timing of monitoring and management components will be defined in the BMP based on known appropriate seasonal conditions specified by the BAM for the flora and fauna entities being addressed.	The timing of monitoring and management components will be defined in the BBAMP, with increased occurrence of some components to coincide with known seasonal peaks in numbers of key species covered by the BBAMP. It is expected that baseline data will be required across 12 months or more specifically within four seasons.
Monitoring methods	Ecological monitoring program to be developed which identifies at a minimum: • ensure the persistence of BC Act and EPBC Act listed CEECs within the partial direct impacts within the transmission line easements. • site vegetation condition • presence of threatened species • evidence of erosion • occurrences of weeds and feral fauna • human disturbance. Monitoring will inform further requirements for corrective actions to be undertaken.	• Post-construction bird and bat survey programs must relate to the timing, location, and effort of the baseline surveys. This will allow before and after analysis of data. • Carcass searches will be undertaken in a manner that accounts for variables which affect detectability of carcasses. They will be conducted regularly, with increase in searches to coincide with peak numbers of key species known to occur in the area. The design of these searches will consider: o Frequency of searches o Number of turbines to be searched o Radius around turbines to be searched o Influence of vegetation structure within searched areas on carcass detectability o Effectiveness of human observers and dogs o Carcass removal rates by scavengers.
Trigger values	Trigger values will be defined in the BMP and will be generated for the threatened (and significant) ecological communities, populations and species identified in **Sections 3.3**and **3.4**.	Trigger values will be defined in the BBAMP and will be generated for the following species the species identified to have a High or Moderate overall risk rating, as presented in **Section 5.3.5**

Feature	BMP	BBAMP
Management actions	The BMP will provide detailed management actions including actions specifically addressing: • disruption to connections between suitable habitat for fauna foraging • implementing an integrated feral animal monitoring and control program targeting cats and foxes. These management actions will be prepared in consultation with BCS.	Management actions will include: • carrion removal program to reduce the likelihood of raptors accessing carrion on the ground below wind turbines • pest animal control • raptor perch management • lighting and deterrents These management actions will be prepared in consultation with BCS.
Measurement of impacts	The information collected during monitoring events conducted under the BMP will be used to analyse condition trends over time, to assess initial and ongoing impacts of the Project. These may be used to inform further action to be undertaken during ongoing operations to reduce the extent of indirect impacts.	The information collected during baseline data and monitoring events conducted under the BBAMP will be used to develop triggers for impacts on threatened and non-threatened species, analyse condition trends over time, to assess initial and ongoing impacts of the Project. These may be used to inform further action to be talking during ongoing operations to reduce the extent of indirect impacts.

5.0 Assessment of Impacts

5.1 Impacts on Native Vegetation and Habitat

5.1.1 Direct Impacts

The development of the Project will result in direct impacts on biodiversity values. Direct impacts include the loss of vegetation and fauna habitats as a result of clearance works and subsequent operation of the wind farm. The Modified Development Corridor contains a range of habitat features (such as hollow-bearing trees, fallen logs and threatened flora species habitat) and species-credit species have been identified to occur within the Indicative Development Footprints.

Table 5.1 below outlines the direct impacts on native vegetation, which totals approximately 1,650.4 ha. This includes 772.9 ha of vegetation described as 'Exotic' in condition, being Vegetation Zones 8 and 12. While these two vegetation zones have been identified as 'exotic' due to their degraded nature, they still meet the formal definition of 'native vegetation' as per Section 60B under the *Location Land Services Act 2013*.

The impacts are presented based on the IBRA Subregion and the portion of the Indicative Development Footprints that occur within that subregion. Impact calculations do not include the 42.1 ha of Category 1 – Exempt Land or 97.4 ha of cleared land (incl. roads, tracks, and waterbodies). An overview of the Indicative Development Footprints are shown in **Figure 1.4**, and the tiled figure set is provided in **Appendix A**. Avoidance and minimisation measures associated with minimising the impacts of these direct impacts are discussed in **Section 4.0** above.

The summary of change in direct impacts associated with the Modified Project compared with the Approved Project is presented below in **Table 5.2**. While the Modified Project proposes an increased Indicative Development Footprint compared with the footprint assessed for the Approved Project (SSD 6696) there are a number of important factors that must be considered.

- As detailed in **Section 1.2** it is important to clarify that the Approved Project (SSD 6696) did not include an impact assessment of the required external public road upgrades. The Modified Project has captured impacts associated with these critical infrastructure upgrades.
- The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.
- As per Consent Condition 19(a) (SSD 6696), the Modified Project has updated "the baseline mapping of the vegetation and key habitat within the final disturbance area". Through the completion of this process, there has been refinement of the PCT, Vegetation Zone, TEC and threatened species habitat mapping across the Modified Project. This has included:
    - re-allocation of PCTs (of those identified in the Approved Project)
    - identification of new PCTs (not identified in the Approved Project)
    - detailed analysis of 85 BAM Vegetation Integrity Plots to determine their alignment, or otherwise, of Box Gum Woodland CEECs listed under the BC Act and EPBC Act
    - preparing species-credit polygons in accordance BAM (DPE 2020)

- As can be seen in **Table 5.2** below, impacts to threatened species (species-credit species and ecosystem-credit species) were not assessed in detail for the Approved Project (SSD 6696) (Determination Assessment Report (DPIE 2018b)). Instead, these species were assessed using a uniform area of habitat. As the Modified Project has assessed impacts to species-credit species in accordance with BAM (DPE 2020), species polygons were naturally going to increase in size due to the rigour of BAM.

- The areas of impact for the Approved Project (SSD 6696) presented in the Determination Assessment Report (DPIE 2018b) do not describe condition zones for each of the vegetation communities identified and assessed. Furthermore, the areas of impact presented in the Determination Assessment Report (DPIE 2018b) are inconsistent with those presented in the Biodiversity Assessment Addendum (NGH Environmental 2017), nor does the Determination Assessment Report reference where the areas of impact are derived from. In the absence of the areas of impact presented in the Determination Assessment Report (DPIE 2018b) including condition zones or referencing an approval document with consistent areas of impact, it is not possible to make like-for-like comparisons of impacts for the Modified Project to that of the Approved Project. This is primarily applicable for those PCTs with multiple condition zones, being PCT 483 and PCT 488. All other PCTs have only been identified as occurring in a single condition.

Due to factors summarised above, it fundamentally limits the ability to directly compare the impacts identified in the Approved Project (SSD 6696) with those of the Modified Project.

In addition, it is worthy to note that in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project (see **Section 1.2**), the External Transmission Line component would no longer be required and all impacts on biodiversity values associated with the External Transmission Line would no longer apply. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 216 ha of various PCTs including approximately 97 ha of impact to NSW Box Gum Woodland CEEC.

Table 5.1 Direct Impacts of the Proposed Modified Project on Biodiversity Features

Ecosystem/ Species	Modified Project - Area within the Indicative Development Footprint – Wind Farm (ha)				Modified Project - Area within the Indicative Development Footprint – External Transmission Line (ha)				Modified Project - Area within the Indicative Development Footprint – Public Road Upgrades (ha)				Total (ha)
	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	
Plant Community Type													
PCT 84	4.9	1.6	-	**6.5**	-	-	-	**-**	1.1	0.5	-	**1.6**	**8.1**
PCT 281	0.7	-	-	**0.7**	-	1.5	10.5	**12.0**	-	0.7	-	**0.7**	**13.4**
PCT 395	147.9[1]	1.3	-	**149.2** [1]	18.3 [1]	19.9[1]	3.6[1]	**41.8** [1]	6.0	0.2	0.1	**6.3**	**197.3**
PCT 479	-	-	-	**-**	-	16.4	2.9	**19.3**	-	0.7	-	**0.7**	**20.0**
PCT 481	-	-	-	**-**	-	10.4	2.3	**12.7**	-	-	-	**-**	**12.7**
PCT 483	417.3[1]	120.1[1]	-	**537.4** [1]	30.9[1]	7.0[1]	9.1[1]	**47.0** [1]	36.7	47.5	0.1	**84.2**	**668.6**
PCT 488	606.0[1]	7.0[1]	-	**613.0** [1]	-	-	-	**-**	14.6	0.2	-	**14.8**	**627.8**
PCT 490	11.0	-	-	**11.0**	-	-	-	**-**	-	-	-	**-**	**11.0**
PCT 495	7.3	-	-	**7.3**	-	-	-	**-**	-	-	-	**-**	**7.3**
PCT 1661	-	-	-	**-**	-	28.2	24.7	**52.9**	-	0.3	-	**0.3**	**53.2**
PCT 1675	-	-	-	**-**	-	10.1	20.5	**30.6**	-	-	0.4	**0.4**	**31.0**
Species-credit Species Habitats													
Ausfeld's wattle (*Acacia ausfeldii*)	-	-	-	**-**	-	-	10.5	**10.5**	-	-	-	**-**	**10.5**

Ecosystem/ Species	Modified Project - Area within the Indicative Development Footprint – Wind Farm (ha)				Modified Project - Area within the Indicative Development Footprint – External Transmission Line (ha)				Modified Project - Area within the Indicative Development Footprint – Public Road Upgrades (ha)				Total (ha)
	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	
silky swainson-pea (*Swainsona sericea*)	-	-	-	**-**	-	19.4	-	**19.4**	-	-	-	**-**	**19.4**
glossy black-cockatoo (breeding) (*Calyptorhynchus lathami*)	-	-	-	**-**	-	0.1	0.7	**0.8**	-	0.1	0.1	**0.2**	**1.0**
large-eared pied bat (*Chalinolobus dwyeri*)	265.6	-	-	**265.6**	-	0.4	12.2	**12.6**	6.2	-	0.1	**6.3**	**284.5**
square-tailed Kite (Breeding) (*Lophoictinia isura*)	-	-	-	**-**	-	-	1.4	**1.4**	-	-	-	**-**	**1.4**
squirrel glider (*Petaurus norfolcensis*)	164.4	2.6	-	**167.0**	40.0	9.2	24.9	**74.1**	0.8	1.3	0.1	**2.2**	**243.3**

Ecosystem/ Species	Modified Project - Area within the Indicative Development Footprint – Wind Farm (ha)				Modified Project - Area within the Indicative Development Footprint – External Transmission Line (ha)				Modified Project - Area within the Indicative Development Footprint – Public Road Upgrades (ha)				Total (ha)
	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	BBS – Liverpool Range IBRA	BBS – Pilliga IBRA	SB - Kerrabee IBRA	Sub-total	
eastern cave bat (*Vespadelus troughtoni*)	267.7	-	-	**267.7**	-	0.4	12.2	**12.6**	6.2	-	0.1	**6.3**	**286.6**

BBS – Brigalow Belt South IBRA Region; SB – Sydney Basin IBRA Region

[1] Denotes vegetation that occurs within the transmission line Balance of Easement, either within the Indicative Development Footprint – Wind Farm or Indicative Development Footprint – External Transmission Line. Areas indicated by this denotation includes the areas exposed to direct ground disturbance and vegetation removal. Impacts have only been assessed for vegetation zones within the transmission line easement that are currently or have the potential to grow to four metres in height, or higher. PCT 395 is a derived native grassland condition and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement (i.e., vegetation impacts have been calculated for poles, string pads…etc associated with the transmission line). Vegetation Zone 8 (PCT 483) and Vegetation Zone 12 (PCT 488) are primarily exotic grasslands with scattered trees and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement.

Table 5.2 Summary of Change Between Approved Project and Modified Project

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
Ecosystem							
PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	6.47	Moderate/Good	6.5	-	1.6	8.1	**+1.63**

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	18.94	Moderate/Good	0.7	12.0	0.7	13.4	**-5.54**
PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	77.26	*Moderate/Good*	149.2[4]	41.8[4]	6.3	197.3	**+120.04**
PCT 467 – Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)	3.30	n/a	n/a	n/a	n/a	-	**-3.30**
PCT 477 – Inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion	31.51	n/a	n/a	n/a	n/a	-	**-31.51**
PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	42.65	*Moderate/Good*	-	19.3	0.7	20.0	**-22.65**

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
PCT 480 – Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion	10.32	n/a	n/a	n/a	n/a	-	**-10.32**
PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	30.04	*Moderate/Good*	-	12.7	-	12.7	**-17.34**
PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	10.37[6]	*Moderate/Good*	23.3	5.4[4]	-	28.7	**+18.33**
PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	90.73[7]	*Low*	191.3	39.2	10.9	241.4	**+150.67**
PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	171.7[8]	*Exotic*	322.8[4]	2.3	73.4	398.5	**+226.8**
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	70.16[9]	*Moderate/Good*	95.9	-	-	95.9	**+25.74**

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	n/a	*Moderate/Good-Shrubby*	0.5	-	-	0.5	**+0.5**
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	n/a	*Low*	152.2	-	4.9	157.1	**+157.1**
PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	171.7[8]	Exotic	364.4[4]	-	10.0	374.4	**+202.7**
PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion	3.12	*Moderate/Good*	11.0	-	-	11.0	**+7.88**
PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion	1.51	*Moderate/Good*	7.3	-	-	7.3	**+5.79**
PCT 278 – Blakely's Red Gum – Grey Box – White Box – Riparian Woodland	3.55	n/a	n/a	n/a	n/a	-	**-3.55**
PCT 478 – Sandstone Forest – Red Ironbark dominant	1.20	n/a	n/a	n/a	n/a	-	**-1.2**

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
PCT 588 – White Box – Cypress Pine Shrubby Open Forest	0.36	n/a	n/a	n/a	n/a	-	**-0.36**
PCT 1661 - Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	n/a	*Moderate/Good*	-	52.9	0.3	53.2	**+53.2**
PCT 1675 - Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	n/a	*Moderate/Good*	-	30.6	0.4	31.0	**+31.0**
Sub-total (ha)	744.89		1,325.1	216.3	109.0	1,650.40	**+905.51**
Species							
Ausfeld's wattle	-	n/a	-	10.5	-	10.5	**+10.5**
silky swainson-pea	1.0	n/a	-	19.4	-	19.4	**+18.4**
glossy black-cockatoo	19.0	n/a	-	0.8	0.2	1.0	**-18.0**
large-eared pied bat	19.0	n/a	265.6	12.6	6.3	284.5	**+265.5**
square-tailed kite	-	n/a	-	1.4	-	1.4	**+1.4**
squirrel glider	19.0	n/a	167.0	74.1	2.2	243.3	**+224.3**
eastern cave bat	19.0	n/a	267.7	12.6	6.3	286.6	**+267.6**
black-chinned honeyeater[2]	19.0	n/a	-	-	-	-	**-**
powerful owl[3]	19.0	n/a	-	-	-	-	**-**
corben's long-eared bat[2]	19.0	n/a	-	-	-	-	**-**

PCT/Species	Approved Project Area of Impact (ha)[1, 5]	Umwelt Condition Class	Modified Project Area of Indicative Development Footprint – Wind Farm	Modified Project Area of Indicative Development Footprint – External Transmission Line	Modified Project Area of Indicative Development Footprint – Public Road Upgrades	Total	Order of Change between Original Approval and Modified Project
grey-crowned babbler[2]	19.0	n/a	-	-	-	-	-
diamond firetail[2]	19.0	n/a	-	-	-	-	-
masked owl[3]	19.0	n/a	-	-	-	-	-
eastern bentwing bat	19.0	n/a	-	-	-	-	-

[1] Determination Assessment Report (DPIE 2018b)

[2] This species is an Ecosystem Credit Species under BAM (DPIE 2020a) and as such does not require an individual assessment of habitat

[3] This species is a Dual Credit Species (Ecosystem and Species) (DPIE 2020a), however only breeding habitat is recognised as the species credit component and no breeding habitat for the species were recorded

[4] Denotes vegetation that occurs within the transmission line Balance of Easement, either within the Indicative Development Footprint – Wind Farm or Indicative Development Footprint – External Transmission Line. Areas indicated by this denotation includes the areas exposed to direct ground disturbance and vegetation removal. Impacts have only been assessed for vegetation zones within the transmission line easement that are currently or have the potential to grow to four metres in height, or higher. PCT 395 is a derived native grassland condition and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement (i.e. vegetation impacts have been calculated for poles, string pads and other infrastructure associated with the transmission line). Vegetation Zone 8 (PCT 483) and Vegetation Zone 12 (PCT 488) are primarily exotic grasslands with scattered trees and will not be subject to direct impacts as a result of the construction and operation of the transmission line easement; n/a – represents those PCTs that were not identified as part of the current BDAR.

[5] The areas of impact for the Approved Project (SSD 6696) presented in the Determination Assessment Report (DPIE 2018b) do not describe condition zones for each of the vegetation communities identified and assessed. Furthermore, the areas of impact presented in the Determination Assessment Report (DPIE 2018b) are inconsistent with those presented in the Biodiversity Assessment Addendum (NGH Environmental 2017), nor does the Determination Assessment Report reference where the areas of impact are derived from. In the absence of the areas of impact presented in the Determination Assessment Report (DPIE 2018b) including condition zones or referencing an approval document with consistent areas of impact, it is not possible to make like-for-like comparisons of impacts for the Modified Project to that of the Approved Project. This is primarily applicable for those PCTs with multiple condition zones, being PCT 483 and PCT 488. All other PCTs have only been identified as occurring in a single condition.

[6] Table 13 of Determination Assessment Report (DPIE 2018b) confirms that 10.37 ha of the 101.1 ha total impacts to PCT 483 conformed with the Commonwealth Box Gum Woodland CEEC. On that basis, Umwelt compared the approved impact of 10.37 ha to PCT 483 - Moderate/Good condition zone, being Vegetation Zone 6, of the Modified Project.

[7] Comparison of the PCT 483 – Low condition zone, being Vegetation Zone 7, of the Modified Project is based on the difference between the above described 10.37 ha of Commonwealth Box Gum Woodland CEEC and the total impacts to PCT 483.

[8] Table 13 of the Determination Assessment Report (DPIE 2018b) does not allocate the approved impacts of 343.4 ha Exotic vegetation to a PCT. On that basis, Umwelt compared the approved impacts to exotic vegetation to PCT 483 – Exotic (Vegetation Zone 8) and PCT 488 – Exotic (Vegetation Zone 12) by splitting the approved impact equally.

[9] Table 13 of the Determination Assessment Report (DPIE 2018b) does not identify whether the approved impacts to PCT 488 occurs across multiple condition zones. While it does identify two areas of impact for the PCT 488, being 1.05 ha and 69.11 ha, these impacts occur in different Catchment Management Areas (CMAs). On that basis, Umwelt compared the approved impact of PCT 488 entirely to PCT 488 – Moderate/Good condition zone, being Vegetation Zone 9, of the Modified Project.

5.1.2 Balance of Easement Partial Direct Impacts

The Proponent confirmed the easement specifications required for the project for the future operation of the proposed transmission lines, through consultation with Transgrid as the transmission networks service provider (TNSP) for the region.

Transgrid's easement guidelines recommend an approximately 60 m wide easement for the transmission line within vegetation that is currently or can grow equal to or greater than 4 m tall. For vegetation zones that meet these characteristics, partial direct impacts have been calculated within the 60 m wide easement (excluding the pole and string pad locations) as per Section 8.1.1.2 of the BAM (DPIE 2020a). This section of the BAM (DPIE 2020a) specifically states that '*future values of the attributes may be amended to reflect the impacts from partially clearing a vegetation zone, including areas such as…easements*'.

This is also referred to as 'Balance of Easement'. This means that the future vegetation integrity score for these applicable areas is not reduced to the default score of 0 (no biodiversity value).

Pole and string pad locations, and access tracks associated with the transmission line are included in the direct impact calculations outlines in **Section 5.1.1**.

Within these easements, a proportion of biodiversity values will remain within select vegetation zones following the construction and during the operation of the wind farm. All Vegetation Zones, expect Vegetation Zone 3, Vegetation Zone 8 and Vegetation Zone 12 were assigned partial impact values where they occurred within the transmission line easements (i.e., Vegetation Zones 1, 2, 4 – 7, 9 – 16). The extent of partial direct impact assessed for each of the applicable vegetation zone is presented below in **Table 5.3**.

The process of constructing a transmission line easement in this manner (i.e. allowing biodiversity values to remain) is substantially more time consuming, complex to manage, requires ongoing monitoring and management and is ultimately more costly to construct. This demonstrates the level to which the proponent is committed to minimising the impact of the Modified Project on biodiversity values, particularly in relation to Box Gum Woodland CEEC (BC Act and EPBC Act) and large intact patches of remnant vegetation which occur along the majority of the External Transmission Line.

This section assesses the Partial Direct Impacts of the Balance of Easement as a whole. However, in total 220.1 ha of vegetation is assessed as being impacted within the Balance of Easements within the internal and external transmission lines. A breakdown of this is provided below:

- 101.6 ha within Internal Balance of Easement impacts on vegetation >4 m, and
- 118.5 ha within the External Balance of Easement impacts on vegetation >4 m.

Partial direct impacts have been assessed for Vegetation Zones 2, 6 and 7 within the transmission line easements of the Modified Project. As presented in **Section 3.3.3.1**, Vegetation Zones 2, 6 and 7 were identified as conforming with NSW Box Gum Woodland CEEC under the BC Act and Vegetation Zones 2 and 7 also conform with Commonwealth Box Gum Woodland CEEC under the EPBC Act (refer to **Section 3.3.3.2**). Given the ecological sensitivity of these three Vegetation Zones, strict construction and post-construction monitoring protocols will be implemented where partial direct impacts have been assessed to ensure the respective CEECs persist. This will include management actions as well as monitoring activities. The detail of such protocols are summarised in **Section 4.3**, but will be detailed through the preparation of the Biodiversity Management Plan.

Table 5.3 Partial Direct Impacts per Vegetation Zone

Vegetation Zone / IBRA Sub-region	Partial Direct Impact (ha)	Full Direct Impact (ha)	Total Impacts (ha)
BBS - Liverpool			
VZ 1	2.9	3.1	6.0
VZ 2	0.7	-	0.7
VZ 6	7.8	20.7	28.5
VZ 7	48.1	133.1	181.2
VZ 9	16.8	77.4	94.2
VZ 10	0.5	-	0.5
VZ 11	39.7	117.3	157.0
Sub-total (ha)	**116.5**	**351.6**	**468.1**
BBS - Pilliga			
VZ 1	0.8	1.3	2.1
VZ 2	0.8	1.4	2.2
VZ 4	11.3	5.7	17.0
VZ 5	4.7	5.7	10.4
VZ 7	11.8	40.1	51.9
VZ 15	20.4	8.1	28.5
VZ 16	7.5	2.6	10.1
Sub-total (ha)	**57.3**	**64.9**	**122.2**
SB - Kerrabee			
VZ 2	6.9	3.6	10.5
VZ 4	1.8	1.0	2.8
VZ 5	1.2	1.1	2.3
VZ 6	0.2	-	0.2
VZ 7	5.4	2.9	8.3
VZ 15	16.2	8.5	24.7
VZ 16	14.6	6.3	20.9
Sub-total (ha)	**46.3**	**23.4**	**69.7**
Total (ha)	**220.1**	**439.9**	**660.0**

Umwelt have carefully considered the extent of decline in each of the three assessment components of the BAM Credit Calculator (Composition, Structure and Function), for the relevant vegetation zones, and applied settings in each of the applicable attributes for each of the assessment components as per the detail provided above in **Table 5.4**. Through the application of these settings, the BAM Credit Calculator uses the equations in Appendix H (of the BAM) as per the requirements of Section 8.1.12 of the BAM (DPIE 2020a) to determine the 'Future Vegetation Integrity Score'.

Umwelt has considered the application of balance of easement partial direct impacts within particular sections of the proposed transmission line, in order to provide a conservative assessment. This has only been undertaken where there is confidence that biodiversity values will persist. This confidence is based on Umwelt experience assessing other transmission line easements within NSW where biodiversity values have been confirmed, including TECs, to persist following the construction of the transmission line and its associated easement.

A range of impact assessment and monitoring projects in transmission line easements demonstrate that biodiversity values can be maintained or improved following the construction works within an easement. Review of plot data indicates a reasonable total species diversity (30 – 56 species), dominated by native species (66 – 71 per cent). Native species diversity across the plots ranged from 20 to 40 flora species, which included grasses, forbs and ferns. In 67% of the floristic plots analysed, a canopy species was recorded as persisting in the landscape. Native grasses dominated the vegetation composition, while low numbers of hardy native shrub and forb species also persist. Fallen logs were recorded in 33% of the floristic plots, however we note the remaining floristic plots may have support logs but they will not have been recorded if less than 10 cm in diameter and 50 cm in length.

This approach is consistent with the approach that was applied by Umwelt for the BDAR that was prepared in support of the Modification Application (Mod 1) for the Rye Park Wind Farm project (SSD 6693) (Umwelt 2020). The Rye Park Wind Farm Project Modification Application (Mod 1) and referral under the EPBC Act (EPBC 2020/8837) were granted approval on 15 April 2021 and 1 June 2021 respectively, based on the BDAR (Umwelt 2020) and subsequent response to submissions documentation (Umwelt 2021).

The values used for partial impacts are presented below in **Table 5.4**.

Table 5.4 Partial Direct Impact Values

Attribute	CCS	SCS	FCS
Tree	Same as original	5 per cent of original	
Shrub	Same as original	25 per cent of original	
Grass and Grass Like	50 per cent of original	50 per cent of original	
Forb	50 per cent of original	5 per cent of original	
Fern	50 per cent of original	5 per cent of original	
Other	50 per cent of original	5 per cent of original	
Number of Large Trees			Default
Litter Cover			Same as original
Coarse Woody Debris			Same as original
Stem Size Class			1
Regeneration stems <5cm DBH			Present
High Threat Weed Cover			Same as original

CCS – Composition Condition Score, SCS – Structure Condition Score, FCS – Function Condition Score

Full detail of the partial assessment for each of the applicable vegetation zones, including current and future integrity scores is provided in **Appendix E**.

5.1.3 Indirect Impacts

The Project is likely to result in additional indirect impacts on biodiversity values of surrounding lands. In particular:

- erosion
- dust pollution
- noise, vibration, and activity during construction works
- pollution risks associated with use of concrete, fuels and lubricants and construction chemicals
- weed and feral animal encroachment.

These potential impacts on biodiversity will vary depending on the type of impact, the duration and frequency of the impact and the ability of the biodiversity features to respond to these changes. However, these indirect impacts are considered to be manageable with appropriate management and mitigation measures that would be formalised through the required management plans, many of which are described above in **Section 4.0**.

Given the long and linear extent of the Modified Development Corridor (approximately 68 kilometres in length from the northern tip of the wind farm to the southern tip of the transmission line) the indirect impacts listed above are likely to be of low magnitude temporally and spatially.

This position remains broadly consistent with the original assessment of indirect and peripheral impacts considered as part of the original Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017). Despite the increased extent of ground disturbance and vegetation removal proposed by the Modified Project, the predicted indirect and peripheral impacts remain unchanged in nature and extent from the Approved Project.

Further detail on the indirect impacts is provided below, and in the Modification Application Report where relevant.

5.1.3.1 Erosion

The extent of works proposed by the Modified Project has the potential to result in indirect impacts to biodiversity values through erosion. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan (BMP) that will be required to be prepared and finalised prior to construction. The changes to the Approved Project proposed by the Modified Project do not present an increased risk in the likelihood or magnitude of these indirect impacts.

The extent and risk of indirect impacts from erosion associated with the Modified Project is considered to be broadly consistent with those presented, discussed, and assessed as part of the original approval, including Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017).

5.1.3.2 Dust Pollution

The extent of works proposed by the Modified Project has the potential to result in indirect impacts from dust pollution. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan (BMP) that will be required to be prepared and finalised prior to construction. The changes to the Approved Project proposed by the Modified Project do not present an increased risk to biodiversity values from dust pollution.

The extent and risk of indirect impacts from the dust pollution associated with the Modified Project is considered to be broadly consistent with those presented, discussed, and assessed as part of the original approval, including Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017).

5.1.3.3 Noise, Vibration and Activity During Construction

The extent of works proposed by the Modified Project has the potential to result in indirectly impact fauna that may be nesting, foraging, or migrating through noise, vibration and activity during construction. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan (BMP) that will be required to be prepared and finalised prior to construction. The changes to the Approved Project proposed by the Modified Project do not present an increased risk of such indirect impacts.

The extent and risk of indirect impacts from the noise, vibration and activity during construction associated with the Modified Project is considered to be broadly consistent with those presented, discussed, and assessed as part of the original approval, including Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017).

5.1.3.4 Pollution

The extent of works proposed by the Modified Project has the potential to result in indirect impacts to biodiversity values through the inadvertent or accidental pollution of concrete, fuels, lubricants and other construction chemicals and materials. Such indirect impacts can be adequately managed through the implementation of a detailed Biodiversity Management Plan that will be required to be prepared and finalised prior to construction. The changes to the Approved Project proposed by the Modified Project do not present an increased risk in the likelihood or magnitude indirect impacts from pollution.

The extent and risk of indirect impacts from pollutions of chemicals and materials associated with the Modified Project is considered to be broadly consistent with those presented, discussed, and assessed as part of the original approval, including Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017).

5.1.3.5 Weed and Feral Animal Encroachment

Due to the long history of intensive agricultural land use within the wind farm component of the Modified Development Corridor and Indicative Development Footprints, weed species are already widespread in these areas. Therefore, it is unlikely that the Modified Project will inadvertently introduce new weed species. However, the Proponent will implement measures to minimise the risk of introduction of weed species not already present in the landscape.

Conversely, there is a risk that during construction weed species may be introduced to the intact vegetation along the External Transmission Line component of the Modified Development Corridor and Indicative Development Footprints. This vegetation remains relatively free of weed species, particularly high threat weeds.

Therefore, the Proponent will manage any movement of machinery, equipment, and materials to minimise the risk of foreign organic material being imported to intact vegetation proximate to the External Transmission Line prior to undertaking construction works south of the Golden Highway.

The presence of weed species within the Indicative Development Footprints has the potential to decrease the value of extant vegetation to native species. Mitigation measures outlined in **Section 4.3** will be implemented to minimise the potential for weed encroachment into surrounding areas.

Populations of feral fauna species such as goats, foxes, rabbits and cats can increase and quickly populate new areas as a result of disturbance. Clearing, thinning of vegetation and the creation of tracks have the ability to assist the establishment and spread of feral fauna species. However, goats, foxes and rabbits already occur throughout the Modified Development Corridor and Indicative Development Footprints as a result of the historical land use. Of particular relevance for the Project is a large goat population that occurs across the majority of the wind farm component of the Modified Development Corridor and Indicative Development Footprints. It is possible, if not likely, that this population could cause interruptions to construction work by direct interactions with works and also damage to materials. Alternatively, the construction works may deter the population out of the Modified Development Corridor and Indicative Development Footprints and into the adjoining Coolah Tops National Park.

Mitigation measures outlined in **Section 4.3** will minimise the potential for feral animal spread and impacts into surrounding areas as a result of the construction and operation of the wind farm. This will be particularly important with the construction of the transmission line south of the Golden Highway, where the Indicative Development Footprint – External Transmission Line intersects with large continuous patches of remnant vegetation.

Generally, there will be no substantial change to impacts from weeds or feral animals, given that the Project is located within, and adjacent to, a landscape exposed to historical and current agricultural land uses.

The indirect impacts associated with weed and feral animal encroachment that will result from the Modified Project are generally considered to be consistent to those that were presented, discussed, and assessed as part of the original approval, including Biodiversity Assessments (NGH Environmental 2013a, 2013b) and Biodiversity Addendum Report (NGH Environmental 2017).

5.2 Impacts on Threatened Ecological Communities

Table 5.5 presents a summary of these impacts in relation to the applicable vegetation zones, which IBRA region it occurs in (necessary for offsetting purposes) and proportion of TECs within the Modified Development Corridor and Indicative Development Footprints. The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

BC Act

The Modified Project will result in 427.0 ha of impact to the CEEC under the BC Act, broken down as follows:

- Indicative Development Footprint – Wind Farm: 316.7 ha (including 40.9 ha of partial direct impact within the Internal Balance of Easement).
- Indicative Development Footprint – External Transmission Line: 97.1 ha (including 40.7 ha of partial direct impact within the External Balance of Easement).
- Indicative Development Footprint – Public Road Upgrades: 13.2 ha.

A total of 81.6 ha (approximately 19%) will be partially directly impacted within the transmission line easements of the Modified Project. Further detail on the application of the partial impacts is provided in **Section 5.1.2**. Specific construction and post-construction management actions and monitoring programs will be implemented to ensure the CEEC persists in those areas of partial direct impacts.

Approximately 4,152 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the BC Act was identified within the Modified Development Corridor. Therefore, 3,725.0 ha (or nearly 90%) of the CEEC (BC Act) in the Modified Development Corridor will not be impacted by the Modified Project and considerable amounts of the CEEC (BC Act) occur beyond the Modified Development Corridor in the local region.

Impacts to the CEEC under the BC Act is approximately 2.1 x greater (**226.15 ha**) than the impact threshold of 200.85 ha for this TEC as specified in Condition 18(a) of the existing Development Consent. Given the Modified Project Indicative Development Footprints are approximately 2.4 x larger in area than the Approved Project Indicative Development Footprints, the increased impacts identified for the CEEC under the BC Act is proportionate to that assessment.

As mentioned in **Section 1.2,** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 97 ha of NSW Box Gum Woodland CEEC.

EPBC Act

The Modified Project will result in 42.1 ha of impact to the CEEC under the EPBC Act, broken down as follows:

- Indicative Development Footprint – Wind Farm: 24.0 ha (including 4.3 ha of partial direct impact within the Internal Balance of Easement).
- Indicative Development Footprint – External Transmission Line: 17.4 ha (including 12.2 ha of partial direct impact within the External Balance of Easement).
- Indicative Development Footprint – Public Road Upgrades: 0.7 ha.

Of the 42.1 ha of impact identified to the CEEC under the EPBC Act, 16.5 ha (approximately 39%) will be partially directly impacted within the transmission line easements of the Modified Project. Further detail on the application of the partial impacts is provided in **Section 5.1.2**. Specific construction and post-construction management actions and monitoring programs will be implemented to ensure the CEEC persists in those areas of partial direct impacts.

Impacts to the CEEC under the EPBC Act is 31.7 ha greater than the impact threshold of 10.37 ha for this TEC as identified in Condition 1 of the existing Federal Approval (EPBC 2014/7136) and Condition 18(b) of the Development Consent (total area 42.1 ha). It is noted that approximately 362.5 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act was identified within the Modified Development Corridor. Therefore, 320.4 ha (or 88%) of the CEEC (EPBC Act) will not be impacted by the Modified Project and will persist within the Modified Development Corridor, and considerable amounts of the CEEC (EPBC Act) occur beyond the Modified Development Corridor in the local region.

The increase in identified impacts (31.7 ha) to the CEEC under the EPBC Act associated with the Modified Project compared to the existing Federal Approval (EPBC 2014/7136) is not considered to be a result of the Modified Project impacting new areas or better quality and/or intact patches of the CEEC. Instead, Umwelt consider the primary reason for this quantum of change to be an outcome of the detailed analysis of extensive BAM Vegetation Integrity Plots undertaken for the Modified Project against the Listing Advice for the CEEC (TSSC 2006).

Table 5.5 Summary of Threatened Ecological Communities

PCT	Threatened Ecological Community (TEC)			
	BC Act	TEC Area (ha)	EPBC Act	TEC Area (ha)
281	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	13.4[1]	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	13.4[1]
395		143.5		-
483		270.1[1]		28.7[1]
	Total (ha)	427.0	Total (ha)	42.1

[1] proportions of this area of impact are associated with partial direct impacts.

As mentioned in **Section 1.2**, in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 17 ha of impact to Commonwealth Box Gum Woodland CEEC.

5.3 Prescribed Impacts

In accordance with Section 8.3 of BAM (DPIE 2020a), prescribed impacts have been assessed and the outcomes are provided in **Sections 5.3.1** to **5.3.6** below.

5.3.1 Impacts to Threatened Species or Ecological Communities Associated with Karst, Caves, Crevices, Cliffs, Rocks and Other Features of Geological Significance

The Indicative Development Footprints do not contain karst, caves, cliffs, and other features of geological significance. Therefore, habitats associated with these geological features will not be impacted by the Modified Project. However, caves, crevices, cliffs, rocks and potentially other geological features of significance are all likely to occur within 2 km of the Indicative Development Footprints (see **Figure 3.2** for an overview, the tiled figure set is provided in **Appendix A**).

Prescribed impact assessments have been completed for a number of threatened microbat species which are known to associate with karst, caves, crevices, cliffs, rocks, and other features of geological significance. The following species which utilise such habitat have been identified by the Project:

- Large-eared pied bat (*Chalinolobus dwyeri*)
- Eastern cave bat (*Vespadelus troughtoni*)
- Large bent-wing bat (*Miniopterus orainae oceanensis*).

Extensive surveys have been undertaken across the Approved and Modified Development Corridors as part of the original approval and the Modified Project. Surveys included the deployment of Anabat recorders across the Approved and Modified Development Corridors, at ground level as well as at height (installed on existing meteorological masts).

Umwelt used this package of bird and bat survey work and available literature to facilitate the preparation of Prescribed Impact Assessment for the Modified Project in relation to turbine strike on bird and bats (refer to **Appendix G**).

It is recognised that other threatened species of microbat in NSW use karst, caves, crevices, cliffs, rocks, and other features of geological significance for breeding or roosting habitat. However, none of these species were recorded as part of the extensive surveys undertaken and therefore none of these species have been considered further.

In summary, prescribed impacts associated with threatened microbat species associated with karst, caves, crevices, cliffs, rocks, and other geological features of significance remains consistent with the original approval (NGH Environmental 2013a, 2013b and 2017).

5.3.2 Impacts to Threatened Species Associated with Human Made Structures and Non-Native Vegetation

No prescribed impacts are expected to occur to threatened species associated with human-made structures or non-native vegetation.

5.3.3 Impacts to Connectivity of Habitat for Threatened Species or Ecological Communities

As described in **Section 1.1.1**, the Modified Development Corridor is located in a region of NSW that has been extensively modified and disturbed as a result of a long history of agricultural land uses. Specifically, the Modified Development Corridor is comprised of agricultural landscapes on the valley floors and low slopes, with substantial areas of intact vegetation associated with the network of public reserves, upper slopes, and ridgetops.

Broadly speaking, much of the Indicative Development Footprints occur where the connectivity of native vegetation and habitat corridors has been previously compromised by historical agricultural land uses. However, there are specific locations within the Modified Development Corridor where substantial areas of intact native vegetation and associated fauna habitat is recognised to occur. Primarily this occurs to the north (private land) and east (Coolah Tops National Park) of the Wind Farm site; and north, east (Durridgere State Conservation Areas, State Forest land, National Park Land – The Drip, Goulburn River National Park) and west of the External Transmission Line site. It is considered likely that the Modified Project could potentially interrupt the connectivity of threated species, but not threatened ecological communities. These are summarised below in **Table 5.6** and presented in **Figure 5.1.**

As mentioned in **Section 1.2**, in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. In which case, much of the information provided below regarding assessment of the Modified Project's impacts to connectivity of habitat would no longer apply.

Table 5.6 Interruption of Habitat Connectivity

Location of Identified Habitat Connectivity within Indicative Development Footprints	Summary of Interruption
External Transmission Line (along Ulan Road)	• The proposed transmission line easement will introduce a new interruption to habitat connectivity within the Durridgere State Conservation Areas; State Forest land and National Park land near Ulan Road, as well as large intact patches of vegetation connected to these reserves on private land. • The proposed transmission line easement will introduce an interruption approximately 60 m in width. • Within these reserves, the construction of the easement will pose the risk of introducing weed and pathogens into adjacent vegetation and habitat. This will be a focus in the preparation of the required BMP. • This interruption will not remove all biodiversity values within the easement, with canopy, mid-storey and ground-storey flora species able to grow and persist in the easement. However, the height of this vegetation will be a maximum of 4 m generally in accordance with Transgrid guidelines. Therefore, this easement will no longer support mature trees and hollow bearing trees. • While the transmission line easement is a new disruption to habitat connectivity, its width and nature of impact will not completely prevent connection of habitat for flora and fauna species in the region. • The Durridgere State Conservation Area will experience the introduction of approximately 4 km length (approximately 60 m width) of interruption to habitat connectivity. • State Forest land will experience the introduction of approximately 6 km length (approximately 60 m width) of interruption to habitat connectivity. • National Park Land will experience the introduction of approximately 1.2 km length (approximately 60 m width) of interruption to habitat connectivity. • Land owned by the Proponent on the south side of Cliffdale Road will experience the introduction of approximately 1.2 km (approximately 60 m width) of interruption to habitat connectivity. **Importantly, just 1.5 km (4%) of the 36 km of proposed transmission line easement occurring south of the Golden Highway occurs outside of the Approved Development Corridor. In this 1.5 km section located on land owned by the Proponent, the proposed transmission line occurs parallel to the approved route, ranging between 300 m and 400 m to the north west. Therefore, the transmission line easement proposed as part of the Modified Project is considered to be consistent with the Approved Project with regard to impacts on biodiversity values.**

Location of Identified Habitat Connectivity within Indicative Development Footprints	Summary of Interruption
Northern connection corridors along main ridgelines within the Wind Farm Project site	• The Wind Farm site supports several ridges, prominent in the landscape, that comprise treed patches of woodland and forests. These patches however are degraded in their condition, to varying degrees, due to being exposed to a long history of intensive (i.e., cropping) and passive (i.e. stock grazing) agricultural land use. • Three of these ridgelines connect directly with Coolah Tops National Park. • One ridgeline that forms the northern boundary of the Project also connects directly with Coolah Tops National Park, providing a habitat corridor north-west beyond the Project site. Another internal ridgeline connects directly with this corridor. • One ridgeline provides a connection of habitat south west beyond the Project site. **The Modified Project is not considered likely to introduce substantial interruptions to habitat connectivity in these corridors, as the habitat of the corridors is degraded due to historical and current land use. While the Modified Project will involve the direct removal of habitat within the corridors, it is not considered likely to be of the extent where it would prevent the movement of fauna or movement of genetic flora material.**
Interruption of aerial habitat connectivity	• The 220 wind turbines proposed as part of the Modified Project will introduce an interruption of aerial habitat through the introduction of potential turbine strike and barotrauma. • The proposed wind turbines introduce an interruption to 34,636 m^2 of aerial habitat per turbine of OR 762 ha in total. • An assessment of this interruption and its associated potential risk of turbine strike for avifauna is presented below in **Section 5.3.5**. **Importantly, the Approved Project provides for the construction of 267 wind turbines with blades up to 65 metres in length, representing an RSA of 13,273 m^2 of aerial habitat per turbine of or 354 ha in total. Therefore, the interruption of aerial habitat connectivity proposed as part of the Modified Project is not considered to be consistent with the Approved Project with regard to impacts on biodiversity values, however it does represent a consistent proportional increase in impact when compared to the extent of ground disturbance proposed by the Approved Project and Modified Project. Furthermore, turbine spacing has been maximised to provide birds and bats greater opportunity to move through the landscape between the wind turbines, aiming to reduce bird and bat strike. In general, the turbines are a minimum of 500 metres apart, with the majority between 550 metres and 600 metres apart.**

Below is a list of threatened species and ecological communities that could be adversely affected by the interruption of habitat connectivity described above:

- Ausfeld's wattle
- silky swainson-pea
- glossy black-cockatoo
- spotted-tailed quoll
- koala
- squirrel glider
- square-tailed kite
- large bent-winged bat
- large-eared pied bat
- eastern cave bat
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (BC Act)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (EPBC Act).

Of the interruptions to habitat connectivity listed above, those associated with the External Transmission line, south of the Golden Highway, are considered to be most substantial. It is in this location of the Project site where the Project impacts on large intact patches of high quality vegetation. This includes publicly owned reserves as well as land in private ownership. This vegetation provides important habitat connection across the landscape for a range of fauna species and also the passive movement of flora species.

However, the impacts of the interruption are not considered likely to cause significant short-term or long-term impacts to those threatened species and ecological communities listed above. The interruption to these habitat corridors will be most substantial during the construction of the Project, therefore short-term. However, following construction the transmission line easement will be allowed to naturally recruit and regenerate native vegetation to a maximum height of 4 m. The Proponent is committed to facilitating this process and as part of the BMP will design a monitoring program of the easement to ensure habitat connectivity is maintained.

Furthermore, interruptions to the habitat connections identified within the Wind Farm component of the Modified Project are not considered to be substantial and will not cause significant short-term or long-term impacts to those threatened species and ecological communities listed above. They will not introduce interruptions to habitat connectivity to an extent where the movement of fauna species or flora genetic material is restricted or prevented.

The turbine hardstands contain the necessary clearing between adjacent native vegetation and the turbine as a mechanism to deter fauna species (i.e., birds and bats) from being impacted by blade strike, and they will persist as permanent disruptions to the connectivity. Over time, native vegetation and fauna habitat will return to the access tracks, underground cabling and transmission line disturbance areas and adjoining land. In such circumstances the indirect impacts on connectivity and habitat corridors is considered to be reduced.

In conclusion, the indirect impacts to connectivity and fragmentation that will result from the Modified Project are not considered to be inconsistent with those that were presented, discussed and assessed as part of the Approved Project. The Indicative Development Footprints are realistic estimates, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design. Furthermore, all impacts will be managed through the various management plans that will be required as part of the development consent.

5.3.4 Impacts to Water Bodies, Water Quality and Hydrological Processes That Sustain Threatened Species and Ecological Communities

No prescribed impacts on water quality or hydrological processes that sustain threatened species and threatened ecological communities are expected to occur.

5.3.5 Impacts to Protected Animals from Wind Turbine Strike

A detailed prescribed impact assessment has been prepared to consider the potential impacts associated with turbine strike and barotrauma on protected bird and bat species. This assessment has been prepared in accordance with Sections 6.1.5 and 8.3.5 of the BAM (DPIE 2020a). The prescribed impact assessment is provided in **Appendix G** and a summary is provided below.

The BAM identifies impacts associated with a wind farm to the flyways and migration routes of bird and bat species as 'prescribed impacts' that require specific assessment in accordance with Section 6 of the BAM (DPIE 2020a). The BDAR is required to have regard to the impacts to species that may use the Project site as a flyway or migration route, including:

(a) resident threatened aerial species

(b) resident raptor species, and

(c) nomadic and migratory species that are likely to fly over the Project site.

Candidate species considered as part of this analysis were selected based on recorded flight data collected during bird and bat utilisation surveys (BBUS) during 2012-2015 (NGH Environmental) and during 2020 by Umwelt at the Project site. The assessment considered 27 species, comprising 17 threatened species (12 bird and five bat species). The 18 species assessed were selected based on them being recorded within the Project site, and the known susceptibility of species to turbine strike and barotrauma based on research and monitoring outcomes from other wind farms in Australia.

5.3.5.1 Species Recorded or Predicted to and Considered in the BBUS Assessment

The following list (**Table 5.7**) of species were either recorded or are predicted to occur in the vicinity of the Project site based on the presence of suitable habitat and the presence of nearby records.

Table 5.7 Candidate Species List

Candidate Species	Recorded at Project site?	Considered Further Due to Likelihood of Impact being Moderate or Above
silvereye (*Zosterops lateralis*)	✓	×
Australian pelican (*Pelecanus conspicillatus*)	✓	×
swamp harrier (*Circus approximans*)	×	×
pied currawong (*Strepera graculina*)	✓	×
Australian magpie (*Gymnorhina tibicen*)	✓	×
white-throated needletail (*Hirundapus caudacutus*)	✓	✓
black-chinned honeyeater (*Melithreptus gularis*)	✓	✓
painted honeyeater (*Certhionyx variegatus*)	✓	✓
superb parrot (*Polytelis swainsonii*)	×	×
wedge-tailed eagle (*Aquila audax*)	✓	✓
little eagle (*Hieraaetus morphnoides*)	×	✓
brown falcon (*Falco berigora*)	✓	✓
spotted harrier (*Circus approximans*)	×	×
square-tailed kite (*Lophoictinia isura*)	✓	✓
white-striped freetail bat (*Austronomus australis*)	✓	×
Gould's wattled-bat (*Chalinolobus gouldii*)	✓	×
eastern cave bat (*Vespadelus troughtoni*)	✓	✓
Corben's long-eared bat (*Nyctophilus corbeni*)	✓	✓
large bent-winged bat (*Miniopterus orianae oceanensis*)	✓	✓
yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*)	✓	✓
large-eared pied bat (*Chalinolobus dwyeri*)	✓	✓
barking owl (*Ninox connivens*)	✓	✓
powerful owl (*Ninox strenua*)	✓	✓
masked owl (*Tyto novaehollandiae*)	✓	✓
regent honeyeater (Anthochaera *phrygia*)	×	✓
swift parrot (*Lathamus discolor*)	×	✓
dusky woodswallow (*Artamus cyanopterus*)	✓	✓

5.3.5.2 Prescribed Impact Assessment Summary

To ascertain the likelihood and consequence of impacts on aerial species, a risk-based assessment approach was applied. The assessment was developed with consideration of a comprehensive report completed by the Arthur Riley Institute that aimed to develop a science-based approach to defining key species of birds and bats of concern for wind farm developments in Victoria (Lumsden et al. 2019). The assessment considers the likelihood of blade strike based on recorded flight behaviours and assesses consequence using a range of measures associated with population ecology, abundance, and conservation status.

The results of the risk assessment are summarised in **Table 5.8** below, with six (6) species considered a High risk, 10 species considered to be at Moderate risk and the remaining two (2) species considered a Minor risk of being impacted by turbine strike and barotrauma as a result of the Modified Project.

The resultant risk rating for these species is primarily due to their relative abundance within the Project site, their predicted or observed flight behaviour and/or their known susceptibility to blade strike at wind farms in south-east Australia.

The risk rating for powerful owl, barking owl and large bent-winged bat reflect the likelihood of those species occurring in the Project site, their population sizes and potential to fly within the RSA. The overall risk rating of High for swift parrot and regent honeyeater reflect the very small remaining population sizes, coupled with each species' migratory nature, the extent of habitat fragmentation in the local area and region and the species' critically endangered status. The overall risk rating of High for white-throated needletail largely reflects the High likelihood of collision of birds in the Project site given their known susceptibility to blade strike at other wind farms in Australia.

The interpretation and justification for these results is provided in **Appendix G**.

Table 5.8 Risk Assessment Summary

Common Name	Latin Name	Likelihood	Consequence	Risk Rating
white-throated needletail	*Hirundapus caudacutus*	High	Moderate	High
barking owl	*Ninox connivens*	High	Moderate	High
large bent-winged bat	*Miniopterus orianae oceanensis*	High	Moderate	High
powerful owl	*Ninox stenua*	High	Moderate	High
regent honeyeater	*Anthochaera phrygia*	Moderate	High	High
swift parrot	*Lathamus discolor*	Moderate	High	High
large-eared pied bat	*Chalinolobus dwyeri*	Moderate	Moderate	Moderate
yellow-bellied sheath-tail bat	*Saccolaimus flaviventris*	Moderate	Moderate	Moderate
eastern cave bat	*Vespadelus troughtoni*	Moderate	Moderate	Moderate
Corben's long-eared bat	*Nyctophilus corbeni*	Moderate	Moderate	Moderate
dusky woodswallow	*Artamus cyanopterus*	High	Low	Moderate
wedge-tailed eagle	*Aquila audax*	High	Low	Moderate
black-chinned honeyeater	*Melithreptus gularis*	Moderate	Moderate	Moderate
painted honeyeater	*Grantiella picta*	Moderate	Moderate	Moderate
superb parrot	*Polytelis swainsonii*	Moderate	Moderate	Moderate
little Eagle	*Hieraaetus morphnoides*	Moderate	Moderate	Moderate
brown falcon	*Falco berigora*	Moderate	Low	Minor
square-tailed kite	*Lophoictinia isura*	Low	Moderate	Minor

The prescribed impact assessment outcomes have been compared to the BBUS survey and assessment outcomes of the Approved Project. While the indicative RSA of the Modified Project has increased due to blade length increases, the overall impact of blade strike and barotrauma is considered to be consistent with the Approved Project. The proponent has sought to modify the wind turbine layout to avoid areas of high quality habitat for particular bird and bat species, the slight increase to the minimum blade tip height reduces the potential impact or risk of impact on smaller woodland bird species, and the proponent has modified the wind turbine layout to increase the distance between them and therefore allowing greater distances for avian fauna species to travel within the Project site.

5.3.6 Impacts of Vehicle Strike on Threatened Fauna Species, or Fauna from Part of a Threatened Ecological Community

The Modified Project will result in an increase of vehicle activity through construction of a network of internal access tracks, predominantly between turbine locations but also within the transmission line easement for servicing purposes. These internal access tracks are located on private properties and access will be restricted to landholders and the Proponent's employees and contractors. Internal access tracks will have enforced speed restrictions to adequately reduce the risk of interaction between animals and vehicles.

No new public roads will be constructed for the Modified Project, however multiple sections of existing public roads will be upgraded. The upgrade works will be the responsibility of the Proponent but have been designed in consultation with BCS and relevant LGAs.

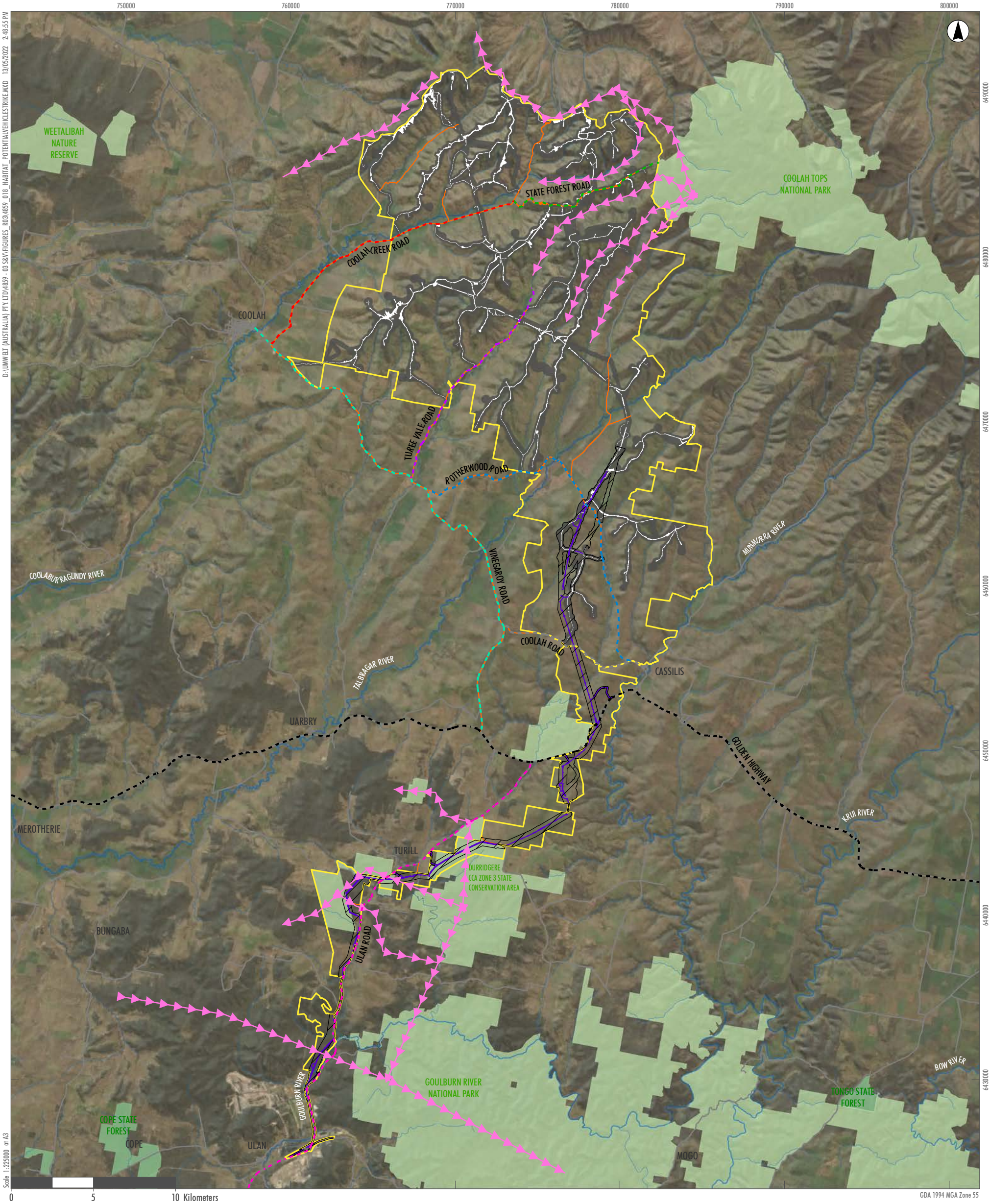
The main public roads of relevance to the Modified Project are Golden Highway, Vinegaroy Road, Ulan Road, Coolah Road, Rotherwood Road, Turee Vale Road, Coolah Creek Road and State Forest Road. Golden Highway, Vinegaroy Road and Ulan Road are primary road networks in the region and already support high vehicle volumes. During the operational phase, the Modified Project is not expected to influence this beyond that standard variation through seasons (i.e., peaks and troughs). However, during construction, there will be a noticeable increase in traffic along these roads, with approximately 320 one-way vehicle movements per day during the peak construction period (estimated at Week 69). Either side of Week 69, the increased usage will be lower than this. Rotherwood Road, Turee Vale Road, Coolah Creek Road and State Forest Road currently support lower vehicle volumes that are largely limited to local residents. Further information relating to the proposed impacts of the Modified Project on these public roads is provided in the Traffic Impact Assessment prepared as part of the Modification Assessment Report.

The Modified Project will result in increased traffic along the key public roads, particularly during construction. As a result Golden Highway, Vinegaroy Road, Ulan Road, Coolah Road, Rotherwood Road, Turee Vale Road, Coolah Creek Road and State Forest Road are all identified as potential impact locations (**Figure 5.1**).

The following threatened fauna species or fauna species that are part of a TEC have been identified as being at risk of vehicle strike:

- glossy black-cockatoo
- spotted-tailed quoll
- koala
- square-tailed kite
- large bent-winged bat
- large-eared pied bat
- eastern cave bat.

Due to the disturbed condition of the Indicative Development Footprints, the fact that the potential impact locations are all existing public roads that will not have a change in speed limit, it is unlikely that any threatened fauna species or fauna that are part of a TEC would be adversely impacted by the increase in vehicle movement within the Indicative Development Footprints. While such impacts were not specifically assessed as part of the Approved Project (NGH Environmental 2013a, 2013b and 2017), the Modified Project is considered to be generally in accordance with the impacts that would been associated with the Approved Project.



Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Habitat Corridor

Road Locations
- COOLAH CREEK ROAD
- COOLAH ROAD
- GOLDEN HIGHWAY
- ROTHERWOOD ROAD
- STATE FOREST ROAD
- TUREE VALE ROAD
- ULAN ROAD
- VINEGAROY ROAD

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 5.1

Liverpool Range Wind Farm, Habitat Connectivity and Potential Vehicle Strike Impact Locations

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019)

5.4 Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible (SAII) must be made in accordance with the principles prescribed in the BC Regulation. Under Section 6.7(2) of the BC Regulations an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct. Section 3.2 of the Biodiversity Assessment Method Operational Manual – Stage 2 (DPIE, 2019a) specifies that the assessor is not required to provide a recommendation on whether the impact is serious and irreversible. Ultimately, the approval authority is responsible for deciding whether an impact is SAII and can approve an SSD which is likely to have serious and irreversible impacts (SAII) as per Section 7.16(3) of the BC Act.

The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These are impacts that:

- will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline, or
- will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size, or
- will impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution, or
- will impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

A number of species-credit species, predicted species and threatened ecological communities generating biodiversity credits for the Modified Project are nominated as candidate SAII entities in the *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact* (DPIE 2019b) and on the DPE website. These are presented in **Table 5.9**, as well as an indication as to whether or not they were recorded within the Modified Development Corridor.

Table 5.9 Species and Threatened Ecological Communities identified by DPE as being at risk of SAIIs

Nominated SAIIs		Recorded within Modified Development Corridor
Threatened Ecological Communities		
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC (BC Act)		✓
Threatened Species		
Anthochaera phrygia	regent honeyeater	×
Chalinolobus dwyeri	*large-eared pied bat*	✓
Lathamus discolor	swift parrot	×
Miniopterus orianae oceanensis	large bent-winged bat	×
Petrogale penicillata	brush-tailed rock-wallaby	×
Prasophyllum sp. Wybong		×
Vespadelus troughtoni	eastern cave bat	✓

Assessments have been conducted against the principles set out in Section 6.7 of the BC Regulations, the additional impact assessment criteria provided in Subsections 9.1.1 and 9.1.2 of the BAM and the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019b) for the three SAII entities recorded within the Modified Development Corridor and identified by DPE as entities likely to be at risk of an SAII. These assessments are provided in **Appendix H**. These assessments provide an outline of the nature and extent of the Modified Project impacts. A summary of these assessments is provided below.

5.4.1 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

At the time of the original assessment and subsequent approval of the Project, the Box Gum Woodland TEC was listed as an Endangered Ecological Community (EEC). On 17 July 2020, the NSW Threatened Species Scientific Committee (TSSC) made a final determination to list the TEC as a CEEC.

NSW Box Gum Woodland CEEC is identified by DPE as an entity at risk of SAII based on Principles 1 and 2 as outlined below:

- Principle 1. The NSW Scientific Committee determination identifies that the community has suffered a very large reduction in geographic distribution and there is evidence that clearing is ongoing and has increased in recent years; with approximately 93% of the pre-1750 area having been cleared (TSSC 2020). The Modified Project Indicative Development Footprints impact a total of 427.0 hectares of the NSW Box Gum Woodland CEEC in the Modified Development Corridor over a construction period of a minimum of three years. The total impact is an increase of 226.15 hectares compared with the impact threshold of 200.85 ha to the then NSW Box Gum Woodland EEC (now CEEC) for the Approved Project (SSD 6696).

- Principle 2. The determination identifies that the ecological community is subject to a number of threatening processes that have caused severe disruption to biotic processes and interactions throughout its range, compositional change is evident, and these processes are likely to cause continuing decline in the future (TSSC 2020, Tozer and Simpson 2020). Of the four vegetation zones (2, 3 [partially], 6 and 7) identified as the NSW Box Gum Woodland CEEC, only Vegetation Zone 2 (13.4 ha, representing 3.1% of the NSW Box Gum Woodland CEEC) and Vegetation Zone 6 (28.7 ha, representing 6.7% of the NSW Box Gum Woodland CEEC) are considered to be in moderate to good condition (totalling 42.1 ha or 9.9% of the total impact area for this NSW Box Gum Woodland CEEC by the Project). The remaining two vegetation zones (3 and 7) representing about 90% of the impacted NSW Box Gum Woodland CEEC are highly disturbed and do not support remnant woodland. These vegetation zones are likely to have been disrupted by management for agricultural production.

- Principle 3. The geographic range of the NSW Box Gum Woodland CEEC measured by extent of occurrence, area of occupancy and threat defined locations, does not meet the criterion related to geographic distribution for listing as a NSW Box Gum Woodland CEEC (TSSC 2020). Accordingly, it is not identified as an entity at risk of SAII due to a very limited geographic distribution.

- Principle 4. The NSW Box Gum Woodland CEEC is likely to respond to measures to improve its vegetation integrity and accordingly is not identified as an entity at risk of SAII due to evidence that it is unlikely to respond to management. The Modified Project has sought to avoid higher quality remnants, minimise fragmentation and provide buffers. Less than 10% of the NSW Box Gum Woodland CEEC to be cleared is in moderate to good condition with the majority of the NSW Box Gum Woodland CEEC (90%) impacted by the Modified Project being either derived native grassland or low condition woodland. During detailed design and through the construction phase, the Modified Project will implement a range of avoidance, minimisation and mitigation measures targeted at further reducing impacts on the NSW Box Gum Woodland CEEC (refer to **Section 4.0**).

A total of 4,152 ha of the NSW Box Gum Woodland CEEC was identified within the Modified Development Corridor, however the Modified Project will impact only a portion of this. The Modified Project Indicative Development Footprints will impact a combined total of approximately 427.0 ha (10.3%) of the NSW Box Gum Woodland CEEC mapped within the Modified Development Corridor. Of the 427.0 ha of impact identified to the NSW Box Gum Woodland CEEC under the BC Act, 81.6 ha (approximately 19%) will be partially directly impacted within the transmission line 'balance of easement'. As described in **Section 5.1.2**, constructing a transmission line easement in this manner (i.e. allowing biodiversity values to remain) is substantially more time consuming, complex to manage, requires ongoing monitoring and management and is ultimately more costly to construct. This demonstrates the level to which the proponent is committed to minimising the impact of the Modified Project on biodiversity values, particularly in relation to Box Gum Woodland CEECs (BC Act and EPBC Act).

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

Of the 427.0 ha of the NSW Box Gum Woodland CEEC estimated to be impacted by the Modified Project, only 42.1 ha (9.9%) is in moderate to good condition woodland, with the remaining 384.9 ha (90.1%) being derived native grasslands and low condition. The moderate to good condition NSW Box Gum Woodland CEEC comprises Vegetation Zones 2 (13.4 ha, representing 3.1% of the NSW Box Gum Woodland CEEC) and 6 (28.7 ha, representing 6.7% of the NSW Box Gum Woodland CEEC). While the remaining Vegetation Zones 3 and 7 are highly disturbed and do not support remnant woodland. Vegetation Zone 3 (143.5 ha conforming with the NSW Box Gum Woodland CEEC, representing 33.6%) is a derived native grassland (however scattered canopy trees do occur) and Vegetation Zone 7 (241.4 ha, representing 56.5%) is considered to be in low condition. Despite hardy native flora species persisting in the understorey,

Vegetation Zone 7 it is characterised by a mostly exotic understorey, with scattered canopy trees occurring throughout.

Photographic examples of the varying conditions of Box Gum Woodland CEEC that were identified within the Modified Development Corridor are provided below in **Plate 5.1** – **Plate 5.4**.

Plate 5.1 Moderate to Good Patch of NSW Box Gum Woodland CEEC within Vegetation Zone 2

Plate 5.2 Moderate to Good Patch of NSW Box Gum Woodland CEEC within Vegetation Zone 6

Plate 5.3 Derived Native Grassland Patch of NSW Box Gum Woodland CEEC within Vegetation Zone 3

Plate 5.4 Low Condition Patch of NSW Box Gum Woodland CEEC within Vegetation Zone 7

Given that 384.9 ha (90.1 %) of the NSW Box Gum Woodland CEEC listed under the BC Act proposed to be impacted within the Indicative Development Footprints is considered to be in either derived native grassland or in low condition, in the absence of the Modified Project, it is likely that this vegetation (at least a portion thereof) will continue to be disturbed and degraded by existing land uses.

The identification of 4,152 ha of the NSW Box Gum Woodland CEEC (including moderate to good, derived native grassland and low condition) within the Modified Development Corridor indicates the extent of the vegetation across the landscape. This represents approximately 33% of the entire Modified Development Corridor. Given the extent of derived native grassland and low condition patches of vegetation conforming with the NSW Box Gum Woodland CEEC (384.9 ha), it is not considered possible for the Modified Project to substantially avoid the NSW Box Gum Woodland CEEC. Despite the proposed removal of 427.0 ha of the NSW Box Gum Woodland CEEC by the Modified Project, a further 3,725.0 ha (or nearly 90%) will remain in the Modified Development Corridor.

The Modified Project has considered the design of access tracks and underground cabling routes (which contribute most to the increased impacts to native vegetation compared with the Approved Project (SSD 6696)) and associated infrastructure by carefully balancing the multiple different objectives and constraints. These include avoiding/minimising ecology and heritage values, minimising ground disturbance by following spurs to the ridgelines and respecting landholder imposed no-go-zones. **Section 4.1** details the efforts of the Proponent to avoid impacts to the NSW Box Gum Woodland CEEC wherever feasibly possible during the detailed design of the Project.

Umwelt has analysed the extent of NSW Box Gum Woodland EEC (now CEEC) assessed as part of the Approved Project (SSD 6696) (NGH Environmental 2013a, 2013b and 2017) and how this compares with the biodiversity assessment and NSW Box Gum Woodland CEEC identified as part of the Modified Project. A summary of this is provided below in **Table 5.10**.

Table 5.10 Species and Threatened Ecological Communities at risk of SAIIs

Comparison of Threatened Ecological Community Mapping of the Approved Project (SSD 6696) (NGH Environmental 2013a, 2013b and 2017)		
Box Gum Woodland EEC [now CEEC]	**Approved Development Corridor (12,405.04 ha)**	**Modified Development Corridor (12,601.7 ha)**
With absent or isolated native tree component	970.15 ha (7.8%)	815.57 ha (6.5%)
With native tree component	901.72 ha (7.3%)	763.14 ha (6.1%)
TOTAL	**1,871.87 ha (15.1%)**	**1,578.71 ha (12.5%)**
Comparison of Umwelt Threatened Ecological Community Mapping (Section 3.3.3.1)		
TOTAL	**3,081.19 ha (24.8%)**	**4,151.96 ha (32.9%)**

Substantial additional vegetation survey and TEC analysis was undertaken as part of this biodiversity assessment to satisfy consent condition 19a of SSD 6696, being updating "the baseline of the vegetation and key habitat". This assessment identified a discrepancy between the revised extent of NSW Box Gum Woodland CEEC mapping in the Approved Development Corridor (3,081.19ha) compared to the area of NSW Box Gum Woodland EEC (now CEEC) identified as part of the Approved Project (1,871.87 ha) (NGH Environmental 2013a, 2013b and 2017). An additional 1,209.32 ha or 1.6 x more NSW Box Gum Woodland CEEC was identified in the Approved Development Corridor following the additional detailed survey and analysis. It is likely the more comprehensive survey and analysis undertaken as part of the biodiversity assessment of the Modified Project has resulted in a more detailed map of PCTs, vegetation zones and TECs across the Project.

The Modified Project proposes to impact 427.0 ha of the NSW Box Gum Woodland CEEC within the Indicative Development Footprints, of which only 42.1 ha (9.9%) is in moderate to good condition woodland, with the remaining 384.9 ha (90.1%) being derived native grasslands and low condition.

The total potential impact to the NSW Box Gum Woodland EEC (now CEEC) proposed by the Modified Project equates to an increase of 226.15 ha compared with the impact threshold of 200.85 ha for the Approved Project. Despite the increase in potential impacts, it is considered that the significance of the proposed impact is not considered to have substantially increased.

The overarching reason for the increased impact of the Modified Project on NSW Box Gum Woodland CEEC are not due to a change in the Project per-se, but rather a result of more detailed design assumptions based on recent wind farm construction experience and extensive 3D terrain modelling, which together result in more realistic estimates of ground disturbance in complex topography. Additionally, of the 42.1 ha of NSW Box Gum Woodland CEEC in moderate to good condition estimated to be impacted, 17.4 ha occurs in the Indicative Development Footprint – External Transmission Line which remains almost unchanged from the Approved Project (SSD 6696). Therefore, those impacts are consistent with the existing State Approval.

The Proponent is committed to further minimising potential impacts to the NSW Box Gum Woodland CEEC through a range of measures through the detailed design phase once the preferred turbine model and contractors have been identified. The key avoidance and minimisation measures implemented to-date include, but are not limited to, the following:

- The Proponent has reduced the maximum number of turbines proposed by the Modified Project to 220 turbines, which equates to a reduction of 47 turbines (refer to **Section 4.1**). Reducing the maximum number of turbines and refining the turbine layout has minimised potential impacts to the NSW Box Gum Woodland CEEC in certain locations, particularly in the south east portion of the Indicative Development Footprint – Wind Farm. The Proponent is committed to avoid and minimise impacts to NSW Box Gum Woodland CEEC, wherever practicable, through the detailed design phase (refer to **Section 4.3**).
- The eight turbines, associated access tracks and infrastructure proposed in the North East Turbine Cluster do not result in any impacts to NSW or Commonwealth Box Gum Woodland CEEC.
- The Approved Project referred to the need for public road upgrades to construct and operate the Project, however no biodiversity assessment was undertaken. Assessment of the Indicative Development Footprint – Public Road Upgrades was a key component of the Modified Project. The Proponent worked closely with Umwelt to understand the constraints this NSW Box Gum Woodland CEEC presented in relation to the public road upgrade design. Many of the public road corridors support patches of the NSW Box Gum Woodland CEEC listed under the BC Act (and also EPBC Act). The public road reserves anticipated to require upgrades support large areas of NSW Box Gum Woodland CEEC, generally being moderate to good condition woodlands. The Modified Project proposes to impact approximately 13.2 ha of the NSW Box Gum Woodland CEEC within the Indicative Development Footprint – Public Road Upgrades, representing approximately 7 % of the total Indicative Development Footprint – Public Road Upgrades. This same extent of impacts would similarly applyt to the Approved Project. Ultimately the extent of impacts is determined by the specific road upgrade standards required by councils. The Proponent has worked closely with relevant councils to optimise the road upgrade standards to minimise potential impacts to roadside vegetation, and is committed to work with the relevant councils to further reduce impacts through the detailed design process.
- As mentioned in **Section 4.1**, the Proponent consulted and sought feedback from Umwelt following completion of extensive field surveys to understand the NSW Box Gum Woodland CEEC constraints for the Project. Through this effort, the Modified Project has avoided better quality and larger patches of BC Act and EPBC Act listed Box Gum Woodland CEECs, including:

- The public road reserves in the Project locality support large areas of NSW Box Gum Woodland CEEC, for the most part substantial impacts to these stands of vegetation have been avoided, particularly along Vinegaroy Road, Turee Vale Road and Coolah Road. It is understood that the Proponent has negotiated with relevant councils to consider reduced road cross-sections in highly constrained locations, which could provide further opportunities to reduce impacts to the Box Gum Woodland CEECs.
- Extensive patches of the Box Gum Woodland CEECs occur in private properties between Rotherwood Road and Coolah Road. While the Modified Project does interact with this vegetation, the Proponent has avoided impacts to the better quality and larger patches of the Box Gum Woodland CEECs.
- Removal of section of 33 kV overhead cabling in C Cluster east of Pandora Pass Road, avoiding approximately 6.5 ha of Box Gum Woodland CEEC.
- Removal of section of 33 kV overhead cabling in D Cluster south of State Forest Road, avoiding approximately 1.5 ha of NSW Box Gum Woodland CEEC.
- Removal of 33 kV overhead cabling in F Cluster east of Rotherwood Road, avoiding approximately 15.6 ha of NSW Box Gum Woodland CEEC.
- Removal of access track off Rotherwood Road to F Cluster, avoiding approximately 9 ha of NSW Box Gum Woodland CEEC.
- Removal of approved turbine G5-4 (near Bounty Creek Road north of the F Cluster) and associated access track and overhead 33 kV overhead cabling from Bounty Creek Road, avoiding approximately 4.5 ha of NSW Box Gum Woodland CEEC.
- Removal of section of 33 kV overhead cabling in F Cluster east of Yarrawonga Road, avoiding approximately 6.3 ha of NSW Box Gum Woodland CEEC.
- Removal of section of access track in F Cluster east of Yarrawonga Road, avoiding approximately 1 ha of NSW Box Gum Woodland CEEC.

- As presented in **Section 4.3**, the following indicative mitigation measures are considered to be directly linked with minimising and/or mitigating impacts to the NSW Box Gum Woodland CEEC. The final measures will be documented as part of the BMP that will be prepared in consultation with BCS and in accordance with the Development Consent:
  - Demarcation of NSW Box Gum Woodland CEEC within the approved Indicative Development Footprints and Modified Corridors to avoid accidental or inadvertent impacts to the NSW Box Gum Woodland CEEC.
  - Pre-clearance and tree-felling protocols for the removal of all key fauna habitat, which will substantially minimise impacts to fauna species that are part of the NSW Box Gum Woodland CEEC, including threatened and non-threatened fauna species.
  - Salvage of key fauna habitat; minimising additional impacts to fauna species including those that are part of the NSW Box Gum Woodland CEEC.
  - Natural regeneration and recruitment of native flora species within the transmission line easement, including patches of NSW Box Gum Woodland CEEC, which may provide connectivity for flora and fauna species across the transmission line easement, including those that are part of the NSW Box Gum Woodland CEEC.

5.4.2 Large-eared pied-bat

The distribution of the large-eared pied bat is discontinuous and ranges from Shoalwater Bay in Queensland through to Ulladulla in New South Wales (DERM 2011). There is no definitive data on the total population of this species (TSSC 2010), however it is presumed to have undergone large declines in numbers due to removal of suitable habitat (TSSC 2010).

The Modified Project has identified 1,573.7 ha of habitat for the species in accordance with the BAM methodology within the Modified Development Corridor, of which 284.5 ha will be impacted within the Indicative Development Footprints. This area of habitat represents foraging habitat for the species in proximity to potential roost sites and breeding habitat.

The large-eared pied bat is identified by DPE as an entity at risk of SAII based on Principle 4. That is, the species is unlikely to respond to measures to improve its habitat and therefore its members are not replaceable. As highlighted in **Appendix H** this is due to its reproductive characteristics that severely limit its ability to occupy new habitat as they are reliant upon specific cave structures for maternity roosts, and they require high fertility forests or woodlands nearby.

The large-eared pied bat was recorded at five locations, primarily within and adjacent to the Durridgere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017). The Modified Project Indicative Development Footprint would clear about 18.1% of the area of habitat recorded within the Modified Development Corridor as defined by the BAM (that is habitat within 2 km of suitable rocky habitat). The species is particularly vulnerable to threats that impact shelter and breeding sites. While the project will clear about 18.1% of habitat it will not impact directly on shelter and breeding sites.

The Modified Project has the potential to impact on the species through turbine strike and/or barotrauma. The number of individuals is not known and cannot be accurately predicted. The Modified Project will prepare and implement a BBAMP which will assess and monitor micro-bats being impacted by turbine strike and/or barotrauma. Trigger levels will be established as to corrective measures that would be required should the species be impacted by turbine strike and/or barotrauma.

5.4.3 Eastern cave bat

The eastern cave bat has primarily a tropical distribution and is found in a broad band on both sides of the Great Dividing Range from Cape York (QLD) to Kempsey (NSW), with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT (DPIE 2021).

The TBDC profile for the eastern cave bat states that “very little is known about the biology of this uncommon species” and “little is understood of its feeding or breeding requirements or behaviour” (DPIE 2021). There is no available literature or information on the population size of whether there has been a decline of the eastern cave bat in the last 10 years.

The eastern cave bat is identified by DPE as an entity at risk of SAII based on Principle 4. That is, the species is unlikely to respond to measures to improve its habitat and therefore its members are not replaceable. As highlighted in Appendix H this is due to it being reliant upon on caves for maternity roosts and therefore breeding habitat cannot be restored or replaced.

The species was recorded at 7 locations, spanning the north of the Project to Durridgere State Conservation Area as part of the original assessment (NGH 2013a, 2013b and 2017). Umwelt recorded this species to a possible or species group confidence at one location. The population size within the Indicative Development Footprint is not and cannot be known.

Similar to the large-eared pied bat, habitat for the eastern cave bat is defined in the BAM as habitat within 2km of potential roosting habitat. A total of 1,592.4 ha of habitat was mapped in the Modified Development Corridor, in accordance with the BAM methodology, of which 286.6 ha will be directly impacted within the Indicative Development Footprints as part of the Modified Project. This area of habitat represents foraging habitat for the species in proximity to potential roost sites and breeding habitat. Therefore, no individuals of the species will be directly impacted through habitat clearing however, some habitat will be affected. Breeding habitat is not identified for the species, as the Modified Project does not impact on the three known maternity colonies. The Modified Project has the potential to impact on the species through turbine strike and/or barotrauma. The number of individuals is not known and cannot be accurately predicted. The Modified Project will prepare and implement a BBAMP which will assess and monitor micro-bats being impacted by turbine strike and/or barotrauma. Trigger levels will be established as to corrective measures that would be required should the species be impacts by turbine strike and/or barotrauma.

5.5 Matters of National Environmental Significance

While not a requirement of the BDAR, this section summarises impacts identified for the Modified Project on Matters of National Environmental Significance (MNES). Relevant to the Modified Project, and consistent with the Approved Project (EPBC 2014/7136) these include:

- Commonwealth Box Gum Woodland CEEC (threatened ecological community);
- regent honeyeater (threatened species);
- swift parrot (threatened species);
- large-eared pied-bat (threatened species); and
- koala (threatened species).

A summary of the outcomes of the re-referral of the Project to DCCEEW is provided below for relevant species. Consistent with the Approved Project, the Modified Project will directly impact MNES and it is proposed to offset any residual significant impacts through the retirement of biodiversity credits identified through the application of the BAM and as detailed in this BDAR.

5.5.1 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

Through the Biodiversity Assessments (NGH Environmental 2013a and 2013b) and the Biodiversity Assessment Addendum (NGH Environmental 2017) the Federal Approval (EPBC 2014/7136) for the Approved Project allows up to 10.37 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.

As per **Section 5.2** above, the Modified Project will result in impacts to 42.1 ha of Commonwealth Box Gum Woodland CEEC (see **Figure 3.4** for an overview, and the tiled figure set is provided in **Appendix A**). Impacts to the CEEC under the EPBC Act is 31.7 ha more than the approved impact threshold of 10.37 ha (EPBC 2014/7136). It is noted that approximately 362.5 ha of Commonwealth Box Gum Woodland CEEC under the EPBC Act was identified within the Modified Development Corridor. Therefore, 320.4 ha (or 88%) of the Commonwealth Box Gum Woodland CEEC will not be impacted by the Modified Project and will persist within the wider Modified Development Corridor, and considerable amounts of the Commonwealth Box Gum Woodland CEEC occur beyond the Modified Development Corridor in the local region.

Of the 42.1 ha of impact identified to the Commonwealth Box Gum Woodland CEEC under the EPBC Act, 16.4 ha (approximately 39%) will be partially directly impacted within the transmission line 'balance of easement' proposed by the Modified Project. Further detail on the application of the partial impacts is provided in **Section 5.1.2**. Specific construction and post-construction management actions and monitoring programs will be implemented to ensure the Commonwealth Box Gum Woodland CEEC persists in those areas of partial direct impacts.

As mentioned in **Section 1.2** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 17 ha of impact to Commonwealth Box Gum Woodland CEEC.

5.5.2 Regent Honeyeater

This species has not been recorded despite targeted surveys being undertaken in 2020, or during other surveys undertaken as part of the Biodiversity Assessments (NGH Environmental 2013a and 2013b) and the Biodiversity Assessment Addendum (NGH Environmental 2017). The Federal Approval for the Approved Project allows for the removal of up to 234.7 ha of habitat for regent honeyeater listed as critically endangered under the EPBC Act.

A species polygon has not been prepared for the regent honeyeater as the Modified Project does not impact on the State-prepared Important Area Maps for the species and the species was not recorded during targeted bird surveys. Despite this, Umwelt has updated the potentially suitable habitat for the species in recognition of the Approved Project and existing Federal Approval impact threshold.

A total of 4,384.2 ha of potentially suitable regent honeyeater habitat has been assessed within the Modified Development Corridor. The Modified Project will result in impacts to 577.8 ha of regent honeyeater potentially suitable habitat (see **Figure 5.2** for an overview, the tiled figure set is provided in **Appendix A**) within the Indicative Development Footprints. This presents an impact increase of 343.1 ha for potentially suitable regent honeyeater habitat when compared to the current impact threshold previously approved. However, 3,806.4 ha of potentially suitable regent honeyeater habitat will not be impacted by the Modified Project within the wider Modified Development Corridor, and considerable amounts of the potentially suitable habitat occur beyond the Modified Development Corridor in the local region.

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

The 577.8 ha of regent honeyeater potentially suitable habitat is based on the PCTs (84, 281, 479, 481, 483, 488) identified for the Modified Project that are listed as suitable PCTs in the TBDC for the species (DPIE 2021b). This mapping excludes two vegetation zones, one vegetation zone from PCT 488, being Vegetation Zone 12 and one vegetation zone from PCT 483 being Vegetation Zone 8. These mapping units are heavily degraded, support an exotic understorey and few scattered canopy trees. It is considered highly unlikely that regent honeyeater will utilise vegetation zones 8 and 12 other than seeking temporary shelter in the scattered canopy trees when travelling through the landscape in rare occurrences that the species occurred in the Project site. It is more likely the species would utilise the more intact woodlands and forested habitats within the Project site during those occurrences.

The potential risk the Modified Project poses to the regent honeyeater in relation to prescribed impacts of turbine strike is detailed in **Appendix G** and summarised above in **Section 5.3.5**. The regent honeyeater received an overall risk rating of High, based on a Moderate Likelihood Rating and High Consequence Rating. While the species has not been recorded despite extensive surveys across several years, the overall

risk rating reflects the very small remaining population sizes, coupled with the species migratory nature, the extent of habitat fragmentation in the local area and region, and the species critically endangered status.

As mentioned in **Section 1.2** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 89 ha of impact to potentially suitable regent honeyeater habitat.

5.5.3 Swift Parrot

This species has not been recorded despite targeted surveys being undertaken in 2020, or during other surveys undertaken as part of the Biodiversity Assessments (NGH Environmental 2013a and 2013b) and the Biodiversity Assessment Addendum (NGH Environmental 2017). The Federal Approval for the Approved Project allows for the removal of up to 256.3 ha of habitat for swift parrot listed as critically endangered under the EPBC Act.

A species polygon has not been prepared for the swift parrot as the Project does not impact on the State-prepared Important Area Maps for the species. Despite this, Umwelt has identified potentially suitable habitat for the species.

A total of 4,073.4 ha of potentially suitable swift parrot habitat has been assessed within the Modified Development Corridor. The Modified Project will result in impacts to 471.7 ha of swift parrot potentially suitable habitat (see **Figure 5.3** for an overview, the tiled figure set is provided in **Appendix A**) within the Indicative Development Footprints. This presents an impact increase of 215.4 ha for potentially suitable swift parrot habitat when compared to the current impact threshold previously approved. However, 3,601.7 ha of potentially suitable swift parrot habitat is considered to have been avoided by the Modified Project within the wider Modified Development Corridor, and considerable amounts of the potentially suitable habitat occur beyond the Modified Development Corridor in the local region.

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

The 471.7 ha of swift parrot potentially suitable habitat is based on the PCTs (281, 395, 488 and 495) identified for the Modified Project that are as listed as suitable PCTs in the TBDC for the species (DPIE 2021b). This mapping excludes just one vegetation zone from PCT 488, being Vegetation Zone 12 as this mapping unit is heavily degraded, supports an exotic understorey and few scattered canopy trees. Vegetation Zone 3 (PCT 395) comprises 197.4 ha of the total swift parrot potentially suitable habitat. As this vegetation is a Derived Native Grassland vegetation zone, and only supports scattered canopy trees, it is considered marginal habitat at best. It is considered highly unlikely that swift parrot will utilise this vegetation zone other than seeking temporary shelter in the scattered canopy trees when travelling through the landscape in rare occurrences that the species occurred in the Project site. It is more likely the species would utilise the more intact woodlands and forested habitats within the Project site during those occurrences.

The potential risk the Modified Project poses to the swift parrot in relation to prescribed impacts of turbine strike is detailed in **Appendix G** and summarised above in **Section 5.3.5**. The swift parrot received an overall risk rating of High, based on a Moderate Likelihood Rating and High Consequence Rating. While the species has not been recorded despite extensive surveys across several years, the overall risk rating reflects the very small remaining population sizes, coupled with the species migratory nature, the extent of habitat fragmentation in the local area and region, and the species critically endangered status.

As mentioned in **Section 1.2** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 53.9 ha of impact to potentially suitable swift parrot habitat.

5.5.4 Large-eared pied bat

There are more than 20 known records of the species within 10 km of the External Transmission Line, but not in proximity to the Wind Farm component of the Modified Project (DPIE 2021a). NGH Environmental survey effort included 15 survey sites, totalling 21 nights of survey data. This survey effort recorded this species at one location within Durridgere State Conservation Area (NGH Environmental 2013a, 2013b and 2017).

Umwelt survey effort including six anabat units were deployed within the Modified Development Corridor in May 2020, four of which were at/near ground level, while two were deployed on a meteorological mast approximately 20-30 m high. There were a total of 13 nights worth of data. Umwelt survey effort did not record this species despite extensive surveys.

A species polygon has been mapped for the species based on the intersection of suitable PCTs (281, 395, 495 and 488) as identified in the TBDC (2021b) within 2 km of mapped rocky areas in order to quantify the offset liability for this species.

A total of 1,573.7 ha of habitat for the large-eared pied-bat occurs within the Modified Development Corridor. The Modified Project will result in impacts to 284.5 ha of habitat (see **Figure 3.9** for an overview, the tiled figure set is provided in **Appendix A**). However, 1,289.2 ha of habitat is not being impacted by the Modified Project and will persist within the wider Modified Development Corridor. Furthermore, considerable amounts of consistent habitat occur beyond the Modified Development Corridor in the local region. The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

The Modified Project is not expected to result in an adverse impact on a potentially occurring important population of the large-eared pied bat due to the very low density of the species (as evidenced by the lack of records since 2012), no breeding habitat being directly impacted, the retention of substantial areas of potential foraging habitat within the Modified Development Corridor and the mitigation strategies that will be employed as part of the Modified Project.

The potential risk the Modified Project poses to the large-eared pied bat in relation to prescribed impacts of turbine strike is detailed in **Appendix G** and summarised above in **Section 5.3.5**. Despite there being a substantial lack of information on the flying behaviour of this species, it is possible that the large-eared pied bat will involve flying activity at RSA height. NGH Environmental survey effort recorded the large-eared pied bat at five locations as part of the original assessment, primarily within and adjacent to the Durridgere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017). Umwelt survey effort did not record this species despite extensive surveys. In light of this, the large-eared pied bat received an overall risk rating of Moderate, based on Moderate Likelihood and Consequence Ratings.

As mentioned in **Section 1.2** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 13 ha of impact to foraging habitat for large-eared pied bat.

5.5.5 Koala

There are nine known records of the species within 10 km of the Modified Development Corridor (DPIE 2021a), of which four occur within the Wind Farm component and five occur within the External Transmission Line component of the Modified Development Corridor (DPIE 2021a).

Spotlighting surveys were undertaken in October 2012, October 2013, March 2015, May 2020 and May 2021. Additionally, Koala Spot Assessment Technique searches were undertaken in May 2020, June 2020, October 2020, January 2021 and May 2021.

Habitat assessments and opportunistic surveys were conducted during all surveys, which occurred during October 2012, October 2013, March 2015, October 2016, April 2020, May 2020, June 2020, August 2020, October 2020, January 2021, May 2021 and September 2021.

The species was not recorded despite extensive surveys since 2012.

In the absence of current records of the species within the Modified Development Corridor, as PCTs 281, 479, 481, 483, 488, 490, 495, 1661 and 1675 generally support 15 per cent of regionally relevant eucalypt species for the koala, much of the Moderate/Good condition habitat in the Modified Development Corridor is likely to be deemed 'Highly Suitable Koala Habitat' (DPIE 2020c).

Together, these PCTs contain multiple koala tree species across the Modified Project as per schedule 2 of the Koala Habitat Protection State Environmental Planning Policy (SEPP) (DPIE 2021d), including Blakely's red gum (*Eucalyptus blakelyi*), white box (*Eucalyptus albens*), rough-barked apple (*Angophora floribunda*), broad-leaved ironbark (*Eucalyptus fibrosa*), narrow-leaved ironbark (*Eucalyptus crebra*), narrow-leaved stringybark (*Eucalyptus sparsifolia*), grey box (*Eucalyptus moluccana*), large-flowered bundy (*Eucalyptus nortonii*), silvertop stringybark (*Eucalyptus laevopinea*), mountain gum (*Eucalyptus dalrympleana*), brittle gum (*Eucalyptus mannifera*), bundy (*Eucalyptus goniocalyx*), red stringybark (*Eucalyptus macrorhyncha*), yellow box (*Eucalyptus melliodora*) and mugga ironbark (*Eucalyptus sideroxylon*).

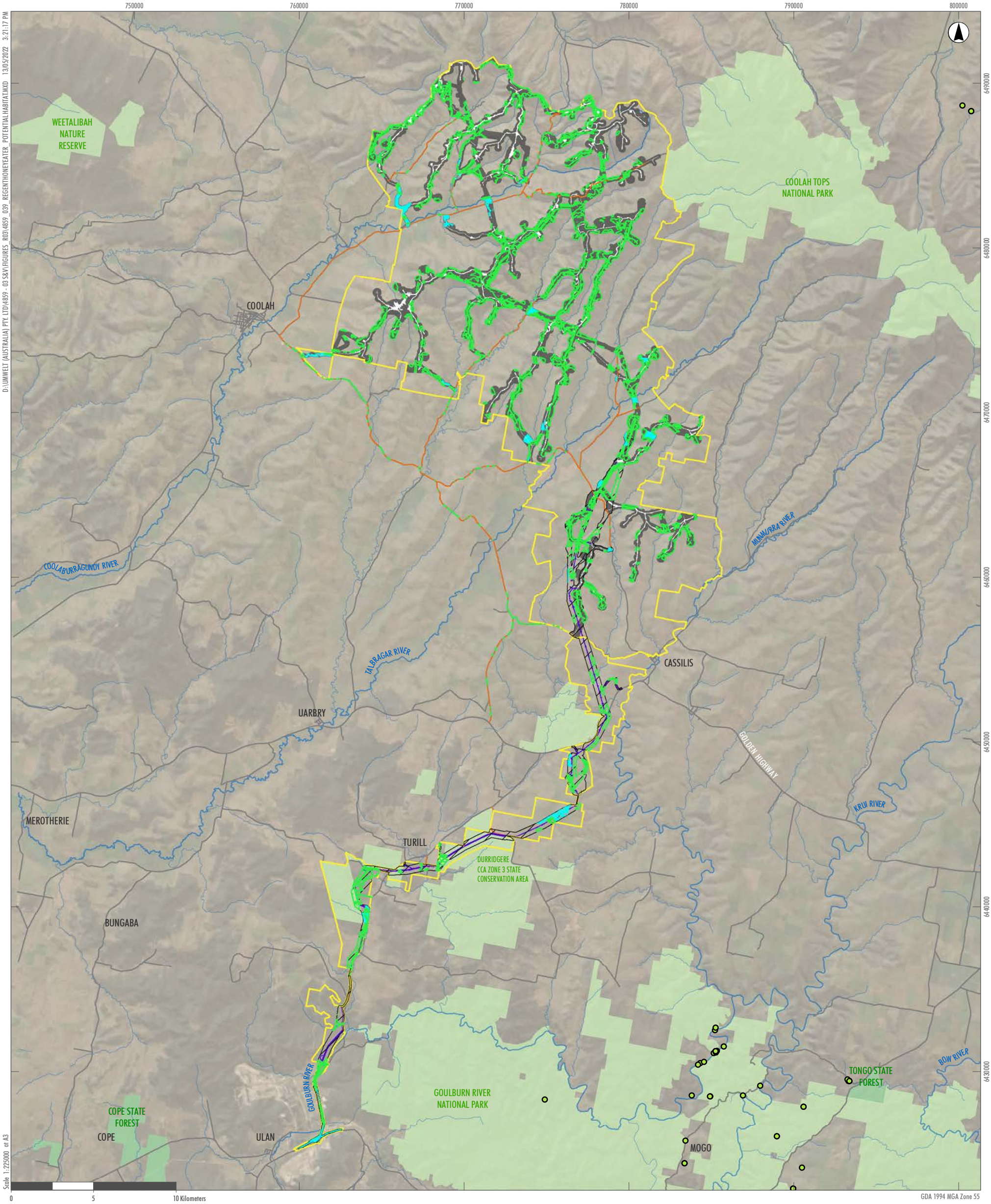
Umwelt found that the Modified Project will result in the loss of approximately 672.3 ha of potential foraging and breeding habitat for the koala within the Indicative Development Footprints (see **Figure 5.4** for an overview, the tiled figure set is provided in **Appendix A**). A total of approximately 5,110 ha occurs within the Modified Development Corridor. This comprises all Moderate/Good and Low condition vegetation zones, specifically:

- Vegetation Zone 2
- Vegetation Zone 4
- Vegetation Zone 5
- Vegetation Zone 6
- Vegetation Zone 7
- Vegetation Zone 9
- Vegetation Zone 10
- Vegetation Zone 11
- Vegetation Zone 13
- Vegetation Zone 14
- Vegetation Zone 15
- Vegetation Zone 16.

The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design.

The Modified Project is not expected to result in an adverse impact on a potentially occurring population of the koala due to the very low potential density of the species (as evidenced by the lack of records since 2012), the retention of substantial areas of potential habitat within the Modified Development Corridor and the mitigation strategies (**Section 4.3**) that will be employed as part of the Modified Project. Particular mitigation measures that will facilitate reducing impacts of the Modified Project on potential koala habitat are the pre-clearance and tree-felling procedures and identification of clearance boundaries to avoid inadvertent impacts. Furthermore, the Indicative Development Footprints are realistic estimates, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design. Furthermore, all impacts will be managed through the various management plans that will be required as part of the development consent.

As mentioned in **Section 1.2** in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm project the External Transmission Line component would no longer be required. Removal of the External Transmission Line component would result in the avoidance of impact to approximately 172 ha of impact to potential foraging and breeding habitat for the koala.



Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- Regent Honeyeater Potentially Suitable Habitat

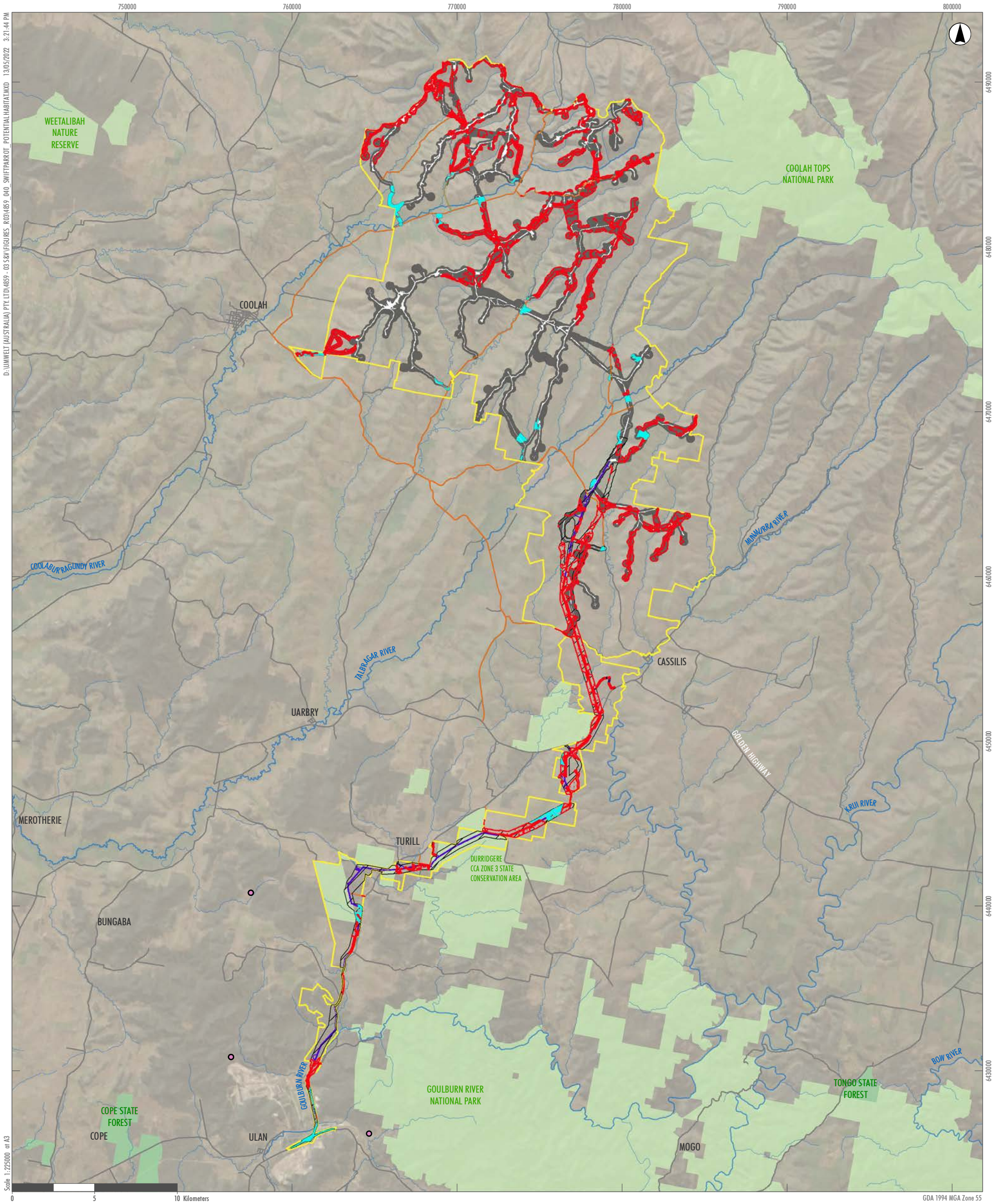
NSW Bionet Atlas TS Records
- Regent Honeyeater

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 5.2

Liverpool Range Wind Farm
Regent Honeyeater Potentially Suitable Habitat

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)



Legend

Modified Project

- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor

- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line
- Land Category 1 - Exempt Land
- Swift Parrot Potentially Suitable Habitat

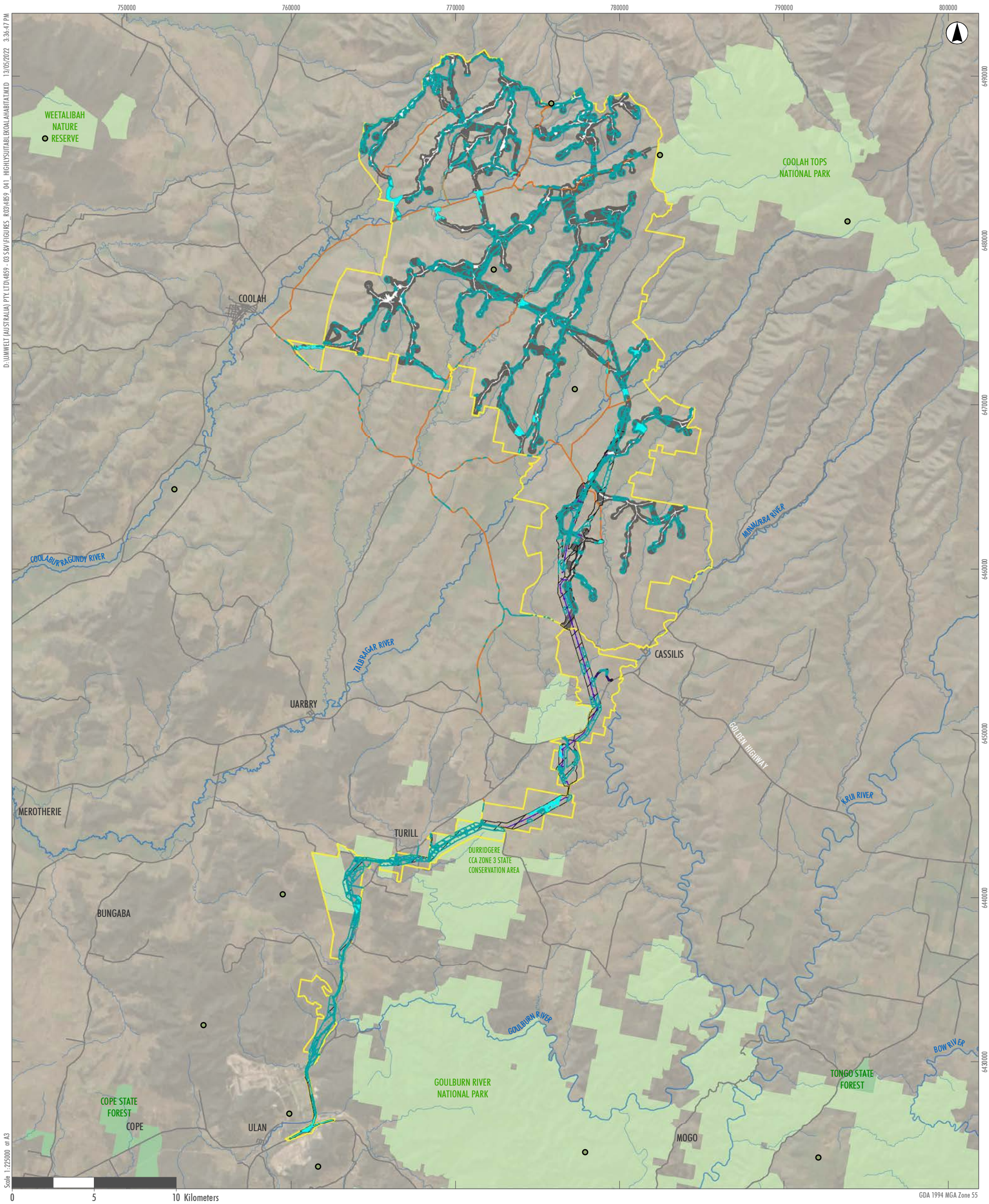
NSW Bionet Atlas TS Records

- Swift Parrot
- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 5.3

Liverpool Range Wind Farm
Swift Parrot Potentially Suitable Habitat

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), NSW Bionet Atlas records (2021), (NGH Environmental 2013a, 2013b and 2017)



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 S&V\FIGURES_R03\4859_041_HIGHLYSUITABLEKOALAHABITAT.MXD 13/05/2022 3:36:47 PM

Legend

Modified Project
- Modified Site Boundary
- Indicative Development Footprint – Wind Farm
- Indicative Development Footprint – External Transmission Line
- Indicative Development Footprint – Public Road Upgrades

Modified Development Corridor
- Modified Development Corridor – Wind Farm
- Modified Development Corridor – External Transmission Line

- Land Category 1 - Exempt Land
- Highly Suitable Koala Habitat

NSW Bionet Atlas TS Records
- Koala

- Road
- Drainage Line
- National Parks (NPWS Estate)
- State Forest

FIGURE 5.4

Liverpool Range Wind Farm
Highly Suitable Koala Habitat

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019), (NGH Environmental 2013a, 2013b and 2017)

6.0 Biodiversity Credit Impact Summary

6.1 Impacts Not Requiring Assessment

Under the BAM, impacts to areas of land without native vegetation do not require further assessment. The Indicative Development Footprints contains approximately 97.4 ha of cleared land that will be removed as a result of the Modified Project and does not require further assessment as they do not contain native vegetation. This mapping unit includes roads, farm dams devoid of vegetation and cleared areas.

Additionally, 42.1 ha of Category 1 – Exempt Land was identified in the Indicative Development Footprints and was excluded from assessment.

6.2 Impacts Not Requiring Offset

In accordance with Section 9.2.1 of the BAM (DPIE 2020a), impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of less than 20 (where it is not associated with ecosystem-credit species habitat or a TEC), less than 17 (where it is associated with ecosystem-credit habitat or a VEC) or less than 15 (where it is representative of an EEC or CEEC).

As discussed in **Section 3.2.1,** two vegetation zones were identified as 'Exotic', being Vegetation Zone 8 and Vegetation Zone 12.

The application of the BAM Credit Calculator for the Modified Project identified that despite the degraded nature of Vegetation Zone 8, it had a vegetation integrity score above the threshold for offsetting. Vegetation Zone 12 however had a vegetation integrity score below the threshold for offsetting. These are presented below:

- Vegetation Zone 12: Brigalow Belt South – Liverpool Range (Vegetation Integrity Score 7.2)
- Vegetation Zone 12: Brigalow Belt South – Pilliga (Vegetation Integrity Score 7.2).

Impacts associated with Vegetation Zone 12 (374.4 ha) do not require offsets.

6.3 Impacts Requiring Offset

11 PCTs and seven species-credit species are considered to require offsetting in accordance with the BAM (DPIE 2020a). Condition 20 of the Development Consent (SSD 6696) requires that the Proponent retire the required biodiversity offsets within two years of commencement of construction; or stage thereof (as per Condition 9). **Table 6.1** summarises this outcome per IBRA Bioregion.

Table 6.1 Impacts Requiring Offset – Per IBRA - Subregion

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future[1]	Change[1]		
Ecosystem Credits						
Brigalow Belt South – Liverpool Range IBRA Bioregion						
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	37.8	15.1	-22.6	6.0	**69**
			0	-37.8		
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	92.3	46.4	-45.9	0.7	**20**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	34.8	0	-34.8	172.3	**3,299**
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	85.7	41.1	-44.7	28.5	**1,327**
			0	-85.7		
7		59.3	15.7	-43.5	181.2	**6,239**
			0	-59.3		
8		23	0	-22.7	275.2	**3,948**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	83.4	35.3	-48.1	94.2	**3,179**
			0	-83.4		
10		82.1	36.4	-45.7	0.5	**10**
11		63.5	23.1	-40.5	157.0	**3,964**
			0	-63.5		
12		7.2	0	-7.2	368.9	**0**
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion	76.8	0	-76.8	11.0	**317**
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion	53.6	0	-53.6	7.3	**147**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future[1]	Change[1]		
Brigalow Belt South – Pilliga IBRA Bioregion						
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	37.8	15.1	-22.6	2.1	**25**
			0	-37.8		
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	92.3	46.4	-45.9	2.2	**104**
			0	-92.3		
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	34.8	0	-34.8	21.4	**451**
4	PCT 479 – Narrow-leaved Ironbark-Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	81.2	25.8	-55.4	17.0	**408**
			0	-81.2		
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	70.2	24.7	-45.6	10.4	**230**
			0	-70.2		
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	-	-	-	-	**-**
7		59.3	15.7	-43.5	51.9	**1,806**
			0	-59.3		
8		23	0	-23	122.6	**1,759**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion	83.4	0	-83.4	1.7	**62**
10		-	-	-	-	**-**
11		63.5	0	-63.5	0.1	**3**
12		7.2	0	-7.2	5.5	**0**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush	86.8	37.6	-49.2	28.5	**747**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future[1]	Change[1]		
	heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin		0	-86.8		
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	86.6	32.4	-54.2	10.1	**237**
			0	-86.6		
Sydney Basin – Kerrabee IBRA Bioregion						
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	87.3	42.4	-44.9	10.5	**390**
			0	-87.3		
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region	24.8	0	-24.8	3.7	**57**
4	PCT 479 – Narrow-leaved Ironbark-Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	62.6	17.4	-45.3	2.8	**54**
			0	-62.6		
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	59.6	15.8	-43.7	2.3	**44**
			0	-59.6		
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	78.2	36.8	-41.4	0.2	**5**
7		52	12.3	-39.7	8.3	**228**
			0	-52		
8		20.1	0	-20.1	0.7	**9**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	69.7	29.6	-40.1	24.7	**543**
			0	-69.7		
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea	74.6	30.2	-44.4	20.9	**420**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future[1]	Change[1]		
	rhombifolia heathy open forest on sandstone ranges of the Sydney Basin		0	-74.6		
Species Credits						
Brigalow Belt South – Liverpool Range IBRA Bioregion						
-	Large-eared pied-bat	n/a	n/a	n/a	271.8	**6,353**
-	Squirrel glider	n/a	n/a	n/a	205.2	**4,872**
-	Eastern cave bat	n/a	n/a	n/a	273.9	**6,401**
Brigalow Belt South - Pilliga IBRA Bioregion						
-	Silky swainson-pea	n/a	n/a	n/a	19.4	**432**
-	Glossy black-cockatoo	n/a	n/a	n/a	0.2	**3**
-	Large-eared pied-bat	n/a	n/a	n/a	0.4	**10**
-	Squirrel glider	n/a	n/a	n/a	13.2	**375**
-	Eastern cave bat	n/a	n/a	n/a	0.4	**10**
Sydney Basin - Kerrabee IBRA Bioregion						
-	Ausfeld's wattle	n/a	n/a	n/a	10.5	**311**
-	Glossy black-cockatoo	n/a	n/a	n/a	0.8	**10**
-	Large-eared pied-bat	n/a	n/a	n/a	12.3	**499**
-	Square-tailed kite	n/a	n/a	n/a	1.4	**29**
-	Squirrel glider	n/a	n/a	n/a	25.0	**601**
-	Eastern cave bat	n/a	n/a	n/a	12.3	**499**

[1] Values within white background cells indicate those portions of relevant Vegetation Zones that had partial direct impacts assessed within the Indicative Development Footprint – External Transmission Line (refer to **Section 5.1.2**).

The required biodiversity credits to offset the impacts of the Project are presented below in **Table 6.2** and **Table 6.3**.

Table 6.2 Impacts Requiring Offset – Ecosystem Credits

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
1	PCT 84 – River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion *Moderate/Good*	6.5	-	1.6	8.1	**94**

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
2	PCT 281 – Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Moderate/Good* [1]	0.7	12.0	0.7	13.4	**514**
3	PCT 395 – Derived speargrass - wallaby grass - wire grass mixed forb grassland mainly in the Coonabarabran - Pilliga - Coolah region *Moderate/Good* [2]	149.2	41.8	6.3	197.3	**3,807**
4	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion *Moderate/Good*	-	19.1	0.7	19.8	**462**
5	PCT 481 – Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region *Moderate/Good*	-	12.7	-	12.7	**274**
6	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Moderate/Good* [3]	23.3	5.4	-	28.7	**1,332**

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
7	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Low* [4]	191.3	39.2	10.9	241.4	**8,273**
8	PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley *Exotic*	322.8	2.3	73.4	398.5	**5,716**
9	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	95.9	-	-	95.9	**3,241**
10	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good-Shrubby*	0.5	-	-	0.5	**10**
11	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion *Low*	152.2	-	4.9	157.1	**3,967**

Veg. Zone	Plant Community Type (PCT)	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Condition Class	Wind Farm	External Transmission Line	Public Road Upgrades	Total Combined Indicative Development Footprints	
12	PCT 488 – Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion Exotic	364.4	-	10.0	374.4	**0**
13	PCT 490 – Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	11.0	-	-	11.0	**317**
14	PCT 495 – Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion *Moderate/Good*	7.3	-	-	7.3	**147**
15	PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin *Moderate/Good*	-	52.9	0.3	53.2	**1,290**
16	PCT 1675 – Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin *Moderate/Good*	-	30.6	0.4	31.0	**657**
-	Nil (incl. roads, tracks and waterbodies)	14.1	4.1	79.2	97.4	**N/A**
-	Category 1 – Exempt Land	28.2	11.6	**2.3**	42.1	**N/A**
	Total	**1,367.4**	**231.9**	**190.7**	**1,790.0**	**30,101**

[1] Associated with BC Act and EPBC Act listed CEECs; [2] Partly associated with BC Act listed CEEC; [3] Associated with BC Act and EPBC Act listed CEECs; [4] Associated with BC Act listed CEEC

Table 6.3 Impacts Requiring Offset – Species Credits

Species	Modified Project - Area within Indicative Development Footprints (ha)				Total Credits Required
	Wind Farm (ha)	External Transmission Line (ha)	Public Road Upgrades (ha)	Total Combined Indicative Development Footprints (ha)	
Ausfeld's wattle	-	10.5	-	10.5	**311**
Silky swainson-pea	-	19.4	-	19.4	**432**
Glossy black-cockatoo	-	0.8	0.2	1	**13**
Large-eared pied-bat	265.6	12.6	6.3	284.5	**6,862**
Square-tailed kite	-	1.4	-	1.4	**29**
Squirrel glider	167.0	74.1	2.2	243.3	**5,848**
Eastern cave bat	267.7	12.6	6.3	286.6	**6,910**
Total	**n/a**	**n/a**	**n/a**	**n/a**	**20,405**

A summary of the credit requirement for the Modified Project associated with BC Act and EPBC Act listed CEECs per IBRA Bioregion is provided below in **Table 6.4**, **Table 6.5** and **Table 6.6**.

Table 6.4 Credit Generation from BC Act and EPBC Act listed CEECs: Brigalow Belt South – Liverpool Range

	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (BC Act)				White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands CEEC (EPBC Act)	
	VZ 2	VZ 3*	VZ 6	VZ 7	VZ 2	VZ 6
Total Area of Vegetation Zone (ha)	0.7	172.3	28.5	181.2	0.7	28.5
Total Credits	20	2,630	1,327	6,239	20	1,327
Total Area of CEEC (ha)	0.7	121.0	28.5	181.2	0.7	28.5
Proportion of Vegetation Zone that is CEEC (%)[1]	100	70	100	100	100	100
Proportional Number of CEEC Credits per Vegetation Zone[1]	20	2,630	1,327	6,239	20	1,327

[1] Rounded to the nearest whole number.

* The CEEC component of Vegetation Zone 3 could be entered separate to the non-CEEC component of the vegetation zone in the BAM – Credit Calculator. Therefore, the 2,630 credits identified above are specifically those associated with the CEEC for Vegetation Zone 3.

Table 6.5 Credit Generation from BC Act and EPBC Act listed CEECs: Brigalow Belt South – Pilliga

	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (BC Act)				White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands CEEC (EPBC Act)	
	VZ 2	VZ 3*	VZ 6	VZ 7	VZ 2	VZ 6
Total Area of Vegetation Zone (ha)	2.2	21.4	-	51.9	2.2	-
Total Credits	104	451	-	1,806	104	-
Total Area of CEEC (ha)	2.2	19.8	-	51.9	2.2	-
Proportion of Vegetation Zone that is CEEC[1]	100	93	-	100	100	-
Proportional Number of CEEC Credits per Vegetation Zone[1]	104	451	-	1,806	104	-

[1] Rounded to the nearest whole number.

* The CEEC component of Vegetation Zone 3 could be entered separate to the non-CEEC component of the vegetation zone in the BAM – Credit Calculator. Therefore, the 451 credits identified above are specifically those associated with the CEEC for Vegetation Zone 3.

Table 6.6 Credit Generation from BC Act and EPBC Act listed CEECs: Sydney Basin - Kerrabee

	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (BC Act)				White box - yellow box - Blakely's red gum grassy woodlands and derived native grasslands CEEC (EPBC Act)	
	VZ 2	VZ 3*	VZ 6	VZ 7	VZ 2	VZ 6
Total Area of Vegetation Zone (ha)	10.5	3.7	0.2	8.3	10.5	0.2
Total Credits	390	57	5	228	390	5
Total Area of CEEC (ha)	10.5	2.6	0.2	8.3	10.5	0.2
Proportion of Vegetation Zone that is CEEC	100	70	100	100	100	100
Proportional Number of CEEC Credits per Vegetation Zone[1]	390	40	5	228	390	5

[1] Rounded to the nearest whole number.

* The CEEC component of Vegetation Zone 3 could not be entered separate to the non-CEEC component of the vegetation zone in the BAM – Credit Calculator. Therefore, the 40 credits identified above for the CEEC component of Vegetation Zone 3 have been calculated based on a proportion of the 57 credits required for the Vegetation Zone as a whole.

7.0 Biodiversity Credit Report

The full Biodiversity Credit Reports from each of the BAM Credit Calculator assessments are included in **Appendix I**.

8.0 Biodiversity Offset Strategy

The Proponent is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Modified Project. Condition 20 of the Development Consent (SSD 6696) requires that the Proponent retire the required biodiversity offsets within two years of commencement of construction; or stage thereof (as per Condition 9).

As discussed in **Section 4.0**, the Proponent has, wherever practicable, optimised the Project (including the Modified Development Corridor and Indicative Development Footprints) to avoid and minimise ecological impacts in the planning and design stages.

Additionally, the Indicative Development Footprints will be finalised once turbine and contractor(s) are selected. In doing so, the Proponent will seek to further minimise impacts to biodiversity values. A range of impact mitigation strategies are proposed to mitigate the impact on ecological values prior to the consideration of offsetting requirements. The offset requirements for the Project, as calculated in accordance with the BAM are identified in **Section 6.3**.

The offset strategy will be implemented in consideration of the process outlined in the BC Act and the final composition of the offset strategy may evolve as the Modified Project progresses.

The biodiversity offset strategy will be developed during the assessment process in consultation with the BCS and DPIE and based on the credits required to be retired to offset the impacts of the Modified Project as specified in **Section 6.3** and the offset options available under the BC Act and BC Regulation including:

- Land based offsets through the establishment of new Stewardship Sites (and subsequent retirement of credits) or by retiring credits from existing Stewardship Sites. The Proponent would retire the required number and class of credits determined in accordance with the BDAR and the offset rules in the BC Regulation.
- Securing (purchasing) credits through the open credit market, and/or
- Paying into to the Biodiversity Conservation Fund (BCF).

The Proponent is currently investigating a number of potential Stewardship Sites to determine their suitability to provide ecosystem credits and / or species credits, and negotiations have commenced on multiple sites. The current investigations have included desktop-based assessments as well as preliminary field surveys. The Proponent is also actively monitoring the credit register for availability of relevant credits. The Proponent will continue its search and investigate potentially suitable Stewardship Sites following submission. Following submission, a detailed offset strategy will be prepared and implemented to ensure the efficient and timely retirement of credits for the Project.

9.0 Conclusion

As part of a detailed layout review and design optimisation process, the Proponent has identified several aspects of the Approved Project which require modification to facilitate safe and efficient construction and operation of the Project. This BDAR has assessed potential impacts to native vegetation and habitat, and impacts to bird and bat species associated with the Modified Project and wherever possible has provided comparisons with the impacts associated with the Approved Project.

The key findings of this BDAR are as follows:

Infrastructure layout

- For the main part, the infrastructure layout including turbine locations, access track alignments and External Transmission Line alignment is generally consistent with the Approved Project.
- Substantial changes to the alignment of the External Transmission Line have been avoided where the extent and quality of vegetation and species habitat is significantly better than elsewhere within the Wind Farm site and along the public roads.

Ground Disturbance

- The Modified Project includes Indicative Development Footprints (1,790.1 ha) that are 1,037.28 ha (x2.4) greater than the Indicative Development Footprint assessed as part of the original biodiversity assessments (NGH Environmental 2013a, 2013b and 2017), being 752.82 ha. The combined Indicative Development Footprints for the Modified Project comprises the following:
    - Wind Farm (1,367.4 ha);
    - External Transmission Line (232.0 ha); and
    - Public Road Upgrades (190.7 ha).
- The Modified Project provides more realistic estimates of the likely ground disturbance and vegetation removal than was provided as part of the Approved Project, and opportunities to further reduce impacts will be explored during detailed design.
- The largest proportion of the increase to ground disturbance is attributable to wind farm access tracks and transmission line access tracks, string pads, and pole/tower construction areas, which together account for nearly 85% of the additional ground disturbance.
- The key reasons for the increases to ground disturbance and native vegetation/habitat impacts are as follows:
    - **More realistic assumptions for access tracks and underground reticulation cabling design:** revised assumptions have been developed based on recent wind farm construction experience and consistent with standard wind farm construction methodology to estimate ground disturbance. The Modified Project assumes that underground cabling is located *adjacent* to the access tracks. In contrast, the Approved Project assumed that underground cabling would be located within the access tracks, which introduces significant constructability and construction scheduling issues and requires turbine selection, detailed geotechnical information, and substantial contractor involvement.

- **Use of detailed 3D terrain modelling to estimate disturbance areas:** powerful 3D terrain modelling software was used extensively across the entire site to accurately estimate disturbance areas for all proposed infrastructure and anticipated public road upgrades.
- **Inclusion of disturbance areas associated with anticipated public road upgrades:** upgrade standards have been agreed with the relevant Roads Authorities and impacts have now been assessed. These were not assessed as part of the Approved Project.
- **Inclusion of disturbance areas associated with upgrades of existing farm access tracks:** farm access tracks are proposed to be used wherever feasible and will require upgrading to facilitate safe and efficient passage of heavy vehicles and large turbine haulage vehicles. Ground disturbance associated with these upgrades to farm access tracks was not included as part of the Approved Project.
- **Inclusion of new access tracks from nearby public roads:** several new access tracks from nearby public roads are proposed for constructability reasons, the key ones being off Vinegaroy Road and Coolah Creek Road to access the ridgelines within the wind farm, and off Ulan Road to access the proposed External Transmission Line.
- **Removal/relocation of key infrastructure to minimise impacts to sensitive native vegetation/habitat:** various approved key infrastructure such as access points and associated access tracks, sections of 33 kV overhead cabling and associated access tracks, and concrete batch plants/construction compounds have been removed/relocated wherever feasible to minimise impacts on Box Gum Woodland CEECs listed under the BC Act and EPBC Act.

Potential impacts to native vegetation/habitat

- The Modified Project results in an increase in the extent of ground disturbance and associated native vegetation/habitat clearance, including to the NSW Box Gum Woodland CEEC listed under the BC Act.
- 11 PCTs and seven species-credit species are considered to require offsetting in accordance with the BAM (DPIE 2020a).
- The Modified Project will impact a total of 427.0 ha of NSW Box Gum Woodland CEEC under the BC Act:
    - Approximately 384.9 ha (90.1 %) of the NSW Box Gum Woodland CEEC listed under the BC Act proposed to be impacted within the Indicative Development Footprints is considered to be in either derived native grassland or low condition.
    - The remaining 42.1 ha (9.9%) of the NSW Box Gum Woodland CEEC listed under the BC Act proposed to be impacted within the Indicative Development Footprints is considered to be in moderate to good condition.
    - Of the 427.0 ha of direct impacts to the NSW Box Gum Woodland CEEC under the BC Act, 81.6 ha (approximately 19%) will be partially directly impacted within the transmission line easements proposed by the Modified Project.
    - Impacts to the NSW Box Gum Woodland CEEC under the BC Act are approximately 2.1 x greater (226.15 ha) than the impact threshold of 200.85 ha for this TEC as specified in Condition 18(a) of the Development Consent SSD 6696.
    - Despite the proposed removal of 427.0 ha of the NSW Box Gum Woodland CEEC by the Modified Project, approximately 3,725.0 ha (or nearly 90%) will remain in the Modified Development Corridor.

- Given the broad extent of the NSW Box Gum Woodland CEEC it is impossible to completely avoid impacts to the NSW Box Gum Woodland CEEC, and very difficult to further minimise impacts by re-routing access tracks from public roads to the turbines without resulting in perverse ground disturbance impacts and impacts to other constraints including landholder no-go-zones, existing land uses, and better quality patches of NSW Box Gum Woodland CEEC.
- A range of avoidance and minimisation measures have been designed and will be implemented by the Modified Project as part of the BMP to reduce impacts to the NSW Box Gum Woodland CEEC. These include avoidance of higher quality patches of the NSW Box Gum Woodland CEEC, reducing the number of proposed wind turbines, no-go zones, pre-clearance and tree-felling protocols, salvage of habitat.
- In the event the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection point and is adopted by the Project, approximately 216 ha of impact to various PCTs (including 97 ha of impact to NSW Box Gum Woodland CEEC and 17 ha of impact to Commonwealth Box Gum Woodland CCEC) would be avoided.

- Due to the increased extent of vegetation removal proposed by the Modified Project, this BDAR identifies that the Modified Project is proposed to have substantially larger impacts on biodiversity values compared with the Approved Project as detailed in the original biodiversity assessments (NGH Environmental 2013a, 2013b and 2017).
- The Modified Project has not identified impacts on new biodiversity values that were not previously assessed for the Approved Project.
- While the extent of impacts of the Modified Project are larger than compared with the Approved Project (SSD-6696) the nature of the impacts and biodiversity values to be impacted by the Modified Project is considered to be consistent with the Approved Project for which Development Consent SSD 6696 and Federal Approval EPBC 2014/7136 were granted.
- In relation to the 8 x turbines relocated within the North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61), the impacts are considered indifferent to the broader Modified Project. Four PCTs (395, 488, 490 and 495) were recorded within this location, all of which are widely recorded throughout the wind farm component of the Modified Project. There are no impacts to NSW Box Gum Woodland CEEC or Commonwealth Box Gum Woodland CEEC associated with the North East Turbine Cluster. Vegetation within this section does support species polygon habitat for eastern cave bat, large-eared pied-bat; as well as potential habitat for regent honeyeater, swift parrot and koala.

Rationale for increased impacts to biodiversity values

- While the Modified Project results in additional impacts to biodiversity values compared with the Approved Project (SSD 6696) there are a number of important factors that must be considered:
  - The Approved Project (SSD 6696) did not include an impact assessment of the anticipated public road upgrades or upgrades of existing farm access tracks. These impacts have now been assessed for the Modified Project.
  - The impacts assessed for the Modified Project are a more realistic estimate of the likely ground disturbance and vegetation removal, and opportunities to further reduce impacts will be explored during detailed design.

- Impacts to threatened species (species-credit species and ecosystem-credit species) were not assessed in detail for the Approved Project (SSD 6696) (Determination Assessment Report (DPIE 2018b)). Instead, these species were assessed using a uniform area of habitat. As the Modified Project has assessed impacts to species-credit species in accordance with BAM (DIPE 2020a), species polygons were naturally going to increase in size due to the rigour of BAM.
- As per Consent Condition 19(a) (SSD 6696), the Modified Project has updated "the baseline mapping of the vegetation and key habitat within the final disturbance area". Through the completion of this process, there has been refinement of the PCT, Vegetation Zone, TEC and threatened species habitat mapping across the Modified Project in accordance with BAM (DIPE 2020a).
- An additional 1,209.32 ha or 1.6 x more NSW Box Gum Woodland CEEC was identified in the Approved Development Corridor following the additional detailed survey and analysis.
- It is likely the more comprehensive survey and analysis undertaken as part of the biodiversity assessment of the Modified Project has resulted in a more detailed map of PCTs, vegetation zones and TECs across the Project.

Assessment of the Approved Project

- Section 5.4 of the Determination Assessment Report (DPIE 2018b) states that the Approved Project was assessed under the NSW Offsets Policy using the FBA.
- A preliminary calculation of the likely credit requirement for the Approved Project was undertaken by NGH Environmental using the FBA calculator as part of the Revised Offset Strategy, as presented in Appendix F of the Biodiversity Assessment Addendum (2017).
- The preliminary FBA assessment calculated the likely ecosystem and species offset requirements for the Approved Project as presented in Table 16 and Table 17 of the Determination Assessment Report (DPIE 2018b).
- It was noted in the Section 2.1 of the Revised Offset Strategy (NGH Environmental February 2017) that these credits were only indicative and would be confirmed "using field collected plot data, and would be based on the final impact areas derived from civil construction drawings (not yet available)".
- Consent Condition 19(b) (SSD 6696) required the Approved Project to calculate the biodiversity offset credit liabilities for the development in accordance with FBA.
- The inception of the BC Act changed the assessment requirements for SSD projects in NSW with biodiversity impact assessment needing to meet the requirements of the Biodiversity Offset Scheme (BOS) via the application of the BAM. Consultation with BCS and DPE, as described in **Section 1.5,** confirmed that the BAM would be the applicable assessment methodology for the Modified Project.

Serious and Irreversible Impacts Assessment

- SAII assessments have been conducted for the three SAII entities recorded within the Modified Development Corridor (NSW Box Gum Woodland CEEC, large-eared pied-bat, and eastern cave bat) in accordance with the BAM and the principles set out in the BC Regulations, and the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE, 2019).
- The consent authority is responsible for deciding whether an impact is serious and irreversible and can approve a State Significant Development which is likely to have SAII, under the BC Act.

Matters of National Environmental Significance

- The Modified Project will result in impacts to 42.1 ha of Commonwealth Box Gum Woodland CEEC listed under the EPBC Act:
    - Impacts to the Commonwealth Box Gum Woodland CEEC under the EPBC Act is 31.7 ha more than the approved impact threshold of 10.37 ha (EPBC 2014/7136).
    - Approximately 362.5 ha of Commonwealth Box Gum Woodland CEEC under the EPBC Act was identified within the Modified Development Corridor. Therefore, 320.4 ha (or 88%) of the Commonwealth Box Gum Woodland CEEC will not be impacted by the Modified Project and will persist within the wider Modified Development Corridor, and considerable amounts of the Commonwealth Box Gum Woodland CEEC occur beyond the Modified Development Corridor in the local region.
- The Modified Project will result in impacts to 577.8 ha of potentially suitable habitat for regent honeyeater, compared with 234.7 ha of habitat for the species identified through the Federal Approval (EPBC 2014/7136).
- The Modified Project will result in impacts to 471.7 ha of potentially suitable habitat for swift parrot, compared with 256.3 ha of habitat for the species identified through the Federal Approval (EPBC 2014/7136).
- The Modified Project will result in impacts to 284.5 ha of foraging habitat for large-eared pied-bat. While the Federal Approval (EPBC 2014/7136) did not identify impacts for this species, an Assessment of Significance was undertaken within the Biodiversity Assessment Addendum (NGH Environmental 2017).
- The Modified Project will result in impacts to 672.3 ha of potential foraging and breeding habitat for the koala. While the Federal Approval (EPBC 2014/7136) did not identify impacts for this species, an Assessment of Significance was undertaken within the Biodiversity Assessment Addendum (NGH Environmental 2017).
- The North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61) results in some impacts to identified foraging habitat for large-eared pied bat, potentially suitable habitat for regent honeyeater and swift parrot, and potential foraging and breeding habitat for koala. These North East Turbine Cluster does not result in impacts on the Commonwealth Box Gum Woodland CEEC.

Bird and bat strike risk assessment

- Prescribed impact of turbine strikes were considered for 18 aerial fauna species including 13 birds and five bat species. Of the 18 species assessed six (6) are assigned a High risk rating, 10 are assigned a Moderate risk rating and two (2) are assigned a Minor risk rating of being impacted by the Project.
- The resultant risk rating for these species is primarily due to their relative abundance in the Project site, their predicted or observed flight behaviour in the Project site and/or their known susceptibility to blade strike at wind farms in south-east Australia.
- For each of the six (6) species assigned an overall risk rating of High, four (4) species were considered to have a High likelihood of collision. The two species that were considered to have a Moderate likelihood of collision were considered to have a High consequence from a potential collision.
- The risk rating for powerful owl, barking owl and large bent-winged bat reflect the likelihood of those species occurring in the Project site, their population sizes and potential to fly within the RSA.
- The overall risk rating of High for swift parrot and regent honeyeater reflect the very small remaining population sizes, coupled with each species' migratory nature and habitat fragmentation.

- The overall risk rating of High for white-throated needletail largely reflects the High likelihood of collision of birds in the Project site given their known susceptibility to blade strike at other wind farms in Australia.

- The North East Turbine Cluster (C11, C14, C17, C19, C20, C21, D60, and D61) will result in negligible change (if any) on the outcome of the prescribed impact assessment for the Modified Project in relation to turbine strike. Their inclusion in the Modified Project have not influenced the risk ratings for assessed species. Furthermore, they are not believed to pose a considerable risk to avifauna species that may reside in the adjacent Coolah Tops National Park.

- The results of this assessment have informed the identification of prescribed impacts on protected species and will inform the BBAMP for the Project.

Conclusion

In conclusion, while the Modified Project is estimated to result in a larger extent of impacts than the Approved Project the biodiversity values being impacted remain consistent. Overall, the Modified Project is considered to be broadly consistent with the Approved Project.

The Proponent has sought to avoid, minimise and mitigate biodiversity impacts in the first instance as part of the design, construction and operation phases of the Project. The Indicative Development Footprints are realistic estimates, particularly when compared to the Approved Project (SSD 6696), and opportunities to further reduce impacts will be explored during detailed design. Furthermore, all impacts will be managed through the various management plans that will be required as part of the development consent.

The Proponent is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the Project. Condition 20 of the Development Consent (SSD 6696) requires that the Proponent retire the required biodiversity offsets within two years of commencement of construction; or stage thereof (as per Condition 9).

10.0 References

Botanic Gardens Trust, (2021) *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <http://plantnet.rbgsyd.nsw.gov.au> accessed November 2021.

Bureau of Meteorology (2021). Climate Data Online http://www.bom.gov.au/climate/data/

CSIRO (2021) Summer and autumn activity patterns of the eastern bent-wing bat (*Miniopterus orianae oceanensis*) at a large maternity site in southern New South Wales CSIRO PUBLISHING Australian Journal of Zoology https://doi.org/10.1071/ZO20041

Department of Agriculture, Water and the Environment (DAWE) (2021). Protected Matters Search Tool, found at http://environment.gov.au/epbc/protected-matters-search-tool, last accessed October 2021.

Department of the Environment (DoEE) (2013). Draft Survey Guidelines for Australia's Threatened Orchids

Department of the Environment and Energy (DoEE) (2017). *Liverpool Range Wind Farm Federal Approval (EPBC 2014/7136)*.

Department of the Environment and Heritage (DEH) (2006) *White Box – Yellow Box – Blakely's Red Gum – grassy woodlands and derived native grasslands – EPBC Act Policy Statement*.

Department of Environment and Resource Management (DERM). 2011. National recovery plan for the large-eared pied bat *Chalinolobus dwyeri*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Department of Planning, Industry and Environment (DPIE) (2015). State Vegetation Type Map – Border Rivers Gwydir / Namoi Region Version 2.0 VIS 4467

Department of Planning, Industry and Environment (DPIE) (2015). State Vegetation Type Map – Central West / Lachlan Region Version 1.4 VIS 4468

Department of Planning, Industry and Environment (DPIE) (2017). State Vegetation Type Map – Central Tablelands Region Version 1.0 VIS 4778

Department of Planning, Industry and Environment (DPIE) (2018a). *Development Consent (SSD 6696)*.

Department of Planning, Industry and Environment (DPIE) (2018b). State Significant Development Assessment, Liverpool Range Wind Farm: Assessment Report (SSD 6696).

Department of Planning, Industry and Environment (DPIE) (2019a). *Biodiversity Assessment Method Operational Manual (Stage 2)*

Department of Planning, Industry and Environment (DPIE) (2019b). *Guidance to assist a decision-maker to determine a serious and irreversible impact*

Department of Planning, Industry and Environment (DPIE) (2019c). State Vegetation Type Map – Upper Hunter v1.0 VIS 4894

Department of Planning, Industry and Environment (DPIE) (2020a). *Biodiversity Assessment Method 2020*

Department of Planning, Industry and Environment (DPIE) (2020b). *Surveying Threatened Plants and Their Habitats,* 3 April 2020.

Department of Planning, Industry and Environment (DPIE) (2020c). *Draft Koala Habitat Protection Guideline and Koala Habitat Protection SEPP*

Department of Planning, Industry and Environment (DPIE) (2021a). BioNet Atlas of NSW Wildlife, last accessed November 2021.

Department of Planning, Industry and Environment (DPIE) (2021b). Threatened Biodiversity Data Collection (TBDC), last accessed November 2021.

Department of Planning, Industry and Environment (DPIE) (2021c). Vegetation Information System (VIS) last accessed November 2021.

Department of Planning, Industry and Environment (DPIE) (2021d). *Koala Habitat Protection SEPP*

Epuron (2011). *Major Project Application: Liverpool Range Windfarm*.

Epuron (2014). *Liverpool Range Wind Farm Environmental Assessment*.

Epuron (2017). *Liverpool Range Wind Farm Response to Submissions Report*.

Harden, G, J, editor, (1992). *Flora of New South Wales. Volume 3*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (1993). *Flora of New South Wales. Volume 4*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (2000). *Flora of New South Wales. Volume 1*. 2nd edition. New South Wales University Press and Royal Botanic Gardens, Sydney.

Harden, G, J, editor, (2002). *Flora of New South Wales. Volume 2*. Revised edition. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Keith D.A (1998). *An evaluation and modification of World Conservation Union Red List criteria for classification of extinction risk in vascular plants*. Conservation Biology 12: 1076– 1090

NGH Environmental (2013a). *Biodiversity Assessment, Liverpool Range Wind Farm – Wind Farm Study Area.*

NGH Environmental (2013b). *Biodiversity Assessment, Liverpool Range Wind Farm – Transmission Line Study Area.*

NGH Environmental (2017). *Biodiversity Addendum Report: Liverpool Range Wind Farm and Transmission Line Project*.

New South Wales (NSW) Scientific Committee (2020). *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC (BC Act), referred to as White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Critically Endangered Ecological Committee – Final Determination*

Strahler, A. N., (1952) Hypsometric (area-altitude) analysis of erosional topography, *Geological Society of America Bulletin* 63 (11): 1117-1142.

Threatened Species Scientific Committee (TSSC) (2006). *Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.* Department of Environment, Climate Change and Water NSW, Sydney.

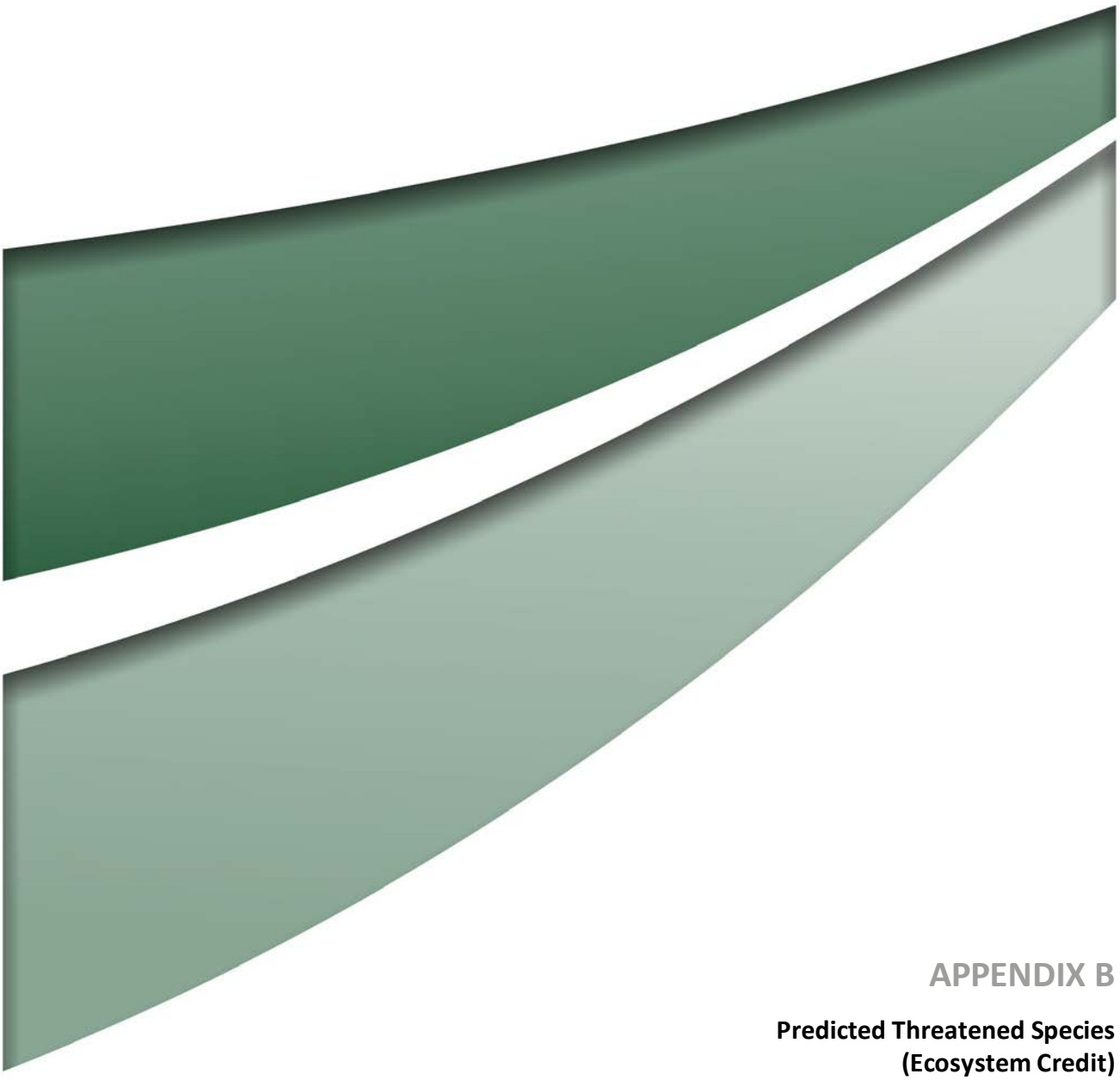
Tozer, M and Simpson, C (2020). Conservation Assessment of White Box – Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland. NSW Threatened Species Scientific Committee 22/06/2020.

Umwelt 2020. Rye Park Wind Farm – Biodiversity Development Assessment Report, Final (August 2020).

Umwelt 2021. Rye Park Wind Farm – Impact Assessment Addendum (March 2021).

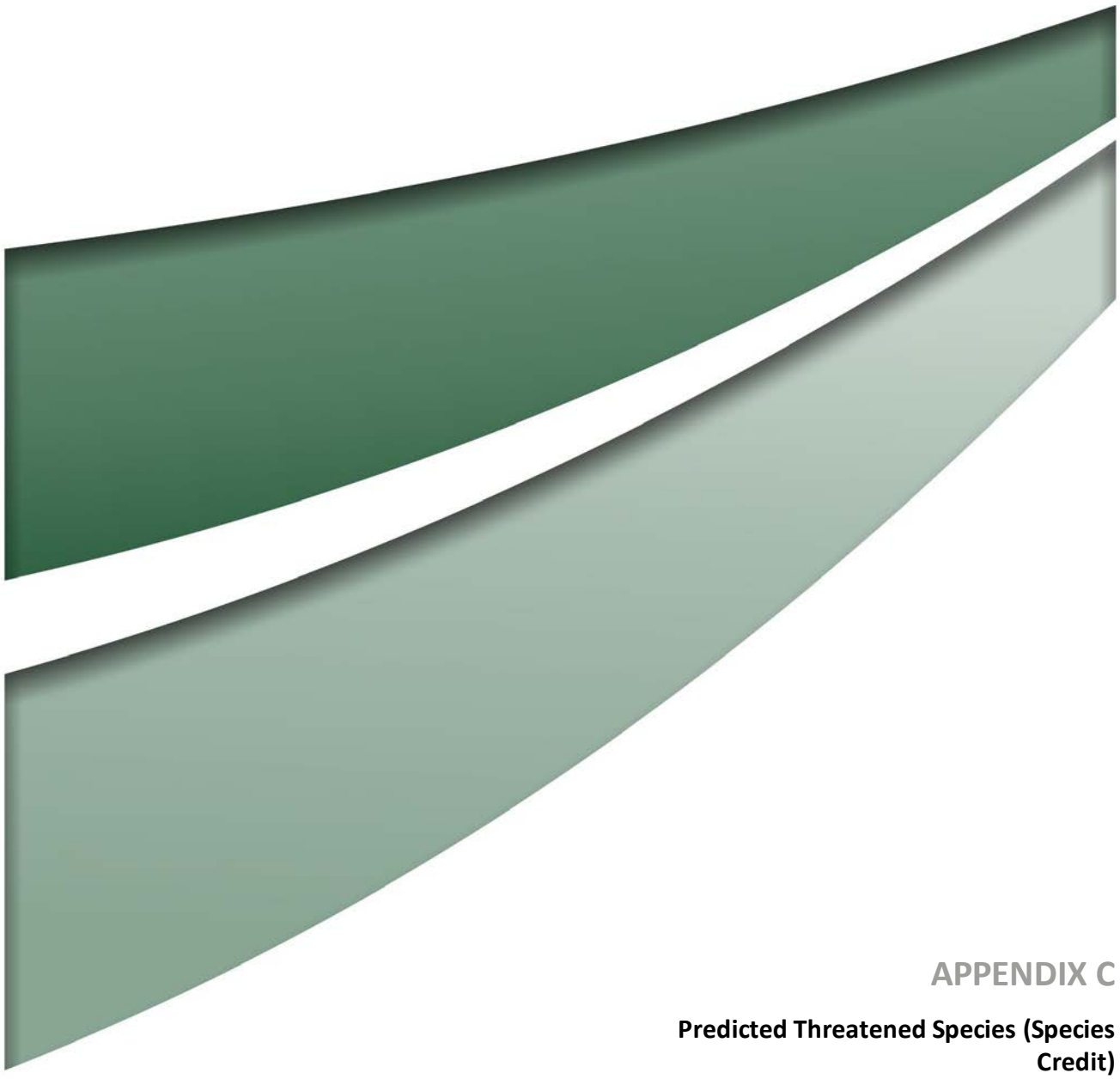
APPENDIX A

Detailed Figure Package



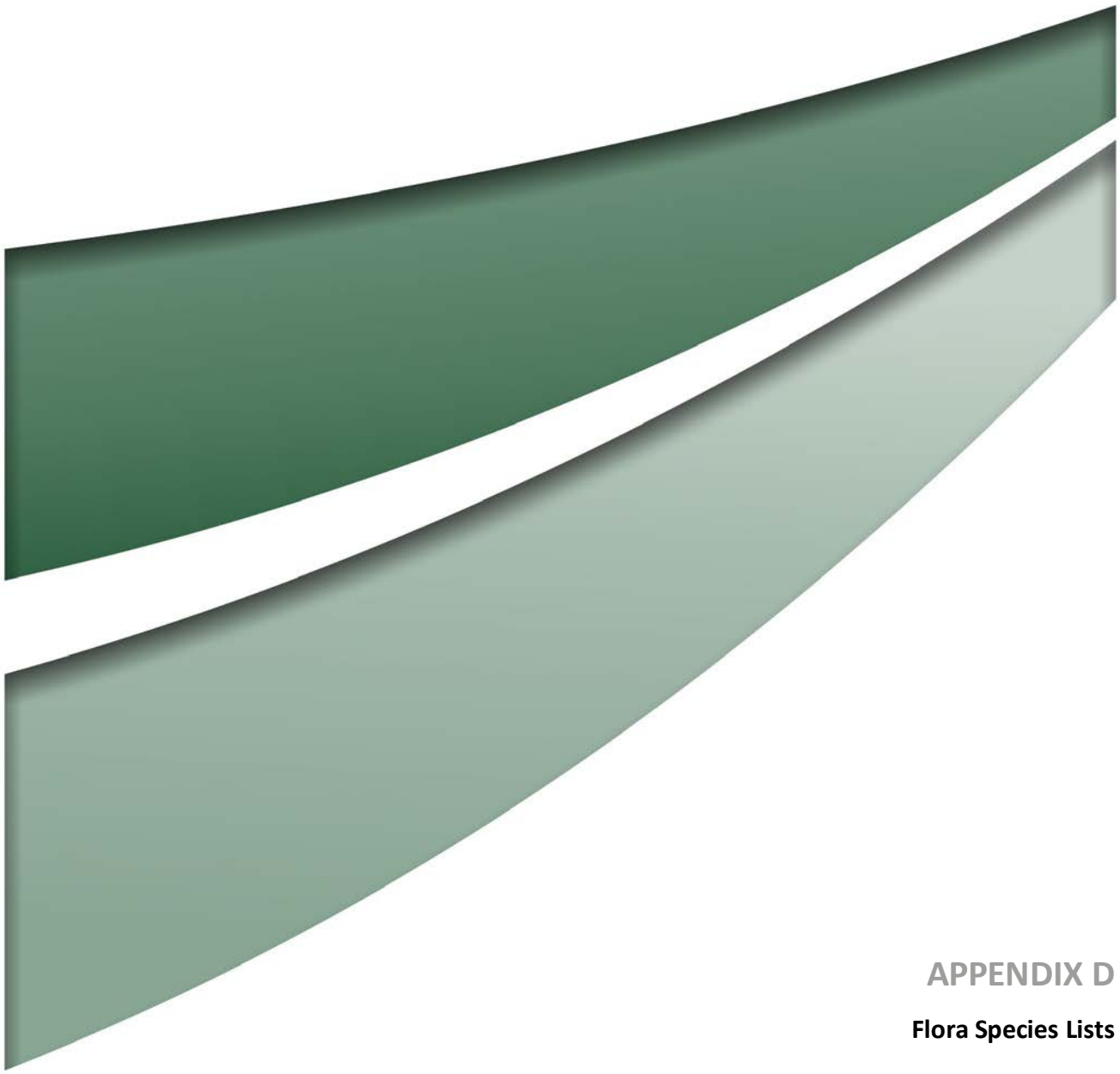
APPENDIX B

Predicted Threatened Species (Ecosystem Credit)



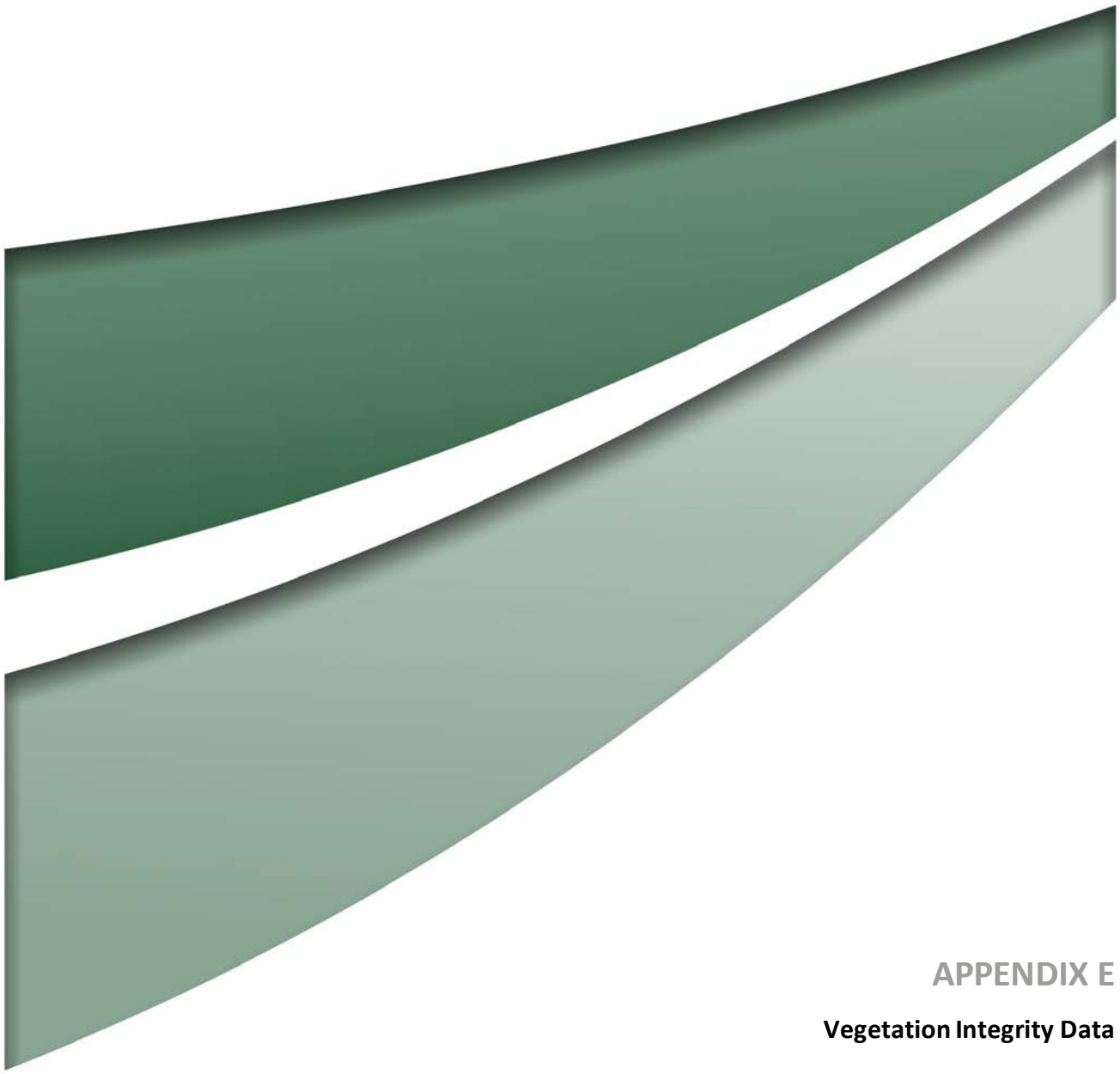
APPENDIX C

Predicted Threatened Species (Species Credit)



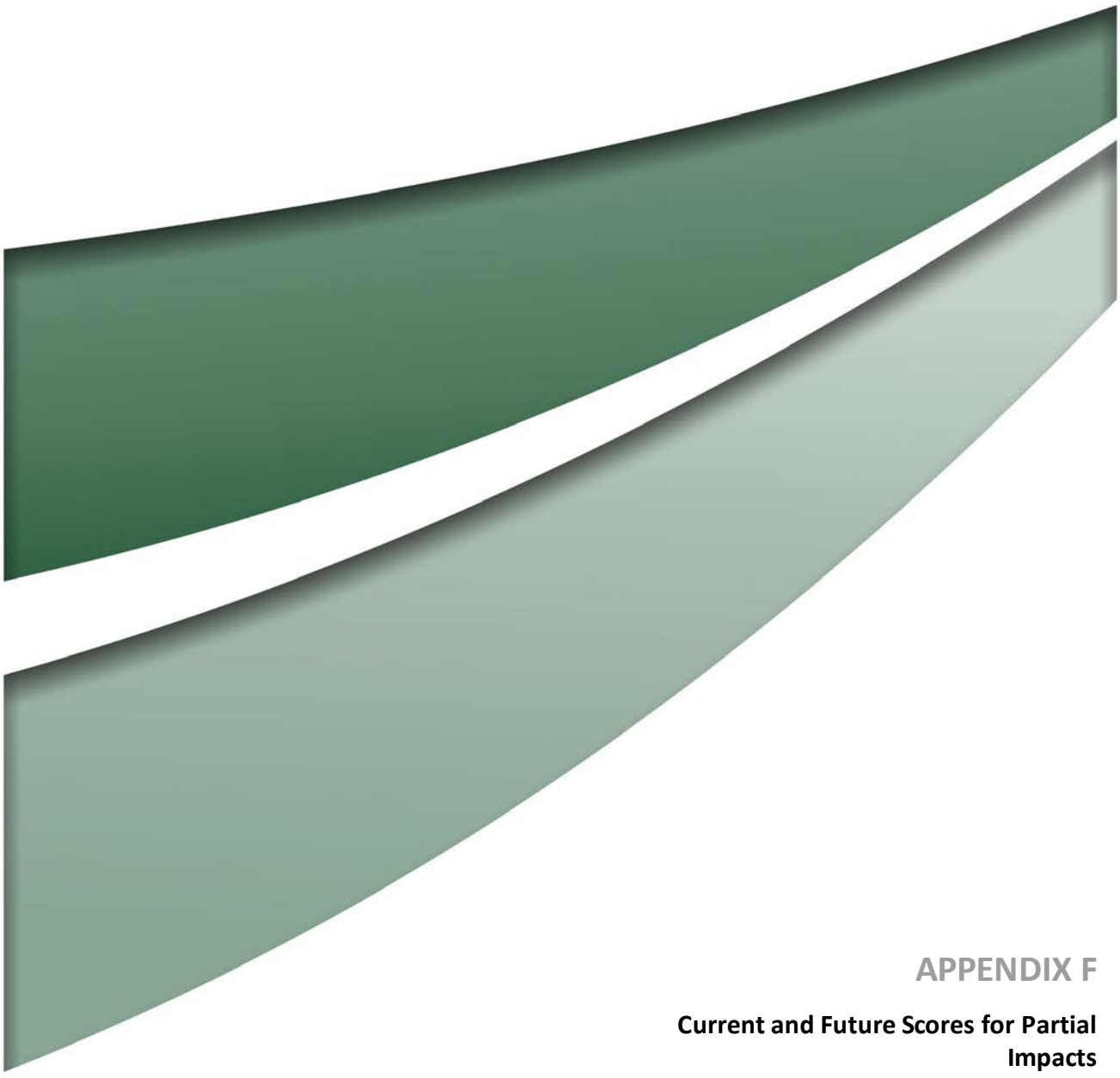
APPENDIX D

Flora Species Lists



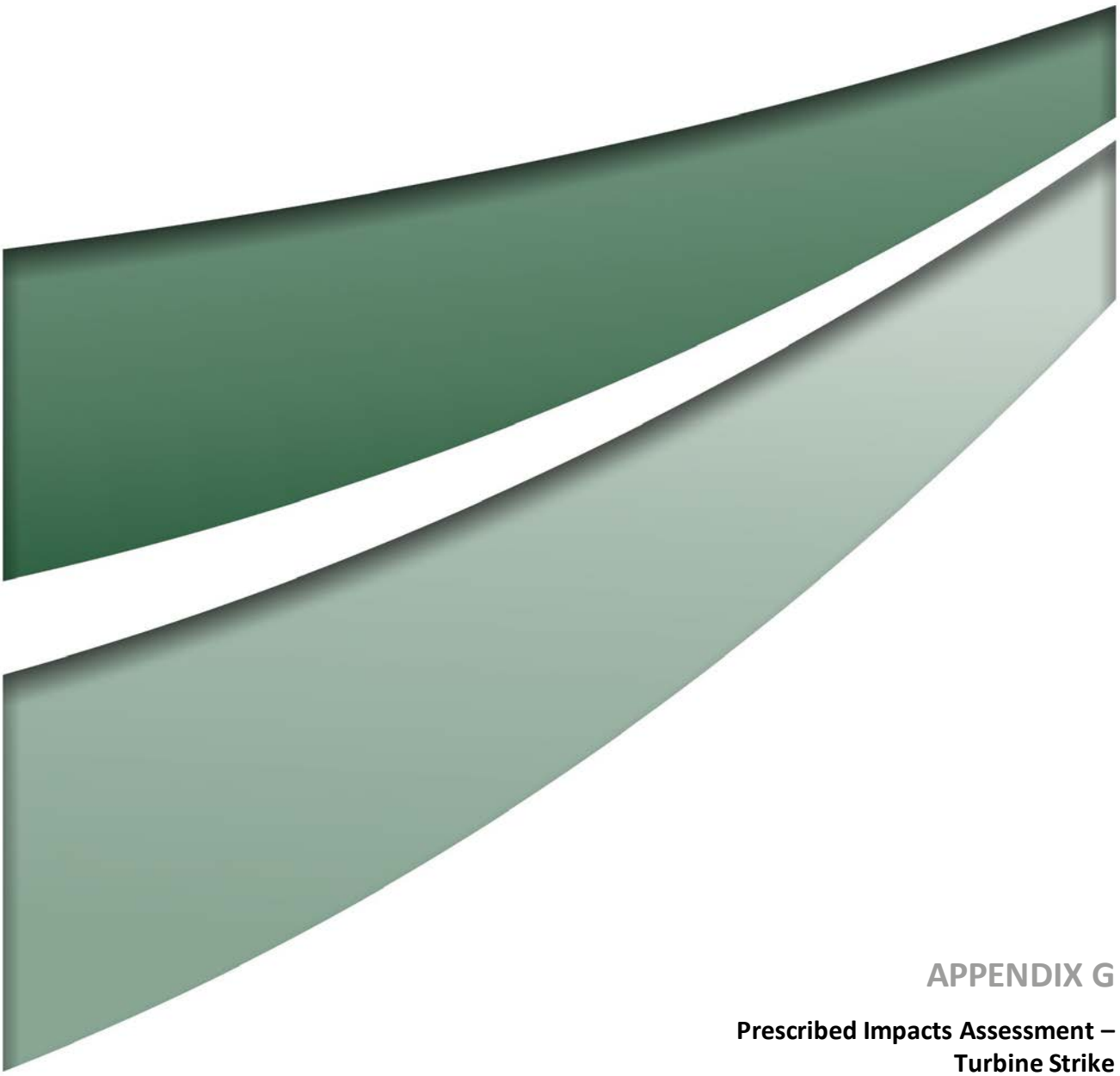
APPENDIX E

Vegetation Integrity Data



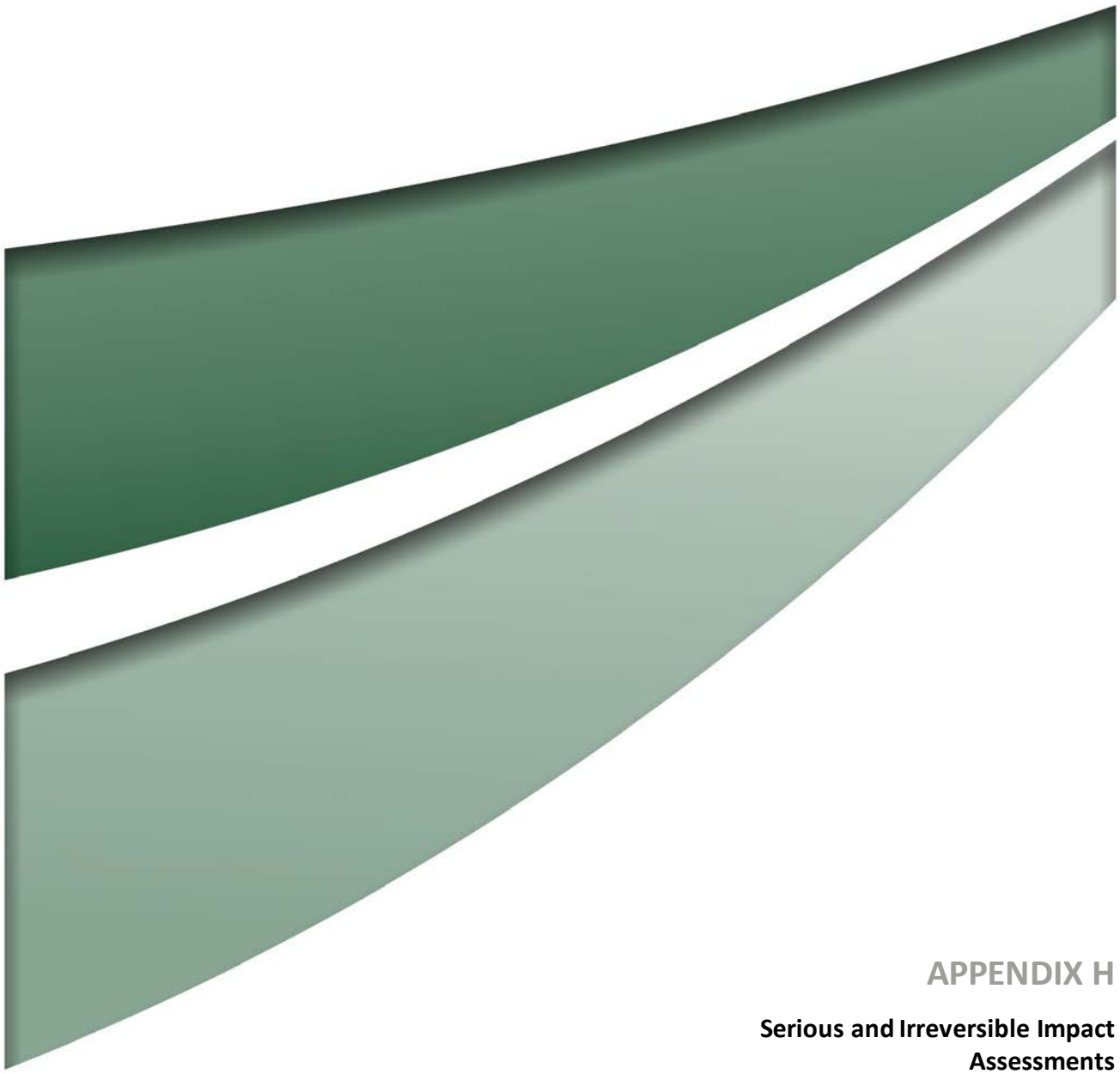
APPENDIX F

Current and Future Scores for Partial Impacts



APPENDIX G

Prescribed Impacts Assessment –
Turbine Strike



APPENDIX H

Serious and Irreversible Impact Assessments

APPENDIX I

Biodiversity Credit Reports

umwelt
Environmental & Social Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au