Chapter 4

Project development

Acknowledgement of Country

Neoen Australia acknowledges the traditional custodians of the land in which we live, and pays its respects to their elders, past and present. The Gunditjmara are the original custodians of the Country on which the Project is located and we acknowledge them as the original custodians. We are committed to Aboriginal engagement and reconciliation and aim to bring Aboriginal and Torres Strait Islander people, local communities and the councils along for the journey to strengthen relationships and enhance local community outcomes.

4 Project development

The Project has been developed using an iterative design process to incorporate environmental and social constraints with consideration of technical and commercial feasibility. The design has continuously been revised as information about these constraints has become available in the Environment Effects Statement (EES) technical studies and in the public domain.

This chapter describes the development of the Project to date, including alternatives considered throughout the EES process. Design decisions that have been made as a result of the EES studies have been discussed, with key alternatives detailed in **Section 4.2** and other design changes discussed in **Section 4.3** onwards.

This chapter addresses Section 3.4 of the *Scoping Requirements for Kentbruck Green Power Hub Environment Effects Statement* (Scoping Requirements), which provides the requirements for documenting the Project alternatives in this EES. In particular, this EES must document the process that has led to the design assessed in this EES and describe the potential environmental impacts of feasible alternatives.

The Scoping Requirements also stipulate that the depth of investigation of alternatives should be proportionate to their potential to minimise potentially significant adverse effects and to meet the Project objectives. Three design alternatives have been assessed in full in this EES, which relate to small sections of the transmission line alignment, the high voltage (likely 275 Kilovolt (kV) powerline alignment, and transport routes. These are discussed in **Section 4.2.**

Former designs and alternatives were evaluated early in the Project's development by Neoen Australia Pty Ltd (the Proponent) and in many cases, were also assessed in early versions of the EES studies. As these designs have been superseded by the layout assessed in this EES (see **Chapter 3 *Project description***), their potential impacts are generally not discussed in the EES technical reports and have instead been summarised in this chapter. However, the **Transmission Line Options Assessment** (**Appendix A**) details the history of the transmission line's development and the environmental issues associated with each of the main route and configuration options considered.

4.1 Site selection rationale

Regions that are most suited to wind farms are characterised by high average wind speeds and winds that are constant, or which coincide with peak electricity consumption periods. Suitable locations for a wind farm are also determined by proximity to electricity transmission infrastructure, available capacity of the transmission network, proximity to areas with high electricity demand, a smooth landscape which minimises turbulence and mechanical stress on turbines while also maximising wind speeds, and environmental and social constraints.

Australia's best wind resources are mostly located in the southern parts of the continent within the westerly wind belt, including in western Victoria (Geoscience Australia, n.d.). Publicly available data and mapping (e.g. (BoM, 2011); see **Plate 4.1**) indicate that the Portland area has a good wind resource, which is reinforced by the presence of existing wind farms in the area. As discussed in **Chapter 2 *Project rationale***, average wind speeds in the Portland region range from 4.1–7.1 metres per second (m/s) (14.7–25.5 kilometres an hour (km/hr)) throughout the year (BoM, 2021). The Project is anticipated to have a high capacity factor of 42 %, meaning that the Project would generate 42 % of its theoretical maximum power, reflecting the excellent wind resource in the Project Area with consistently high average wind speeds.

The extensive tracts of plantation in the region pose a unique opportunity for wind farm development. The Project is proposed in pine plantation to avoid and minimise potential environmental impacts compared to areas where native vegetation is present. Native vegetation often remains on farmland, whereas plantation activities including forestry and bushfire management are typically undertaken intensively across a site and result in extensive loss of native vegetation. The land available in the Green Triangle Forest Products (GTFP) plantation for wind farm development has the potential to host more than 100 wind turbines and provide readily available supporting infrastructure such as access tracks.

Co-locating wind farms in plantations is generally viewed favourably by the public as a loss of productive agricultural land is often raised as a community concern in relation to renewable energy developments. Pine plantations have additional benefits for wind farm co-location as pine trees are relatively uniform and generate less wind turbulence than other forms of vegetation, thereby reducing mechanical stress on turbine parts; have an existing network of roads that could be utilised by construction traffic; and support limited native vegetation and habitat for flora and fauna.

The area surrounding the GTFP plantation is also supported by a very low population and density of people, with a total of 29 dwellings identified within 5 km of wind turbines. The closest township to the Project is the small community of Nelson (population 191 from 2021 ABS census data), approximately 3 km to the west of the wind farm site. Potential noise and annoyance impacts on dwellings would be minimal and easily mitigated compared to development opportunities closer to the existing transmission network, particularly closer to Portland.

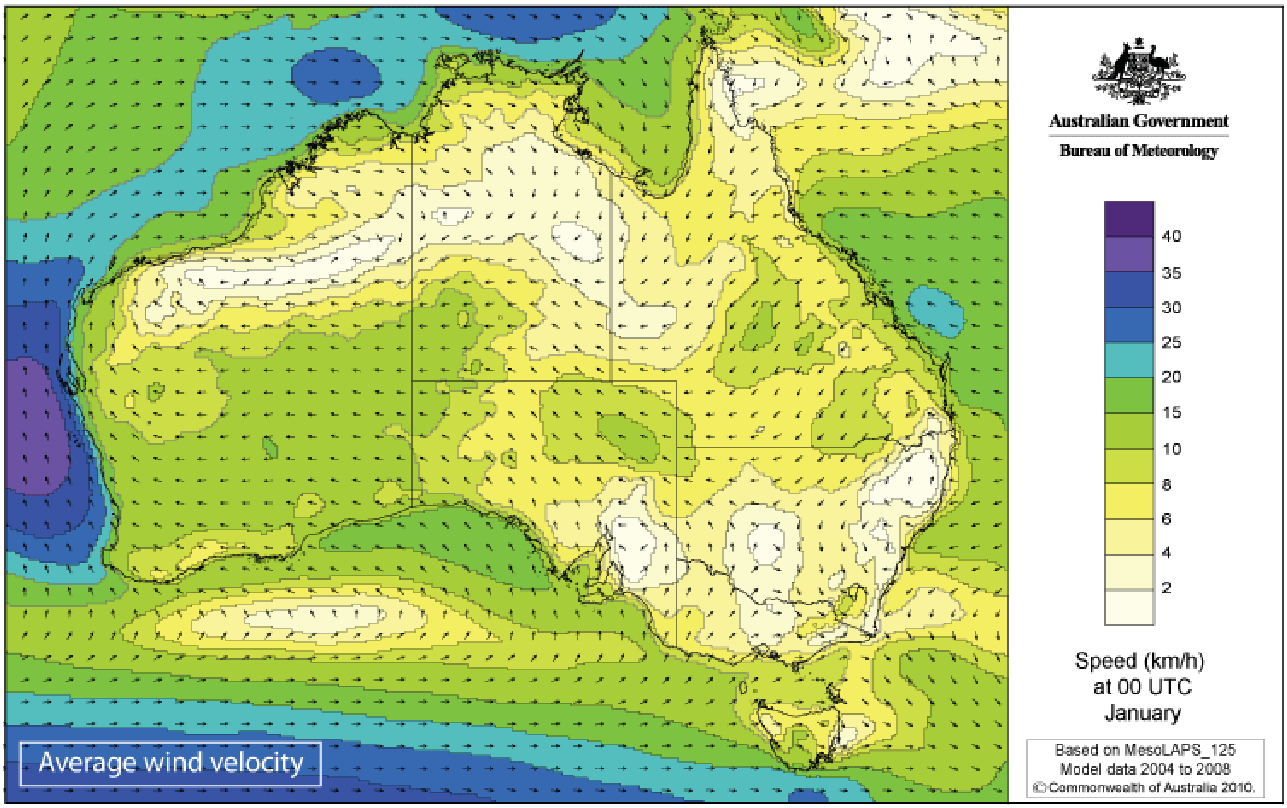

Plate 4.1: Average wind velocity in Australia (BoM, 2011)

The Portland area is an important industrial centre in Victoria due to the Alcoa aluminium smelter, which produces around 19 % of Australia's aluminium (Alcoa, 2022). The area is supported by a large, existing transmission network with a 500 kV transmission line that was built to connect the smelter to the network at the Heywood Terminal Station. The network also supplies electricity to surrounding towns and is extremely secure with the capacity to transport large amounts of electricity to major load centres in Victoria including the smelter and Melbourne. The security of this part of the network means that it can effectively dispatch electricity when required by the Victorian electricity market, which is an important consideration for wind farm projects.

Portland is home to the Port of Portland, which is an important international and national deep water port that specialises in the export of bulk commodity products associated with the region's agriculture, forestry, and mining industries (Port of Portland, 2023). Notably, it is the largest sustainable hardwood chip export port in the world, exporting 7.5 million tonnes (T) in 2016–17 (Port of Portland, 2023). The port is therefore serviced by an existing over-dimensional/oversize overmass (OD/OSOM) vehicle transport network able to transport large equipment from the port into the region, which is critical for wind farm projects.

4.2 Key Project alternatives

The Project has undergone several major design changes in response to various constraints being identified. The various alternatives considered and resulting design changes are summarised in **Table 4.1** and detailed in **Sections 4.3–4.7**.

Table 4.1: Summary of Project alternatives considered throughout the EES process

Project component	Alternatives considered	Relevant section of Chapter 4	Option(s) assessed in this EES
Wind farm			
Wind turbine layout	Various turbine layouts have been considered throughout the EES process. The original layout from 2019 included 157 turbines, while the final layout assessed in this EES includes 105 turbines.	**Section 4.3.1**	105 turbine layout.
Wind turbine design envelope	The exact dimensions and manufacturer of the wind turbines would be selected during detailed design, after the EES process has concluded. As such, this EES is based on a turbine planning envelope for assessing potential impacts relate to blade dimensions and turbine height. The initial planning envelope included a blade tip height of between 45 and 270 metres (m) above ground level. The minimum blade tip height was later increased from 45 m to 60 m to minimise potential impacts on avifauna and bat species.	**Section 4.3.2**	60 m minimum blade tip height and 270 m maximum blade tip height.
High voltage powerline connecting the collector substations to the main wind farm substation	The high voltage powerline has undergone several design iterations. Two key design changes were made to the section of powerline passing through agricultural land in the east of the wind farm site, east of Portland-Nelson Road: • The powerline was changed from overhead to underground. • The powerline was moved from the centre of the property to the northern boundary of the property. In addition, two alternative routes and configurations have been identified for the section of the powerline connecting the eastern collector substation to the main wind farm substation.	**Section 4.4**	Section of the powerline east of Portland-Nelson Road: • configuration: Underground through the agricultural land • location: Along the northern boundary of the agricultural land. Both alternatives between the eastern collector substation and the main wind farm substation.
Battery storage facility	The original Project design included a battery storage facility (BSF). Two different locations had been identified for the BSF: • adjacent to the existing Heywood Terminal Station • adjacent to the main wind farm substation. The BSF was removed from the Project in 2022.	**Section 4.6**	No BSF.
Transmission line			
Transmission line corridor	A range of transmission line route options have been considered throughout the Project's development, including several preliminary options considered prior to referral of the Project in 2019. Of these, two options were identified for further investigation: • option 1 (Heywood option) • option 2 (Portland option). **Section 4.7** describes each transmission line route option and the methodology used to identify unfeasible options.	**Section 4.7.1**	Option 1.

Project component	Alternatives considered	Relevant section of Chapter 4	Option(s) assessed in this EES
Minor route options for sections of Option 1	Several minor route 'sub-options' have been considered for the preferred transmission line alignment (Option 1), including: • Boiler Swamp Road or Cut Out Dam Road through Cobboboonee National Park and Cobboboonee Forest Park (the Parks). • Three options for entry of the transmission line into the Heywood Terminal Station (a northern, southern and middle option). • Two options for the eastern-most crossing of the Surrey River (a northern and southern option). Refer to **Section 4.7** for more information on each sub-option.	**Sections 4.7.2** and **4.7.3**	• Boiler Swamp Road • Middle option for connection into the Heywood Terminal Station • Both options for the eastern-most crossing of the Surrey River.
Transmission line configuration	Two different configurations for the Option 1 transmission line have been considered throughout the Project's development: • Combined underground and overhead configuration, with the underground component through the Parks and the overhead component for the remainder of the transmission line to Heywood Terminal Station • Entirely underground configuration from the wind farm's main substation to Heywood Terminal.	**Section 4.7.1**	• Entirely underground transmission line.
Construction methodology for the underground section of Option 1	Underground cabling within the Parks could be positioned beneath Boiler Swamp Road or along the edge of the road in the shoulder. These options have a range of advantages and disadvantages, as discussed in **Section 4.7.4.** Underground cabling would typically be installed using open cut trenching methods with an excavator. However, an alternative method that involves the use of integrated excavation, cable laying and backfilling equipment was identified as a viable alternative for constructing the underground section of the transmission line through the Parks. A third option considered for the Project is horizontal directional drilling (HDD).	**Section 4.7.4**	• Beneath Boiler Swamp Road • Integrated trenching wheel excavator • HDD for major waterway and culvert crossings and for avoiding impacts on sensitive flora.
Material / equipment supply			
Supply of raw materials	Material needed for construction of the wind farm (and some ongoing maintenance) could be delivered to site from an external supplier or sourced from an onsite quarry.	**Section 4.8**	Onsite quarry.
Wind farm site access points	The wind farm site is serviced by a large network of roads that branch out from Portland-Nelson Road. There are therefore numerous site access points available for transporting Project equipment to the wind farm site during construction (and maintenance and decommissioning).	**Section 4.9**	Ten site access points, including nine for delivery of OD/OSOM)components and one for light vehicle access.

Project component	Alternatives considered	Relevant section of Chapter 4	Option(s) assessed in this EES
Transport routes	Most wind farm components would need to be manufactured overseas and delivered to Australia via sea transport. Three ports located in Victoria could be used for the Project: The Port of Portland, Port of Geelong, or Port of Melbourne. Depending on the port selected for the Project, there would be different route options for transporting OD/OSOM components to the wind farm site.	**Section 4.10**	• Port of Portland for OD/OSOM deliveries and Port of Geelong for other deliveries • Two potential OD/OSOM transport routes from the Port of Portland to the wind farm site, depending on the height of the components.

4.3 Wind turbines

4.3.1 Layout

4.3.1.1 Overview of layout iterations

The Project's turbine layout has undergone several major changes throughout the EES process. The original layout, which accompanied the EES referral in July 2019, involved 157 turbines. As shown in **Figure 4.1**, turbines were distributed in a dense configuration across the initial Project Area. Notably, turbines were located close to the Glenelg Estuary and Discovery Bay Ramsar site (the Ramsar site) boundary, particularly along the southern boundary of the wind farm site where some turbines were within 200 m of the Ramsar site, and on private properties adjacent to the Ramsar site. From the outset, turbines were excluded from within 2 km of the Lake Mombeong campsite to minimise potential visual and noise impacts.

Clusters of turbines were removed or relocated following the identification of constraints and opportunities to avoid or minimise impacts. As outlined in **Table 4.2,** key changes in the turbine layout have been made to minimise potential impacts on biodiversity (including fauna and Groundwater Dependent Ecosystems (GDEs)), and potential noise, visual amenity, and electromagnetic interference impacts, as well as planning considerations. Each of these constraints is shown in **Figure 4.2** and described in detail in the following sections.

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GDA 1994 MGA Zone 54

Legend

- Original Wind Farm Site
- Original turbine layout
- Campsite
- Roads
- Watercourses

FIGURE 4.1

Original turbine layout (July 2019)

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

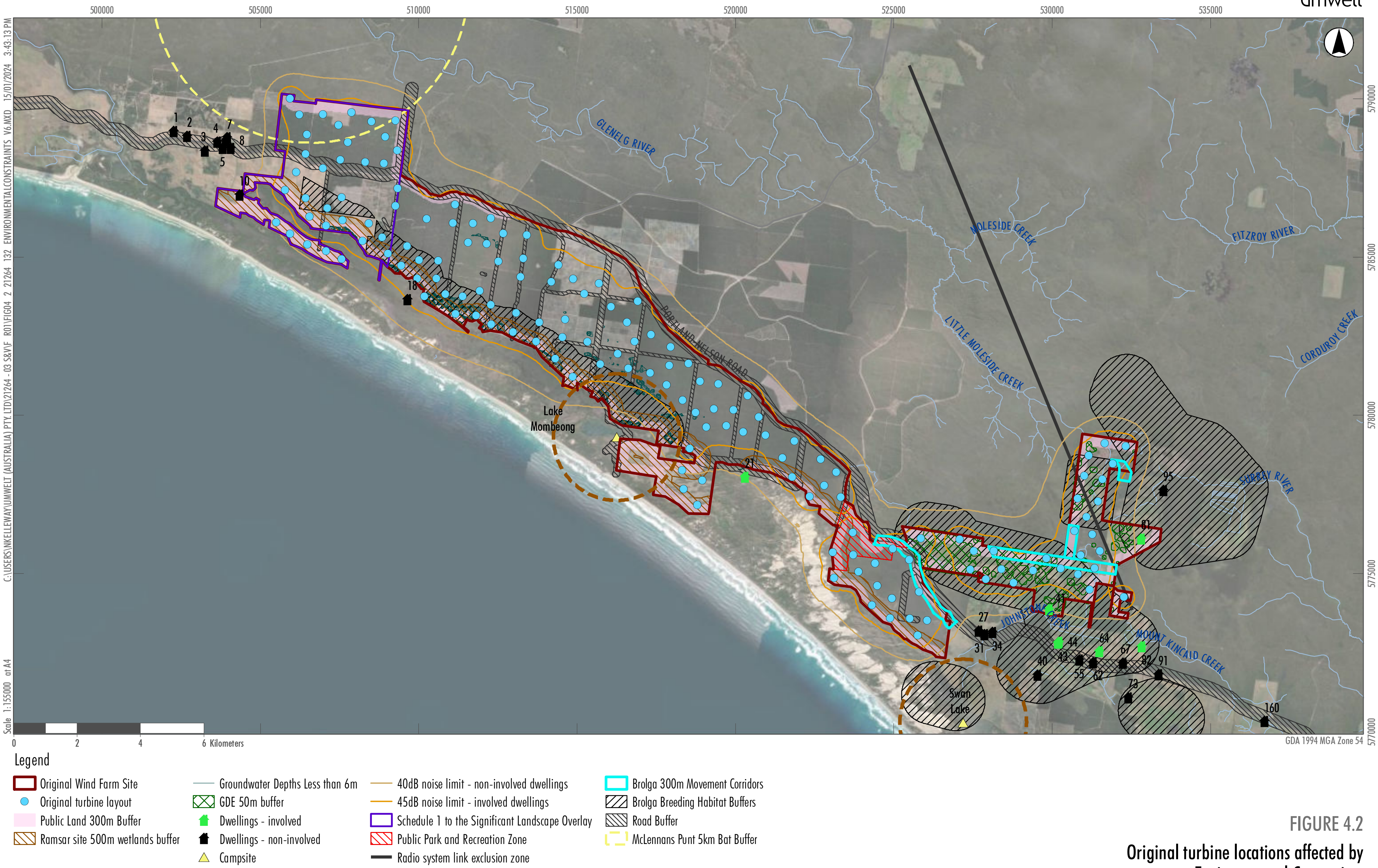


FIGURE 4.2

Original turbine locations affected by Environmental Constraints

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

Table 4.2: Rationale for changes to the turbine layout

Turbine layout change	Description	Rationale	No. of Turbines removed/ relocated as a result	Relevant EES chapter / technical report
Removal of turbines within 300 m of public land	The public land buffer comprises a 300 m-wide turbine rotor exclusion area around conservation reserves adjacent to the wind farm site and other public land that supports native vegetation, including Lower Glenelg National Park, Cobboboonee National Park and the Ramsar site.	The public land buffer would reduce the turbine collision risk for bird species with habitat in the public reserves that may fly across the wind farm site during migratory or local flights. This includes shorebirds, gulls, and terns. Refer to **Section 4.3.1.2** for more information.	**43**	**Chapter 7 *Biodiversity*** **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C)**
Removal of turbines within 500 m of wetlands in the Ramsar site	The Ramsar site wetlands buffer comprises a 500 m-wide turbine rotor exclusion area around wetlands within the Ramsar site. This buffer was extended in practice by an extra 300 m due to other buffers listed in this table (e.g. the Brolga buffers; see below).	The Ramsar site wetlands buffer reduces the turbine collision risk for bird species with habitat within the Ramsar site wetlands that may fly across the wind farm site during migratory or local flights. Refer to **Section 4.3.1.2** for more information.	**27**	**Chapter 7 *Biodiversity*** **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C**)
Removal of turbines from areas within Brolga breeding buffers and movement corridors	The Brolga (*Grus rubicunda*) breeding buffers comprise turbine rotor exclusion areas of various sizes around suitable Brolga breeding and foraging habitat. The movement corridors comprise 300 m-wide turbine rotor exclusion areas to allow for unimpeded movement of Brolgas and other birds between areas of habitat in the eastern portion of the wind farm site.	The Brolga breeding buffers were determined in accordance with the *Interim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population 2011* (2011 Brolga Guidelines) (DSE, 2012) and were informed by current scientific research. **Section 4.3.1.2**details the size of the Brolga buffers adopted by the Project.	**60**	**Chapter 8 *Brolga*** **Brolga Impact Assessment (Appendix D)**
Removal of turbines within 5 km of the Southern Bent-wing Bat roosting site	The buffer comprises a 5 km-wide turbine rotor exclusion area around a Southern bent-wing Bat roosting site.	The buffer reduces the turbine collision risk for the Southern Bent-wing Bat (SBWB), which roosts at the site. Refer to **Section 4.3.1.2** for more information.	**7**	**Chapter 7 *Biodiversity*** **Southern Bent-wing Bat Impact Assessment (Appendix E)**

Turbine layout change	Description	Rationale	No. of Turbines removed/ relocated as a result	Relevant EES chapter / technical report
Removal / relocation of turbines where groundwater levels were estimated to be within 6 m of the ground surface	The groundwater buffer is a 'vertical' 6 m turbine foundation exclusion zone beneath the ground surface in plantation land within the wind farm site.	Any groundwater encountered during excavation would need to be dewatered to allow for Project infrastructure to be installed. A 6 m vertical buffer was used, ensuring that groundwater is highly unlikely to be encountered during wind farm construction within the plantation (the deepest excavations would be 4 m for turbine foundations). This buffer was applied only to the plantation due to the potential connectivity between groundwater in the plantation and GDEs within the Ramsar site. Refer to **Section 4.3.1.3** for more information. Groundwater data indicates that groundwater is likely to be within one and three metres below ground surface (mbgs) in farmland east of Portland-Nelson Road, however all turbines have been removed from this area due to Brolga buffers. Buffers on potential GDEs within this area were applied instead of vertical groundwater buffers, as described below.	**2**	**Chapter 9 *Surface water, groundwater and groundwater dependent ecosystems*** **Groundwater Impact Assessment (Appendix G)**
Removal / relocation of turbines within 50 m of mapped potential GDEs in farmland east of Portland-Nelson Road	The GDE buffer comprises a 50 m-wide turbine foundation exclusion area around mapped potential GDEs within farmland east of Portland-Nelson Road.	GDEs within 50 m of a turbine are considered to be exposed to a high magnitude of impact if dewatering is required for construction of the turbine foundation. A width of 50 m was therefore selected for the GDE buffers. Refer to **Section 4.3.1.3** for more information. No GDE buffers are needed within the plantation as no turbines are expected to intersect with groundwater in this area.	**1**	**Chapter 9 *Surface water, groundwater and groundwater dependent ecosystems*** **Groundwater Impact Assessment (Appendix G)**
Removal of turbines within the Significant Landscape Overlay	Schedule 1 of the Significant Landscape Overlay (SLO1) aims to protect and enhance the landscape character of the Glenelg River Estuary and surrounds.	The area protected by the SLO1 is a regionally significant landscape where the Glenelg River, Southern Ocean and the coastal edge converge, with the landscape's visual significance enhanced by environmental and visitor attractions. The SLO1 covers some of the land in the western end of the wind farm site. Some turbines were removed from within the SLO1 to ensure that the objectives of the overlay could be achieved. Additional turbines were	**4**	**Chapter 16 *Land use and planning*** **Land Use and Planning Impact Assessment (LUPIA) (Appendix Q)**

Turbine layout change	Description	Rationale	No. of Turbines removed/ relocated as a result	Relevant EES chapter / technical report
		also removed from the SLO1 due to the SBWB buffer. Refer to **Section 4.3.1.5** for more information.		
Removal / relocation of turbines within land zoned previously Public Park and Recreation	Objectives of the Public Park and Recreation Zone (PPRZ), of relevance to the Project, are to protect and conserve areas of significance where appropriate, and to provide for commercial uses where appropriate.	A small portion (230 ha) of the wind farm site is located on land previously PPRZ. All wind turbines were removed from within the PPRZ to better meet the public land objectives of this zone. This area of PPRZ has since been rezoned to Farming Zone (FZ) through the gazettal of Amendment C96gelg occurred on 15 June 2023.This is discussed further in **Section 4.3.1.5**.	**4**	**Chapter 12** ***Landscape character and visual amenity*** **LUPIA (Appendix Q)**
Removal / relocation of turbines near roads	These setbacks are turbine foundation exclusion areas from the edge of roads, such as Portland-Nelson Road and Council roads. The setback distance depends on the type of road.	These setbacks would help minimise potential disruption to traffic, particularly with OD/OSOM vehicles turning off Portland-Nelson Road into the wind farm site during Project construction. Refer to **Section 4.3.1.5** for more information.	**21**	**Chapter 15** ***Transport*** **Transport Impact Assessment (TIA) (Appendix P)**
Relocation of turbines within the exclusion zone of a point-to-point radio system link	The point-to-point radio system link exclusion zone, referred to as the second Fresnel zone, is an ellipsoid area through which radio waves travel between a signal source and receiver where maximum interference can occur if the signal is obstructed.	Radio waves associated with a point-to-point radio system operated by Telstra pass through the north-eastern corner of the wind farm site. Wind turbines can impact point-to-point radio systems by interfering with the radio waves passing between two towers. One turbine in the original layout was located within the exclusion zone of this link (the second Fresnel zone). Telstra recommended that this turbine be relocated to the west to provide sufficient clearance, and the turbine was later removed from the Project in response to biodiversity constraints. Refer to **Section 4.3.1.5** for more information.	**1**	**Chapter 18** ***Safety, hazard, and risk*** **Electromagnetic Interference Assessment (Appendix U)**

4.3.1.2 Biodiversity constraints

The original wind farm site comprised approximately 9,641 hectares (ha) of land, including 6,528 ha of pine plantation (the same area of GTFP plantation as in the current Project Area) and 3,113 ha of freehold farming land. The additional farming land included properties close to the Discovery Bay coastline, some of which are surrounded on three sides by the Ramsar site (see **Figure 4.3**). The turbines on these properties were removed from the Project for several key reasons:

1. To minimise turbine collision risk for species flying between inland habitats and the Ramsar site.
2. To avoid potential indirect impacts on the Ramsar site and GDEs more generally, which could arise from dewatering where turbine foundations intersect groundwater. This is discussed further in **Section 4.3.1.3**.
3. To minimise potential visual impacts on users of adjacent public land including the Discovery Bay Coastal Park and Great South West Walk (GSWW) (see **Section 4.3.1.4**).
4. To minimise potential direct and indirect impacts on tangible and intangible Aboriginal cultural values, including the sensitive dune landscapes south of the Project Area.

Five different buffers were identified by Biosis as part of the **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C), Brolga Impact Assessment (Appendix D)** and **Southern Bent-wing Bat Impact Assessment (Appendix E)** to minimise potential biodiversity impacts (see **Figure 4.3**):

- A 300 m turbine rotor exclusion area around public reserves, including Lower Glenelg National Park, Cobboboonee National Park, the Ramsar site, and several other reserves such as the Kentbruck H14 and H50 Bushland Reserves.
- A 500 m turbine rotor exclusion area from wetlands within the Ramsar site.
- A 5 km turbine rotor exclusion area around SBWB roosting cave area.
- Buffers comprising turbine rotor exclusion areas of various dimensions around suitable Brolga breeding and foraging habitat, determined as per the 2011 Brolga Guidelines (DSE, 2012) and informed by current scientific evidence.
- Movement corridors comprising 300 m-wide turbine rotor exclusion areas to allow for unimpeded movement of Brolga and other birds between areas of habitat in the eastern portion of the wind farm site.

Turbines were also removed within the view of Hedditch Hill Scenic Reserve to mitigate potential visual effects of views of turbines from this location (see **Section 4.3.1.4)**. This also has the effect of ensuring a 700 m to 1.1 km wide corridor between habitats south of the wind farm site and those north of Portland-Nelson Road, at the eastern end of the wind farm site, which may be used as a transitory corridor by some bird species. **Plate 4.2** shows a view to the south-west from the lookout in May 2022.

The 300 m public reserve buffers and 500 m Ramsar site wetland buffers were applied to minimise the turbine collision risk for bird species with habitat in the public reserves and Ramsar site wetlands that may fly across the wind farm site during migratory or local flights. The 5 km buffer to SBWB roosting caves was applied to minimise the turbine collision risk specifically for SBWB, but would also reduce collision risk for other flying species in this area.

The 2011 Brolga Guidelines state that siting turbines to avoid and minimise impacts on breeding and non-breeding habitats where Brolgas spend the vast majority of the year is an important strategy for avoiding potential wind farm impacts on Brolgas (DSE, 2012). They recommend that turbine-free areas be established around all potential Brolga nesting sites “sufficient to have no significant impact on the likelihood of successful reproduction” (DSE, 2012). The 2011 Brolga Guidelines provide a general recommendation of a 3.2 km radius turbine-free buffer around breeding sites, noting that the spatial requirements of Brolgas are not well understood so smaller buffer areas can be used if the Pcan show that the habitat requirements can be met and that Victorian Department of Energy, Environment and Climate Action (DEECA) Barwon South West (BSW) endorses this approach (DSE, 2012).

BSW has acknowledged the proposed Brolga buffers shown on **Figure 4.3** respond well to the objectives described in the 2011 Brolga Guidelines. These buffers were developed by Biosis in accordance with the methodology described in the 2011 Brolga Guidelines and based on recent science. **Chapter 8 *Brolga*** details the methodology and information used to determine the buffer dimensions.

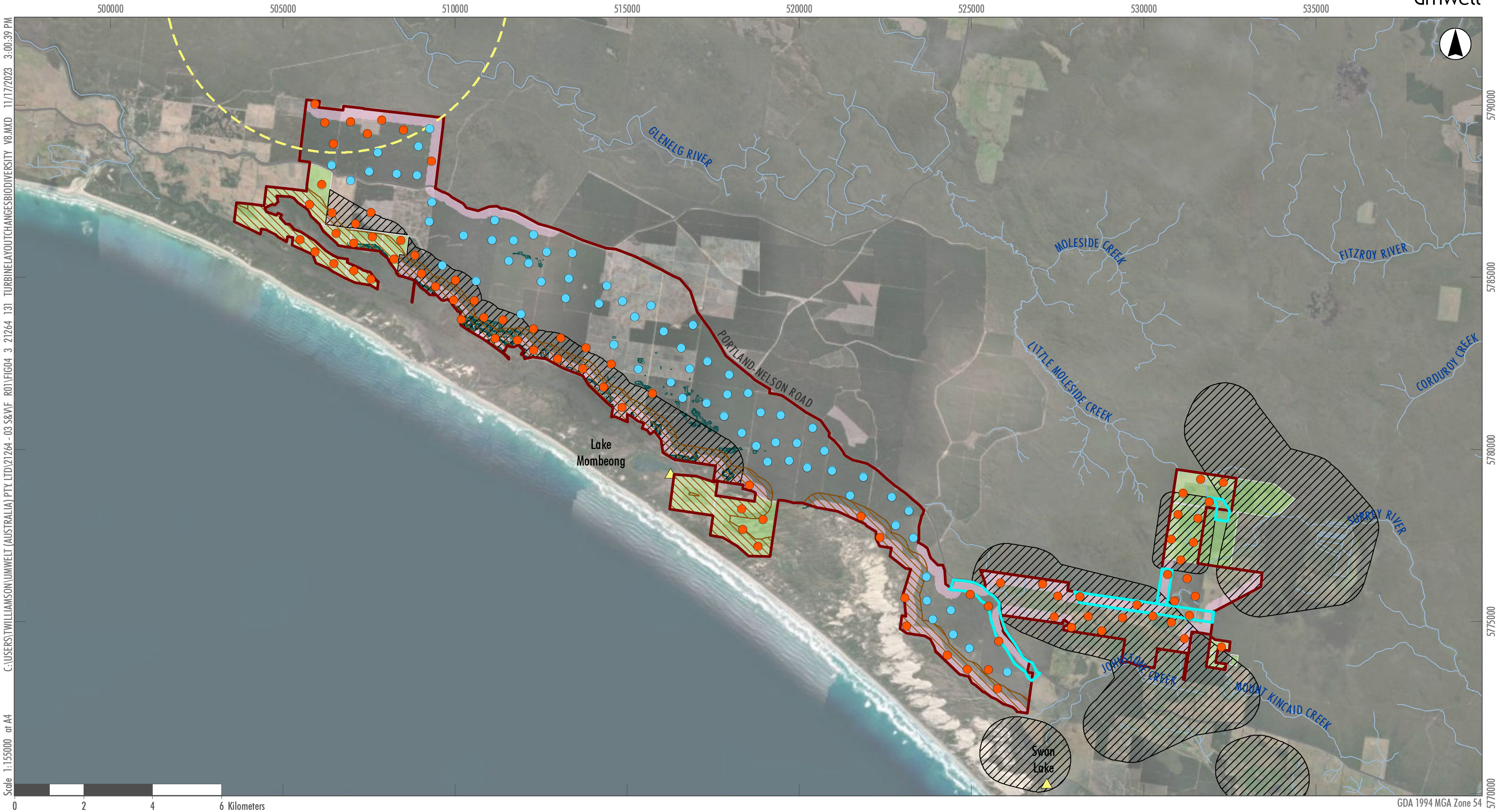
Turbine-free movement corridors are not required under the 2011 Brolga Guidelines but were applied to protect movement pathways known to be used by Brolgas and other birds in the area to further reduce the collision risk.

As shown in **Table 4.3**, a total of 91 turbines from the original layout were removed or relocated as a result of applying the above biodiversity buffers (see also **Figure 4.4**). Of these, 38 were in plantation land and 42 within farming land.

Table 4.3: Summary of original turbines removed or relocated due to biodiversity constraints

Buffer type	Number of turbines removed or relocated		
	Plantation land	Farming land	Total
Initial removal of turbines from properties near the Ramsar site	0	9	9
Public reserve buffers	21	22	43
SBWB roosting cave buffer	7	0	7
Buffers on Ramsar site wetlands	13	14	27
Brolga breeding habitat buffers	20	33	53
Brolga movement corridors	3	4	7
Total number of unique turbines*	**38**	**42**	**91**

*Several of the same turbines were located within more than one type of biodiversity buffer. The total number of turbines removed from the original layout is therefore not the numeric sum of turbines removed from each type of buffer.



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Legend

- Original Wind Farm Site
- Original turbine layout
- Turbines removed or relocated
- Public Land 300m Buffer
- Ramsar Site 500m Wetlands Buffer
- Brolga Breeding Habitat Buffers
- Brolga 300m Movement Corridors
- Properties Removed From the Project
- Campsite
- McLennans Punt 5km Bat Buffer
- Groundwater Depths Less than 6m

FIGURE 4.3

Changes made to the original turbine layout due to biodiversity constraints

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

4.3.1.3 Groundwater constraints

Dewatering would be required where excavation for turbine foundations or other infrastructure such as underground cabling intersects with groundwater, which can impact on GDEs that rely on that groundwater. Groundwater level monitoring undertaken as part of the **Groundwater Impact Assessment (Appendix G)** found groundwater close to the surface at some locations along the southern boundary of the wind farm site, and within farmland in the eastern corner of the wind farm site. Groundwater level contours were able to be predicted within plantation land (see **Figure 4.2**) but not within farmland due to the scarcity of data in these areas.

A large number of turbines in the original layout were located along the southern boundary of the wind farm site (see **Figure 4.4**). Two of these turbines were located where groundwater was predicted to be within 6 m of the ground surface, with an additional three turbines very close to the 6 mbgs groundwater level contour. These turbines were moved to avoid the risk of groundwater intersection and need for dewatering but were later removed from the Project due to biodiversity constraints (see **Section 4.3.1.2**).

Groundwater level data from existing private bores, Project monitoring wells and surface water levels indicate that groundwater is shallow in the farmland east of Portland-Nelson Road. Groundwater levels were found to typically be between 1 and 3 mbgs in the summer months and near surface in winter, with most turbines in this area likely to intersect groundwater.

Drawdown levels were calculated in the **Groundwater Impact Assessment (Appendix G),** finding that groundwater levels in the eastern farmland could be temporarily reduced by up to 1.8 m at 50 m from a turbine where groundwater dewatering is required, up to 0.7 m at 150 m distance, and up to 0.4 m at 210 m distance. Dewatering could therefore reduce water levels in consumptive use bores and impact on GDEs located within the drawdown extent and which utilise water from the same sediments being dewatered.

Several turbines had already been removed from this area due to biodiversity constraints (see **Figure 4.4**). A 50 m buffer was subsequently applied around GDEs mapped within the eastern farmland to identify GDEs at the greatest risk of being impacted if dewatering for turbine foundations was required. This resulted in the relocation of one additional turbine (see **Figure 4.4**).

All turbines in the eastern farmland were subsequently removed from the Project due to revised Brolga buffers (see **Section 4.3.1.2**).

4.3.1.4 Visual amenity constraints

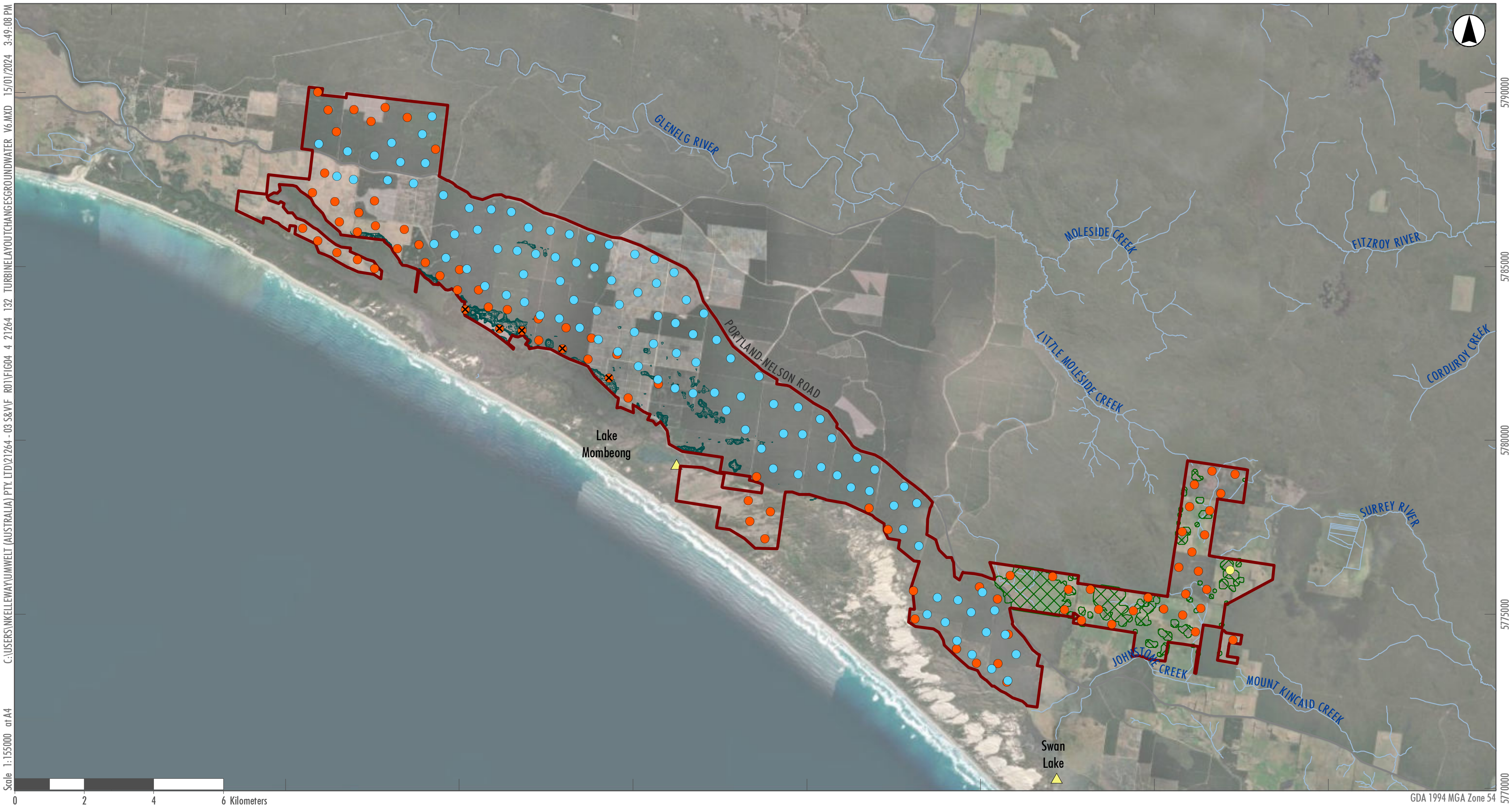
A range of sensitive visual receptors are located near the wind farm site, including dwellings (involved and non-involved), residential areas (e.g. Nelson), and recreational/tourism places such as campsites, lookouts, walking tracks (e.g. the GSWW) and general use areas such as the Discovery Bay Coastal Park.

A 2 km buffer was initially applied around campsites in the vicinity of the wind farm site to mitigate views of turbines from these locations. This buffer is reflected in the original wind farm layout, with turbines offset from the Lake Mombeong Campsite by at least 2 km (see **Figure 4.1**). A campsite buffer of 2 km was chosen as it was the typical buffer size applied to campsites in Victoria at the time and was considered good practice.

Turbines were also removed within the view of Hedditch Hill Scenic Reserve to mitigate views of turbines from this location. The lookout is located on the southern side of Portland-Nelson Road where there are views towards Discovery Bay (when the pine trees are sufficiently short). The buffer is not of a specific width, but extends between around 700 m and 1,100 m from the lookout depending on the direction of view. Views to the south-west were considered most important to retain as they offer a better view of the coastline when the pine trees are sufficiently juvenile. **Plate 4.2** shows a view to the south-west from the lookout in May 2022.

Plate 4.2: View towards Discovery Bay from the Hedditch Hill lookout (Umwelt, May 2022)

Dwellings had 1 km buffers applied to them in accordance with the requirements of the Glenelg Planning Scheme (the Planning Scheme) to identify dwellings that would require written consent from landowners to agree with the turbine placement. This is discussed further in **Section 4.3.1.5**. Potential visual impacts on other visual receptors were assessed in the **Landscape and Visual Assessment (LVIA) (Appendix L)**. No other buffers were applied to the layout to mitigate potential visual impacts.



Legend

- Original Wind Farm Site
- Revised Turbine Layout
- Turbine Removed or Relocated Due to Groundwater Constraints
- Original Turbines Removed or Relocated Due to Biodiversity Constraints
- × Original Turbines That Would Intersect with Groundwater
- Campsite
- Groundwater Depths Less than 6m
- GDE 50m buffer

FIGURE 4.4

Changes Made to the Turbine Layout Due to Groundwater-related Constraints

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

4.3.1.5 Planning constraints

Zoning

Land in the wind farm site is primarily FZ under the Planning Scheme, which provides for the use of land for agriculture and other related uses. A small area of the wind farm site near the Hedditch Hill Scenic Reserve was previously PPRZ, which recognises areas for public recreation and open space and provides for appropriate commercial uses. Glenelg Shire Council (GSC) considered this PPRZ area to be an anomaly in the Planning Scheme, and it has since been rezoned to FZ through the gazettal of Amendment C96gelg occurred on 15 June 2023.

Wind energy facilities are permissible with consent in the PPRZ. Applications for a permit in the PPRZ also require public land manager consent if the applicant is not a public land manager. Although a wind energy facility is not prohibited in the PPRZ, the decision was made to remove four turbines from within the zone to be consistent with its public recreation objectives (see **Figure 4.5**). Despite amendment of the planning scheme to rezone the land to FZ, which would better align with a wind farm development, the removed turbines have not been reinstated in the Project. This has helped minimise potential visual and landscape character impacts associated with views from the Hedditch Hill lookout, as discussed **Section 4.3.1.4**.

Portland-Nelson Road and its road reserve are Transport Zone (TZ). This zone identifies land required for transport services and facilities and provides for the use and development of land that is consistent with the transport system. A turbine-free exclusion zone of 200 m was placed on Portland-Nelson Road to help minimise potential disruption to traffic along Portland-Nelson Road, particularly with OD / OSOM vehicles turning off Portland-Nelson Road into the wind farm site during Project construction. Two turbines in the west of the wind farm site were moved as a result of this setback (see **Figure 4.5**).

Setbacks of various widths were applied to other roads within the wind farm site depending on their level of use by the public and by plantation vehicles, in consultation with GSC, VicRoads (now the Victorian Department of Transport and Planning (DTP)) and GTFP. These buffers were 50 m, 100 m or 200 m. Twenty-one turbines were removed or relocated from within these buffers.

Overlays

The wind farm site is subject to several overlays under the Planning Scheme, including the Environmental Significance Overlay (ESO), SLO and Bushfire Management Overlay (BMO). The ESO and BMO have a range of permit conditions which are relevant to the Project but which do not constrain the Project design. These overlays are discussed in the **Land Use and Planning Impact Assessment (LUPIA) (Appendix Q).**

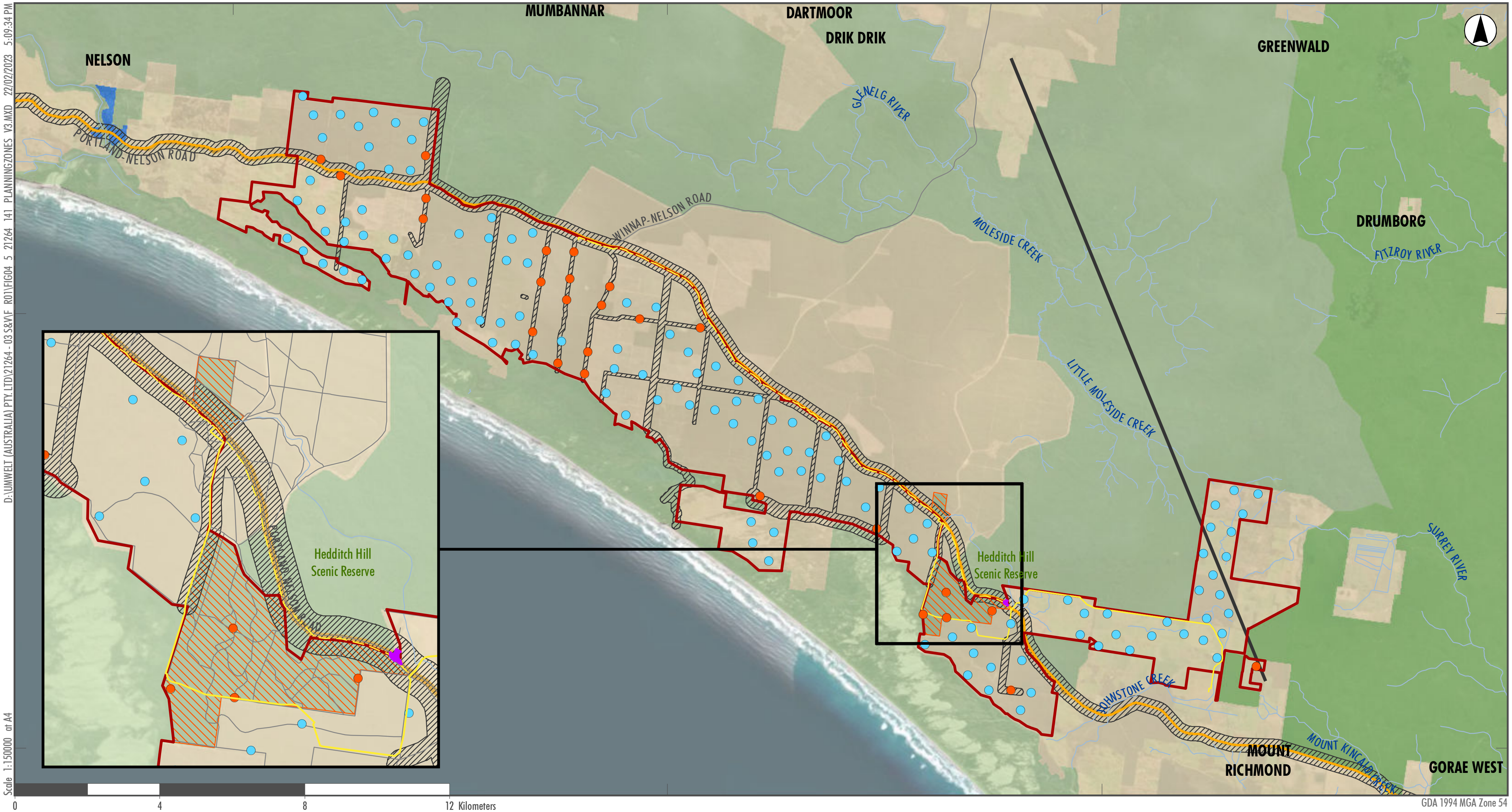
The SLO identifies significant landscapes and aims to facilitate conservation and enhancement of the character of significant landscapes. The SLO1 relates to the Glenelg River Estuary and surrounds. It describes the character of the Glenelg River Estuary as wild and windswept, being dominated by the intersection of strong landscape elements including the sea, beaches, sand dunes and remnant vegetation.

The SLO1 has the following landscape character objectives:

1. To protect locally significant views and vistas, to the ocean, the Glenelg River Estuary and other natural landforms from Nelson-Portland Road, the GSWW and other publicly accessible locations
2. To protect the indigenous coastal vegetation and ensure that it is the dominant feature of the landscape when viewed from the foreshore
3. To retain the undeveloped and vegetated character of coastal dunes, waterways and estuaries near the coastal edge of this landscape
4. To minimise any increase in development visible above the dunes and coastal vegetation outside settlements, when viewed from the beach, foreshore or offshore
5. To discourage buildings set high on dunes or development that will be visible on the skyline
6. To discourage ridge tops and visually prominent hill faces from being visually dominated by buildings
7. To encourage vegetated landscape edges to the settlement of Nelson, which soften the interface of built and rural areas, and avoids expansion of built areas beyond current boundaries.

As shown in **Figure 4.6**, the SLO1 intersects with an area of approximately 1,832 ha in the western portion of the original wind farm site. Most of the turbines south of Portland-Nelson Road within the SLO1 had already been removed or relocated due to biodiversity constraints (see **Section 4.3.1.2**), but an additional four turbines were moved due to the SLO1 to mitigate potential impacts to landscape character in the area, particularly from Nelson and the Discovery Bay coastline (including the GSWW). An additional seven turbines were later removed from the SLO1 to the north of Portland-Nelson Road in response to a buffer around SBWB roosting cave being applied to minimise potential impacts on SBWB (see **Section 4.3.1.2**).

The turbine layout assessed in this EES has retained 12 turbines within the SLO1. Refer to **Chapter 12 *Landscape character and visual amenity*** for further details.



Legend

- Original Wind Farm Site
- Original turbine layout
- Turbine Removed or Relocated
- Watercourses
- Roads
- Radio system link exclusion zone
- 275 kV Powerline - Overhead
- 275 kV Powerline - Underground
- Portland-Nelson Road artefact scatter
- PPRZ Amendement to FZ1
- Road Buffer

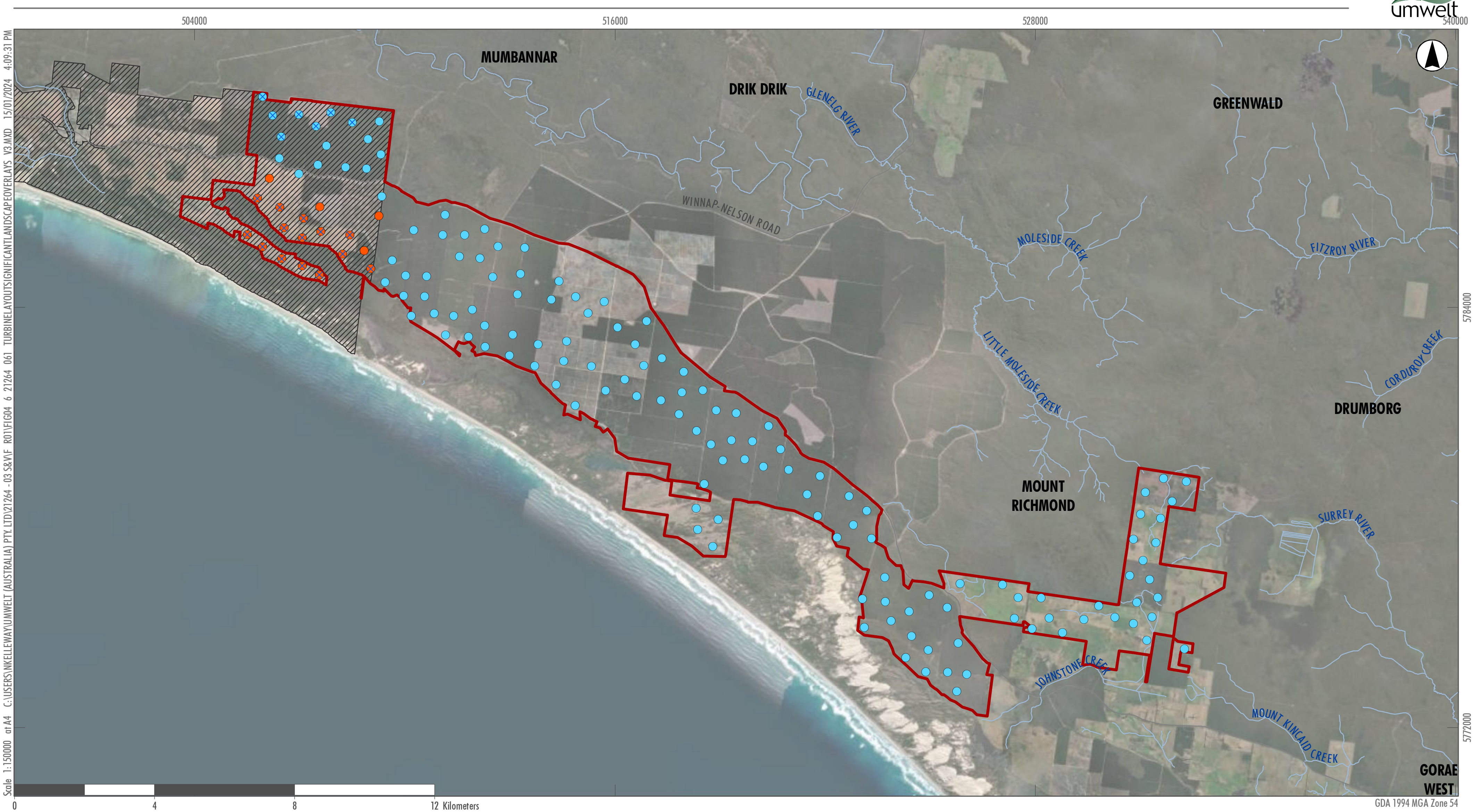
Planning Zones

- FZ - Farming Zone
- PCRZ - Public Conservation and Resource Zone
- PPRZ - Public Park and Recreation Zone
- TZ2 - Transport Zone 2
- RCZ - Rural Conservation Zone
- TZ - Township Zone

FIGURE 4.5

Land use zoning and Changes Made to the Original Turbine Layout

Image Source: ESRI Basemap (2021) Data source: NTTT (2020), Victorian Government (2021), Umwelt (2021)



Legend

- Original Wind Farm Site
- Original turbine layout
- Turbines Removed or Relocated due to the SLO1
- Turbines Already Moved due to Biodiversity Constraints
- Significant Landscape Overlay - Schedule 1 (SLO1)
- Roads
- Watercourses

FIGURE 4.6

Significant Landscape Overlay and Changes Made to the Original Turbine Layout

Image Source: ESRI Basemap (2021) Data source: NTTT (2020), Victorian Government (2021)

Other

The Planning Scheme requires that written agreements be sought from landowners with dwellings located within 1 km of a wind turbine. Dwellings near the wind farm site therefore had 1 km buffers applied to them to identify landowners that would need to provide written agreement for the turbine placement. Turbines would need to be relocated if written agreement was unable to be obtained from any landowners. The Proponent was able to obtain written agreement from all landowners with dwellings within 1 km of a turbine. Although no turbines needed to be moved, the buffers were used to inform turbine layout changes in response to other constraints (e.g. biodiversity), and no turbines have been placed within 1 km of non-involved dwellings.

The 1 km dwelling buffer assists with mitigating potential amenity impacts on people living near the wind farm site. The following noise limits were adopted in accordance with NZS 6808:2010 Acoustics – Wind farm noise (NZS 6808) to identify turbines located too close to dwellings where noise emissions could be non-compliant:

- 40 dB (Decibel) or background L_{A90}+5 dB, whichever is the greater, for non-involved dwellings
- 45 dB or background L_{A90}+5 dB, whichever is the greater, for involved dwellings.

One non-involved dwelling was located within the adopted noise limit (dwelling 18; see **Figure 4.2**). This dwelling later become involved in the Project, despite being outside the 45 dB noise limit for involved dwellings once the layout had been revised due to the biodiversity constraints.

Additionally, radio waves associated with a point-to-point radio system operated by Telstra pass through the north-eastern corner of the wind farm site (see **Figure 4.5**). Wind turbines can impact on point-to-point radio systems by interfering with the radio waves passing between two towers. One turbine in the original layout was located within the exclusion zone of this link (the second Fresnel zone). Telstra recommended that this turbine be relocated to the west to provide sufficient clearance. The turbine was later removed from the Project in response to biodiversity constraints (see **Section 4.3.1.2**).

4.3.2 Minimum blade tip height

The exact dimensions and manufacturer of the wind turbines (and all Project components) would be selected during detailed design, after the EES process has concluded. This EES is based on a turbine planning envelope for assessing potential impacts relating to blade dimensions and turbine height. The original planning envelope included a blade tip height of between 45 and 270 m above ground level. The minimum blade tip height was later increased from 45 m to 60 m to minimise potential impacts on avifauna and bat species.

Findings from the **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C)** and **Southern Bent-wing Bat Impact Assessment (Appendix E)** indicate that most flights for recorded avifauna species occur at heights below 60 m.

4.4 High voltage powerline

The high voltage powerline connects the collector substations to the main wind farm substation. In the original layout which accompanied the EES referral in July 2019, the entire powerline alignment was overhead. In the farmland east of Portland-Nelson Road, the powerline ran through the centre of the property to the main wind farm substation (see **Figure 4.7**).

As discussed in **Section 4.3.1.2**, Brolga breeding and foraging habitats were found within the farmland east of Portland-Nelson Road. Turbine-free buffers were developed in line with the 2011 Brolga Guidelines to identify areas from which turbines should be excluded to remove the collision risk. The guidelines also recommend that new powerlines within the turbine-free buffers be moved to outside the buffers or placed underground (DSE, 2012):

> *"Turbine-free buffer zones are recommended to remove potential impacts of wind farm development on breeding and non-breeding Brolga habitats. Within these areas new powerlines should generally be excluded or placed underground. Other infrastructure which might impact on Brolgas such as new roads should be placed to avoid disturbance".*

The high voltage powerline was therefore changed to underground upon entry into the farmland east of Portland-Nelson Road. As shown in **Figure 4.7**, it was also moved to the northern boundary of the property to minimise direct impacts from excavation and other construction activities on the breeding wetlands. In addition, the Proponent has committed to undertaking certain construction activities in this part of the wind farm outside of the Brolga breeding season to further minimise potential impacts on Brolga.

The final alignment of the high voltage powerline includes two minor route options in proximity to Hedditch Hill. As shown in **Figure 4.7**, the preferred alignment would transition to underground at the eastern collector substation and run beneath existing roads in the GTFP pine plantation to the Portland-Nelson Road / Sandy Hill Road intersection. The alternative route would continue overhead from the collector substation along Portland-Nelson Road to a transition station at the Portland-Nelson Road / Sandy Hill Road intersection.

The underground option is preferred as it would avoid impacts on native vegetation and Aboriginal cultural heritage, avoid potential visual impacts at the Hedditch Hill lookout, and reduce traffic disruptions along Portland-Nelson Road during construction. The Portland-Nelson Road corridor between Wilsons Lower Road and Sandy Hill Road has a relatively narrow shoulder and tight corners, making it a highly constrained section of road where impacts on native vegetation could not be avoided. A large artefact scatter is also located at the Portland-Nelson Road / Telegraph Track intersection which could be difficult to avoid (see **Figure 4.7**).

The non-preferred option has been retained in the Project as it avoids the area south of Hedditch Hill. As discussed in **Section 4.3.1.5**, Project infrastructure was moved out of this area previously zoned PPRZ to better align the Project with the zone's public land objectives. However, GSC has since rezoned this land FZ through the gazettal of Amendment C96gelg to reflect the underlying land use, which is for plantation purposes.

4.5 Other wind farm infrastructure

The locations of the wind farm substations (collector substations and main wind farm substation) are mostly determined by the turbine layout and proximity to a road where they are readily accessible during construction and maintenance. However, the collector substations have also been located to avoid impacts on native vegetation and threatened flora species, and to minimise clearance of pine plantation and impacts on GTFP operations. The main wind farm substation was originally located in farmland adjacent to Cobboboonee Forest Park, but was later moved to the south, further away from the Forest Park (see **Figure 4.7**). The revised location simplifies the transmission line route into the Forest Park and also provides a larger setback from the forest vegetation, which is beneficial for bushfire mitigation. Siting of the transmission line is discussed further in **Section 4.7**.

Turbines and other Project infrastructure such as the substations have also been positioned on flat ground where possible and away from dwellings and groundwater bores, to minimise the amount of ground levelling and vegetation clearance required and to minimise potential impacts on landowners.

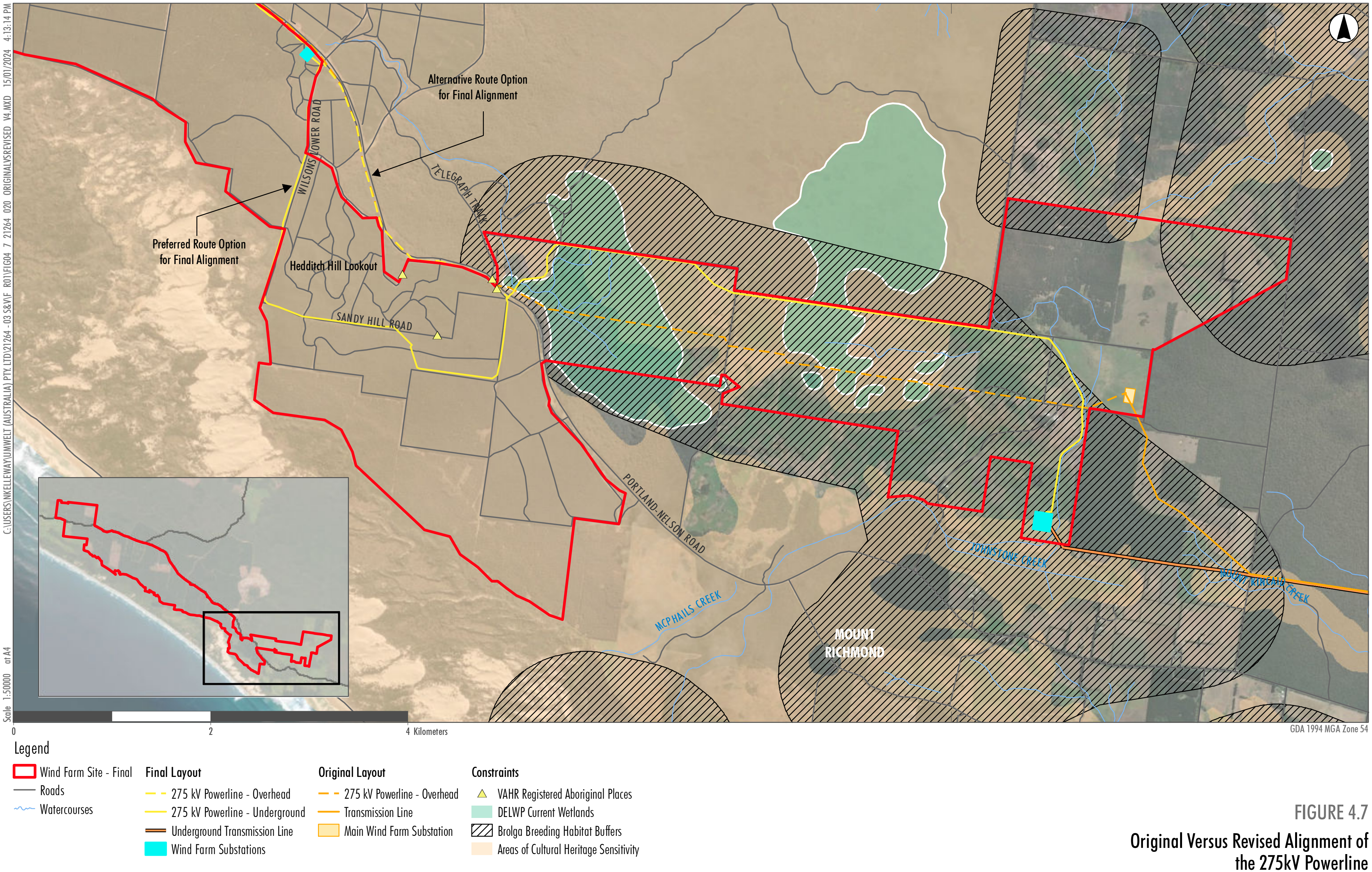


FIGURE 4.7

Original Versus Revised Alignment of the 275kV Powerline

Image Source: ESRI Basemap (2021) Data source: DELWP (2021); Geoscience Australia (2021); Aurecon (2021)

4.6 Battery storage facility

The original Project design included a BSF, located adjacent to either the main wind farm substation or the existing Heywood Terminal Station. The BSF was removed from the Project in 2022 as the Proponent considers that the Victorian electricity network imminently requires wind resources from the Project more so than a BSF at the Project's location. The Proponent's BSF strategies for Victoria are focused on other parts of the state. Removal of the BSF component of the Project has also reduced the bushfire and noise amenity risks of the Project.

The Proponent provided a letter to the Minister requesting to remove the BSF from the Project. The Minister at the time, the Hon Richard Wynne MP, responded on 29 May 2022 that there was no need to amend the Scoping Requirements due to removal of the BSF and approved the Project design change.

The Proponent also submitted a request for variation to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) to vary the 'proposed action' description to remove the BSF. This variation was accepted by DCCEEW on 21 October 2022.

Potential impacts of the BSF have therefore not been assessed in this EES.

4.7 Transmission line

4.7.1 Location of transmission line corridor

The Project's transmission line has been developed through an iterative design process with consideration of technical and commercial requirements in conjunction with environmental, heritage, and socioeconomic values. This section provides a summary of the development history of the Project's transmission line based on a detailed transmission line options assessment undertaken as part of the EES process. The **Transmission Line Options Assessment (Appendix A)** details the route options considered by the Proponent early in the Project's development and provides an assessment of the feasible options against a range of relevant criteria to determine which option would be the least constrained and most aligned with the transmission line Project objectives.

The Proponent initially identified a set of high-level transmission corridor options based on potential grid connection locations in both Victoria and South Australia, as shown in **Figure 4.8**. An initial assessment for each option was undertaken by the Proponent to determine the potential viability of each option, with consideration of Project design, electrical requirements, existing network capacity, engineering capabilities and cost constraints.

A Victorian grid connection was selected as the preferred option due to grid constraints in South Australia and stability issues associated with the length of line that would be needed to connect the Project to Mount Gambier. Broad-scale desktop mapping was undertaken to identify prominent environmental, social and land use constraints to avoid, such as more densely populated areas and sensitive landscapes. Design and constructability factors were also considered, including the length of the transmission line, and whether the transmission line would be located underground or overhead. Commercial factors were also considered, including the costs of constructing and operating the infrastructure and to secure landowner agreements to install infrastructure on freehold land.

From this assessment, four preliminary route options were identified (see **Figure 4.9**):

- **Route 1**: Extending east from the wind farm site through the Parks and freehold agricultural land, connecting into the existing Heywood Terminal Station.
- **Route 2**: Extending south-east from the wind farm site through freehold agricultural land, connecting into the existing 500 kV Heywood-Portland transmission line via a cut-in to the north of Portland.
- **Route 3:** Extending north from the wind farm site through the Hancock Victorian Plantation (HVP) plantation and Lower Glenelg National Park, using the existing easement of the SA-VIC Interconnector to connect into the Heywood Terminal Station.
- **Route 4:** Extending east from the wind farm site through Gorae West, Cobboboonee Forest Park and freehold agricultural land, connecting into the Heywood Terminal Station.

The preliminary route options were assessed against the transmission line Project objectives, to determine which options should be taken forward for further assessment. The overarching objective of the transmission line is to deliver renewable energy from the Project's wind farm to the National Electricity Market (NEM) in a way that minimises potential environmental, heritage, social, economic and land use impacts and is permissible, constructable, and cost-effective. Refer to **Chapter 2 *Project rationale*** for the complete list of transmission line Project objectives.

Route 1 was found to be feasible as it would avoid large extents of productive agricultural and residential land and the associated amenity impacts, and has scope for design, siting and constructability optimisation. The potential for impacts has also been minimised by locating the transmission line located beneath an existing road. Route 2 was also found to be feasible as it would be a cost-effective option that avoids the Parks and any associated impacts and consent requirements. Both route options were included in the Project's EES referral in July 2019 and were taken forward for further consideration as part of the EES process.

Routes 3 and 4 were not found to be feasible so were not considered further. Route 3 is significantly longer and more complex than the other options and is associated with higher costs and land tenure challenges. Route 4 would require substantial native vegetation clearance and three highway crossings and would traverse a relatively narrow and winding road through Cobboboonee Forest Park that has added constructability complexity.

Different configurations and alignments were explored for each preliminary route option. As shown in **Figure 4.10**, this led to the identification of four feasible transmission line options requiring detailed assessment:

- **Heywood Option 1A**: Extending underground from the main wind farm substation through the Parks beneath an existing road, transitioning to overhead after exiting the Forest Park, then extending overhead through freehold rural landholdings to connect into the Heywood Terminal Station. The total length of underground line is 18.8 km, with 7.8 km of overhead line.
- **Heywood Option 1B**: Following the same route as Option 1A but entirely underground. The total length of underground line is 26.6 km.
- **Portland Option 2A**: Extending overhead from the main wind farm substation to the south-east through freehold landholdings and connecting to the existing 500 kV line via a cut-in, north of Portland. Requires a new electrical terminal station adjacent to the cut-in point. The total length of overhead line is 26 km.
- **Portland Option 2B**: Following the same route as Option 2A but entirely underground. Also requires a new terminal station at the cut-in point. The total length of underground line is 26 km.

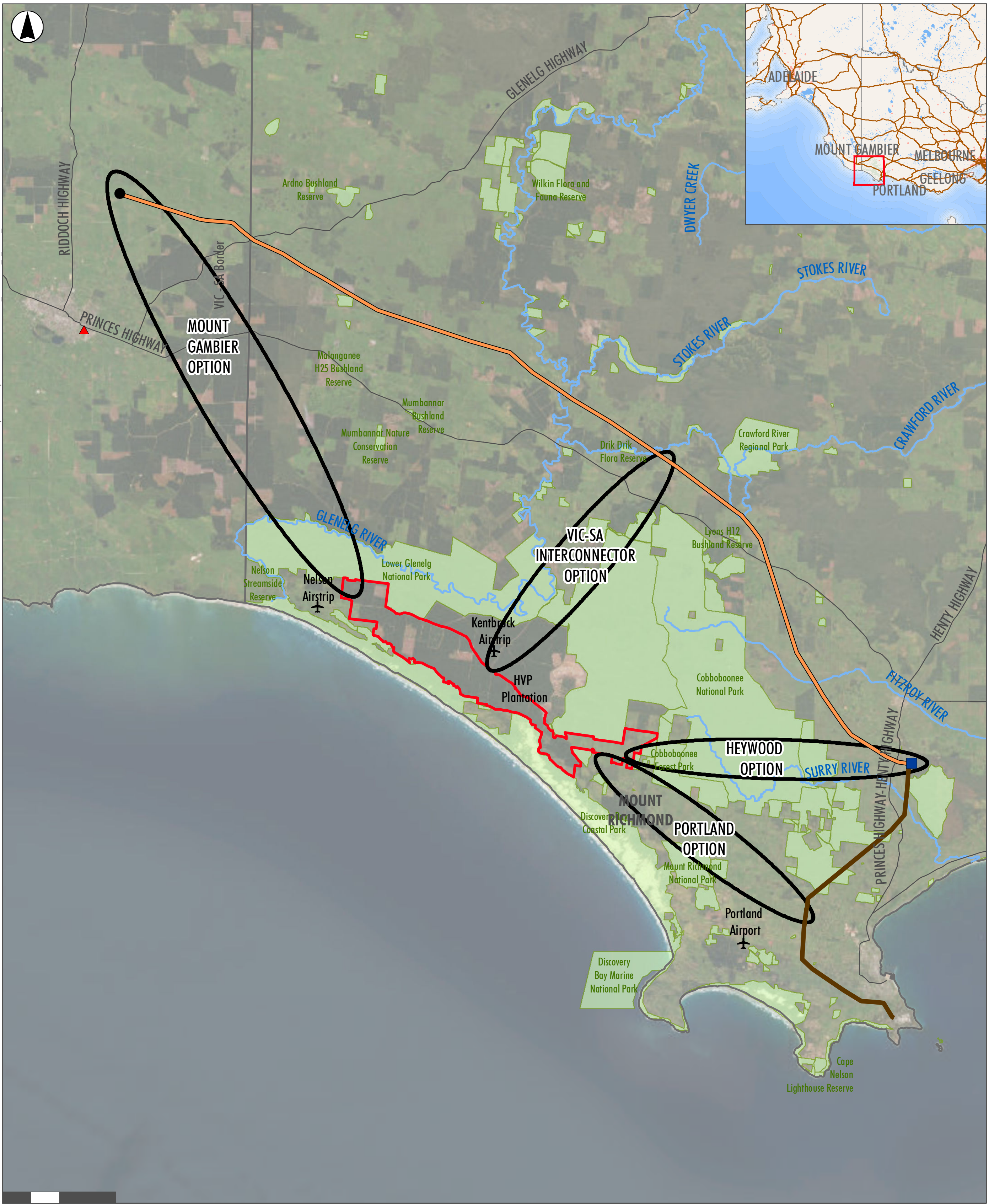
These feasible transmission line options were then assessed against a set of criteria that was developed with consideration of the transmission line Project objectives and the relevant environmental, social, land use, and heritage factors that would affect the siting of a transmission line. Criteria associated with design, constructability, operability, safety, planning, and commercial factors were also considered.

Based on the final scores of this assessment, **Heywood Option 1B** was found to be the preferred option for the Project as it:

- Directly connects the Project to the existing Heywood Terminal Station, and in turn to a transmission line that has sufficient capacity to transport the electricity generated by the Project to where it can be used.
- Is a constructable and cost-effective design solution that utilises an existing infrastructure corridor (Boiler Swamp Road), providing opportunities to minimise potential impacts relating to social and cultural considerations, visual amenity, existing land uses and the environment.
- Removes the potential for collision risk with threatened avifauna species (including Brolga).
- Aligns with strong community preference for the underground transmission line through the Parks.
- Aligns with the preference of the Gunditj Mirring Traditional Owners Aboriginal Corporation (GMTOAC), which is that the transmission line should be located in areas of significant ground disturbance.
- Is located in an area with less intangible cultural heritage value and reduced archaeological sensitivity along Boiler Swamp Road due to past disturbance associated with road grading and maintenance activities through the area.
- Minimises potential visual amenity impacts on nearby residents with the entire transmission line located underground.
- Avoids noise impacts on nearby residents by removing the need for a new terminal station.
- Avoids areas with a higher density of dwellings, particularly around Gorae West and areas north of Portland, as well as landscapes of significance closer to the Discovery Bay and Bridgewater coastlines.
- Avoids any impacts associated with proximity to the Portland Aerodrome.
- Minimises potential impacts/disruption on the continued operation of productive agricultural land.
- Intersects with the lowest number of land parcels, minimising the number of landholder agreements to be secured, with all necessary landholder agreements able to be obtained.
- Avoids potential interference with aerial firefighting operations and removes additional bushfire risk associated with a new terminal station.

Options 2A and 2B were not the preferred option for the Project due to several constraints, including significant community opposition, inability to secure necessary landholder agreements, disruption and impact on agricultural land practices, greater risk of impacting on bushfire fighting operations, intersecting with Portland Aerodrome obstacle limitation surface (for 2A), and the need for a new terminal station (and associated amenity impacts). Option 1A was also not preferred as it had an overhead component through Brolga breeding habitat buffers.

Refer to the **Transmission Line Options Assessment (Appendix A)** for the complete assessment.



Scale 1:475000 at A4

Legend

- Wind Farm Site
- High-level Options
- Heywood-Portland 500 kV Transmission Line
- VIC-SA Interconnector
- Heywood Terminal Station
- South East Terminal Station
- Mount Gambier Substation
- Parks and Reserves
- Roads
- Drainage Line

FIGURE 4.8

High Level Corridor Options

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)

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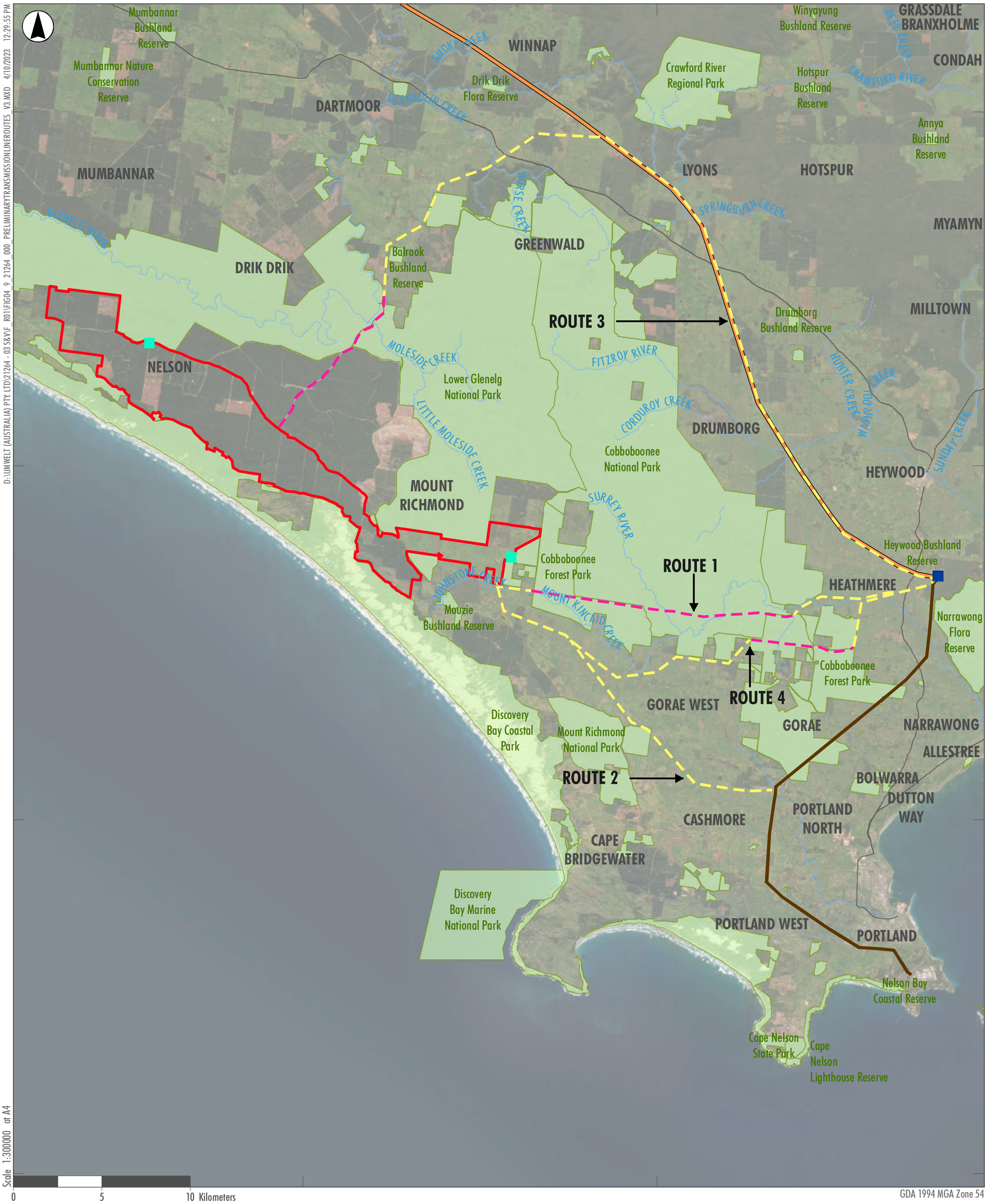

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Legend

- Wind Farm Site
- Heywood-Portland 500kV Transmission Line
- Previous Main Substation Location
- VIC-SA Interconnector Transmission Line
- Heywood Terminal Station
- Parks and Reserves
- Roads
- Named Watercourses

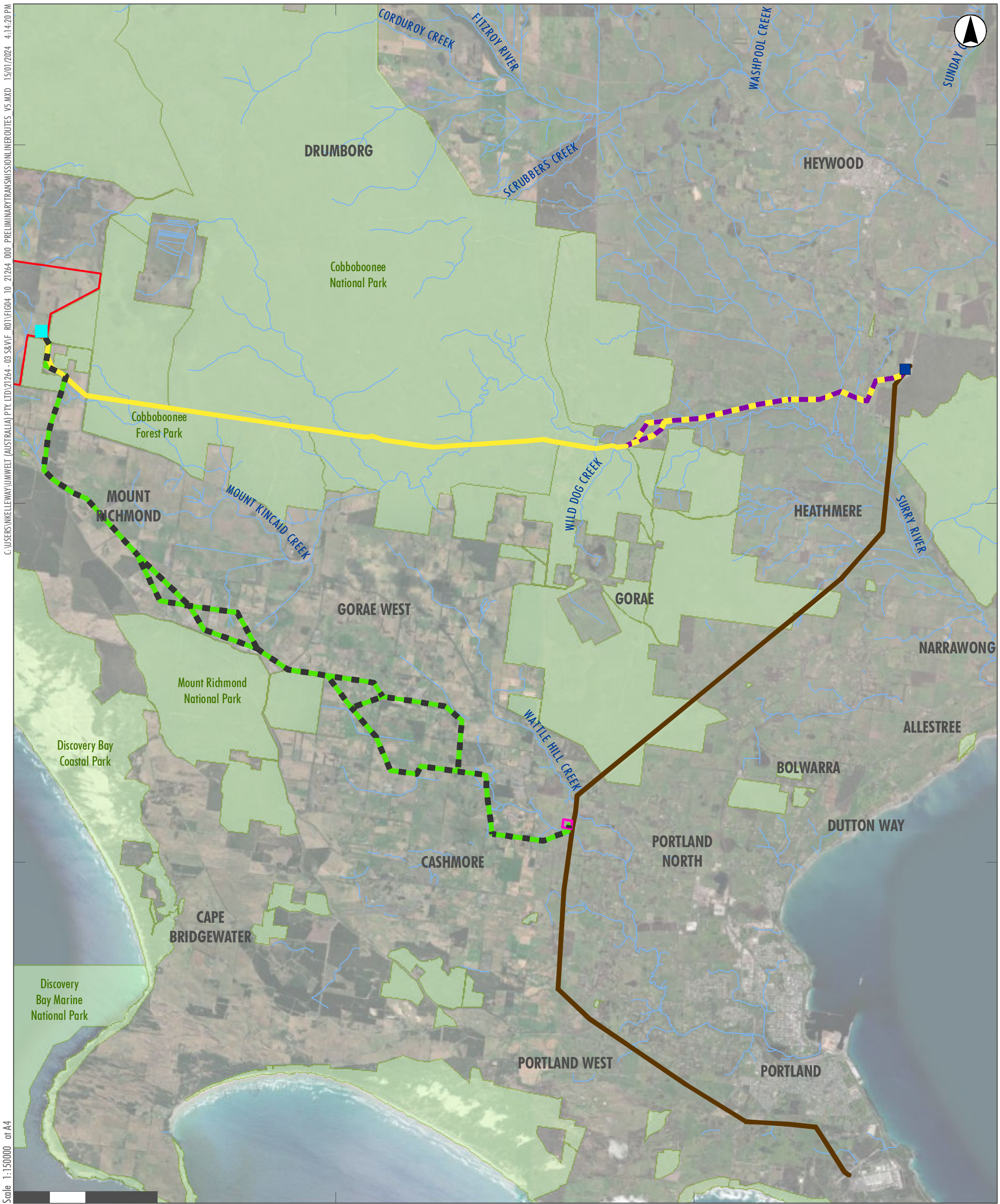
Transmission Line Options

- Overhead
- Underground

FIGURE 4.9

Preliminary Transmission Line Routes

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)



Legend

- Wind Farm Site
- Previous Main Substation Location
- Heywood Terminal Station
- Heywood-Portland 500kV Transmission Line
- Watercourse
- Overhead component of Option 1A
- Underground component of Option 1A and 1B
- Underground component for Option 1B
- Option 2A - Overhead
- Option 2B - Underground
- New Terminal Stayion for Option 2

FIGURE 4.10

Feasible Options Taken Forward for Assessment

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)

4.7.2 Location of transmission line through the Parks

The sections of the transmission line through the Parks, and through freehold land east of the Forest Park, have both involved two different route options. These are discussed below.

4.7.2.1 Cobboboonee National Park and Forest Park

Two potential routes were identified for the component of the transmission line through the Parks: via Boiler Swamp Road or via Cut Out Dam Road. As shown in **Figure 4.11**, Boiler Swamp Road is located south of Cut Out Dam Road and provides a slightly more direct route through the Parks. Both options would exit the main wind farm substation as underground cabling and traverse the Parks beneath the road.

Both potential routes were included in the Project's EES referral in July 2019 as they were considered feasible options at the time and were subject to ongoing design development. Consent would be required for both options under Section 27 of the *National Parks Act 1975* (Vic) (NP Act) to construct the transmission line through Cobboboonee National Park, and a lease under Section 52(1C)(f) of the *Forests Act 1958* (Vic) (Forests Act) would be required for the section of underground transmission line located within Cobboboonee Forest Park.

Boiler Swamp Road and Cut Out Dam Road are both unsealed roads. The Boiler Swamp Road formation is between 5 m and 6 m wide with 1–1.5 m-wide shoulders, while Cut Out Dam Road is 4.5 m wide on average with 1.2–2.5 m-wide shoulders. The wider road formation along Boiler Swamp Road means that there is less potential for impacts on native vegetation during transmission line construction. Field surveys during the **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C)** found the vegetation along Cut Out Dam Road to be denser than along Boiler Swamp Road, with a thicker tree canopy. Australian Standard *AS 4970:2009 Protection of trees on development sites* (AS 4970) considers that impacts on 10 % or more of a tree protection zone result in the loss of the tree. There would therefore likely be a greater native vegetation loss along Cut Out Dam Road than along Boiler Swamp Road due to the greater density of vegetation.

Boiler Swamp Road is relatively straight, with some wide bends in the road. In contrast, Cut Out Dam Road has several relatively tight bends near its eastern end. Cable installation along Cut Out Dam Road would therefore be more complex than for Boiler Swamp Road, requiring additional construction time and cost. The design and narrow width of Cut Out Dam Road would also not easily allow for emergency services and other traffic to pass around construction works, whereas there would be more allowance for emergency vehicles along Boiler Swamp Road during construction. Site inspections of Cut Out Dam Road showed evidence of the road being washed out in some sections over winter months, suggesting that it is not as much of an all-weather road as Boiler Swamp Road.

The Boiler Swamp Road option was therefore considered to be a lower impact and lower complexity route than the Cut Out Dam Road option. The Cut Out Dam Road option was removed from the Project and only the Boiler Swamp Road option was subject to assessment in this EES.

Following selection of the Boiler Swamp Road option, more detailed design work was undertaken for the construction methodology, construction footprint, and operational and maintenance requirements of the underground component to identify opportunities to further minimise potential impacts. This is discussed further in **Section 4.7.4.**

4.7.2.2 Freehold land

Two route options have been identified for the small section of transmission line located in freehold land east of Cobboboonee Forest Park (see **Figure 4.11**). The slightly shorter southern route is the preferred option, but it passes through a swampy area adjacent to the Surrey River which may not be feasible for underground construction. Both options have been fully assessed in this EES but only one would be constructed. The viability of the preferred option would be determined in response to geotechnical investigations undertaken during detailed design.

4.7.3 Location of transmission line at approach to the Heywood Terminal Station

Three different route options for connecting the transmission line into the Heywood Terminal Station were identified early in the Project's development. As shown in **Figure 4.12**, the routes cross the Princes Highway to either the north or south of Meaghers Road:

- Northern route: Crosses the highway to the south of Meaghers Road, extends north alongside the railway line, then connects to the Heywood Terminal Station from the north.
- Central route: Crosses the highway to the north of Meaghers Road and connects to the Heywood Terminal Station from the south-west.
- Southern route: Crosses the highway to the south of Meaghers Road, continues south-east to the edge of Narrawong Flora Reserve, then runs to the north alongside the existing 500 kV Heywood-Portland transmission line easement and connects to the Heywood Terminal Station from the south.

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Legend

- Wind Farm Site
- Previous Main Substation Location
- Via Boiler Swamp Road
- Via Cut Out Dam Road
- Alternative Freehold Option
- Preferred Freehold Option
- Underground Transmission Line
- Roads
- Watercourse

FIGURE 4.11

Route Options for the Transmission Line near the Parks

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021); Biosis (2022)

Legend

- Project Area
- Heywood Terminal Station
- Heywood-Portland 500 kV Transmission Line
- Transmission Line
- Northern Option
- Middle Option
- Southern Option
- Roads
- Watercourse

FIGURE 4.12

Route Options for the Transmission Line Upon Approach to the Heywood Terminal Station

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021); Biosis (2022)

Two of the options were deemed unfeasible by the Proponent following discussions with AusNet, so only the central route option which connects into the Heywood Terminal Station from the south-west has been assessed in this EES.

4.7.4 Underground construction methodology for transmission line through the Parks

As discussed in **Section 4.7.2.1**, Boiler Swamp Road was chosen for the underground transmission line route through the Parks due to its relatively wide road formation and shoulders and more direct route through the Parks. Detailed design work was subsequently undertaken for the construction methodology, construction footprint, and operational and maintenance requirements to identify opportunities to minimise potential impacts.

The underground transmission line design and construction methodology were developed with several key civil and constructability considerations in mind, including:

- Selection of an installation methodology with a minimal construction footprint, minimal spoil creation and which maximises spoil reuse.
- Use of an existing roadway to minimise impacts on vegetation during installation of the cabling.
- Use of existing roadways and cleared areas for vehicle turning to minimise impact on vegetation .
- Siting of construction compounds, including carparking, worker facilities and overnight material laydown and storage, to avoid impacts on native vegetation.
- Emergency vehicle access to be maintained at all times during construction.
- Road closures for non-emergency vehicles to be minimised.

A range of trench excavation methods were explored and assessed to identify the best method in terms of efficiency, cost and environmental impact. The more traditional excavation methods involving an excavator bucket (**Plate 4.3**) or chainsaw style trenchers (**Plate 4.4**) involve large machinery, produce a large spoil storage footprint and are more manually intensive, so were not considered appropriate for use along the constrained Boiler Swamp Road.

Plate 4.3: Traditional excavator bucket (Downer, 2022)

Plate 4.4: Chainsaw trencher (Downer, 2022)

A basis of concept design was undertaken with input a potential trenching machine supplier. The design involved three trenches for three separate cables, to be constructed using a specialised machine that excavates, lays the cable, and backfills the trench in a single pass (**Plate 4.5**). This approach would minimise the construction footprint through small trench widths and minimal spoil generation. A maximum construction corridor width of 6.5 m would be required, involving a 2.9 m-wide cable corridor and 3-3.2 m-wide construction access bypass.

This method is the best option for the Project’s transmission line as it has the smallest construction footprint of the available options, which would allow for impacts on native vegetation to be minimised within the Boiler Swamp Road corridor. It would also provide the largest possible space on the road for emergency vehicle access and Parks Victoria and DEECA operations (e.g. bushfire prevention and management).

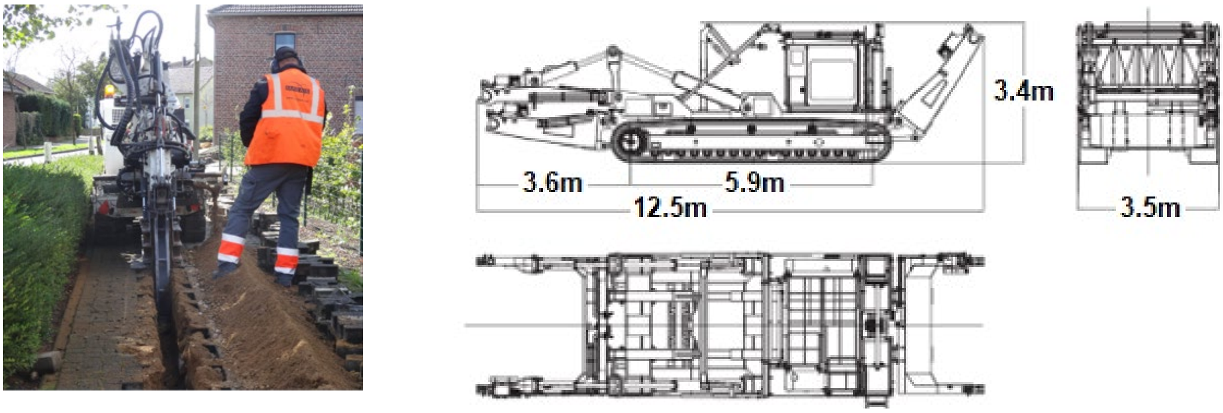


Plate 4.5: Integrated trenching wheel

4.8 Supply of raw materials

The Project includes an onsite quarry for supplying limestone material for construction of hardstands, and for upgrades to existing access roads and construction of new access roads. The decision was made to include an onsite quarry instead of transporting material to site from an external supplier to reduce construction traffic on the local road network (particularly tippers) and minimise subsequent impacts on the road pavement and the risk of traffic accidents.

The quarry site was initially identified due to its location within the wind farm site and proximity to an existing limestone quarry operated by GTFP on North Livingstone Road (WA748), and another quarry operated by HVP on the opposite side of Portland-Nelson Road (WA755) (see **Figure 4.13**). These two quarries are located on a ridgeline of loose to moderately cemented sand, with occasional interbedded limestone layers and shells, extending in a northeast-southwest direction. The Project quarry site is located on this ridgeline between the GTFP and HVP quarries, targeting the cemented “cap rock” layer which is typically 10–15 m thick at this location. The proximate location to the two existing quarries is considered the best option for an onsite Project quarry due to the likelihood for the resource to be present in suitable quantities and quality for the Project.

The quarry site also has limited potential for environmental impacts:

- Impacts on native vegetation would not occur: The site is located within pine plantation where no native vegetation has been identified, and there are no wetlands or other topographic features within the vicinity of the site that might support or encourage native flora or fauna within the area.
- Impacts on heritage are not expected to occur due to the history of site disturbance associated with the pine plantation. The nearest known historical heritage site is located more than 3.5 km to the south (Long Swamp) and the nearest known Aboriginal cultural heritage site is a surface artefact located 2.5 km to the north-west, adjacent to Portland-Nelson Road.
- Groundwater intersection is not expected to occur: The GTFP quarry depth is approximately 18 mbgs and no groundwater ingress has occurred. This is consistent with the predicted groundwater elevation of approximately 36 mbgs at the quarry sites.
- Impacts on surface waterbodies would not occur: No surface waterbodies are located near the quarry (within 2.5 km) and stormwater would be retained on the quarry site.
- Visual, noise and dust impacts would be minimal: No dwellings are located near the quarry site (the closest dwelling is more than 6.7 km away). Any amenity impacts would therefore be limited to vehicles accessing the public roads through the plantation (e.g. North Livingston Road and Cowlands Lower Road), but impacts would be minimal compared to existing conditions as the plantation is subject to ongoing construction-type activities associated with thinning/culling activities and felling/logging operations.

Refer to the **Quarry Work Plan Requirements Report (Appendix W)** for a summary of potential risks and impacts associated with the quarry.

FIGURE 4.13

Proposed Quarry

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)

4.9 Wind farm site access points

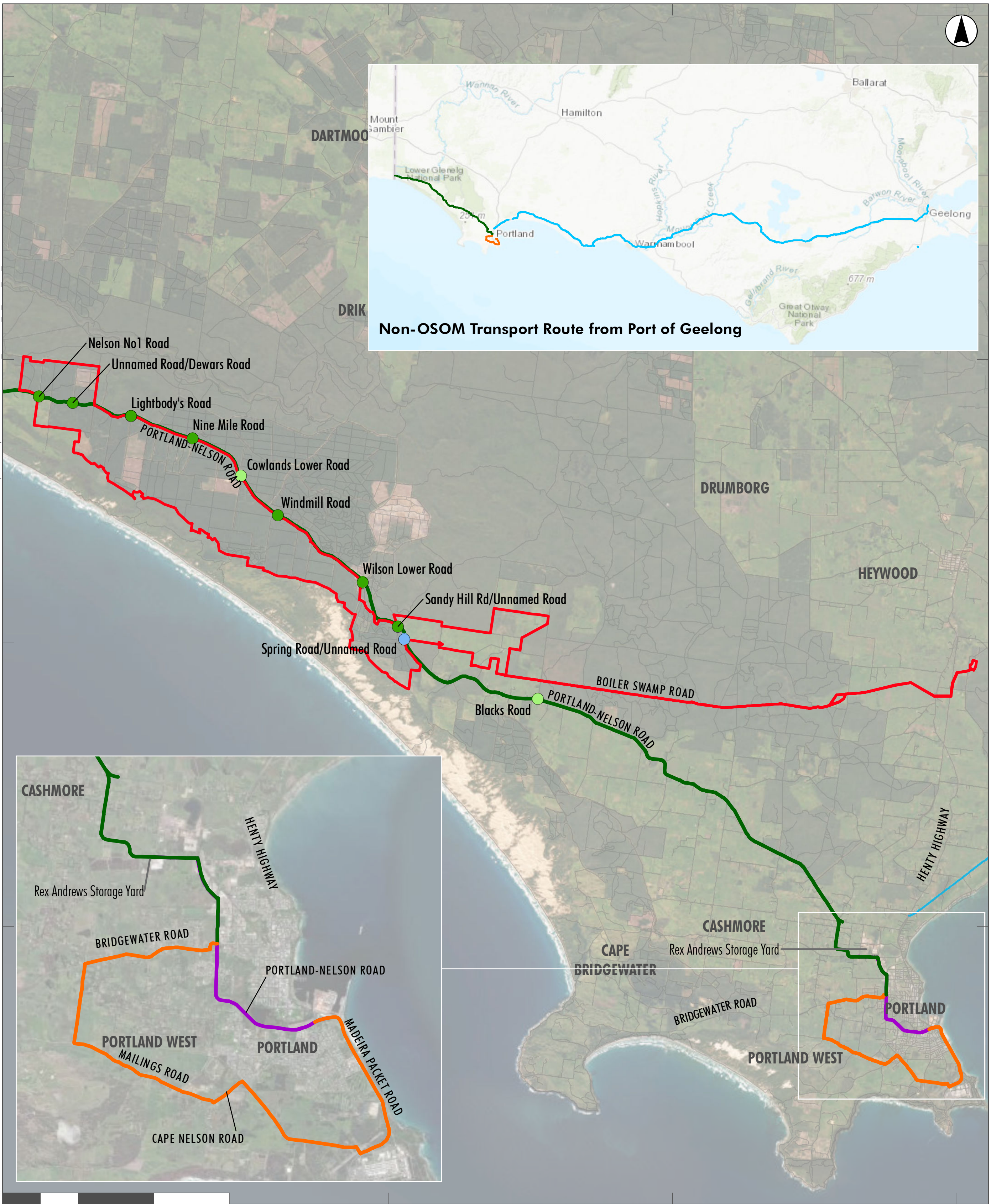
As shown in **Figure 4.14**, ten site access points were initially identified for the wind farm site:

1. Nelson No. 1 Road
2. Dewars Road
3. Unnamed Road (opposite Dewars Road)
4. Lightbody's Road
5. Nine Mile Road
6. Cowlands Lower Road
7. Windmill Road
8. Wilson Lower Road
9. Sandy Hill Road
10. Unnamed road (opposite Sandy Hill Road).

These roads were selected due to their proximity to clusters of turbines, which would minimise the use of plantation roads by OSOM vehicles. This assists in limiting impacts on forestry operations and public road users accessing public land south of the wind farm. The intersections with Portland-Nelson Road are also wide as they have been designed to enable ingress and egress by plantation vehicles. Using these existing access points minimises vegetation removal and other secondary impacts associated with constructing new or upgraded access points.

Biodiversity constraints in the farmland east of Portland-Nelson Road required the high voltage powerline and associated access track to be moved slightly to the north (see **Section 4.4**). To reduce the number of OD/OSOM entry points into the wind farm site and minimise disruption to traffic along Portland-Nelson Road, the Spring Road access point was moved north to Sandy Hill Road. The revised wind farm site access point locations are shown on **Figure 4.14**.

Blacks Road was also added as an additional light vehicle access. Due to the identification of Brolga breeding habitat in farmland east of Portland-Nelson Road through which the access track opposite Spring Road / Sandy Hill Road would pass, it was determined that Blacks Road should be used as a secondary site access point to avoid impacts on Brolga during their breeding season. Blacks Road would not be used by OD/OSOM vehicles. Blacks Road would also be the main construction access point for the transmission line and main substation.



Legend

- Project Area
- Site Access Points
- Site Access Points - Light Vehicles Only
- Site Access Point Removed from the Project
- Transport Route - Vehicles with Loaded Height <4.4m
- Transport Route - Vehicles with Loaded Height >4.4m
- Transport Route - All Vehicles
- Non-OSOM Transport Route from Port of Geelong

FIGURE 4.14

Original Versus Revised Site Access and Potential Transport Routes

Image Source: ESRI Basemap (2021) Data source: DELWP (2021); Geoscience Australia (2021); Aecom (2020)

4.10 Transport routes

The Project intends to use the Port of Portland for delivering large Project components from overseas to site (e.g. turbine blades). The Port of Geelong and Port of Melbourne could also be used; however, the Port of Portland is the preferred option as it is located close to the Project Area (within 30 km) and is known to be suitable for wind turbine transportation as it has been used for other wind farms in the area. Using local transport facilities and services would also have greater economic benefits for the local community.

A desktop analysis of the transport route options from the Port of Portland and Port of Geelong was undertaken as part of the **Transport Impact Assessment** (**Appendix P**). The Port of Portland option was subject to a slightly more detailed analysis involving consultation with the port operator and a swept path assessment, due to the lower likelihood of significant adverse effects of this option (e.g. due to this route having been used for other wind farm projects and being unlikely to require significant road upgrades and vegetation and infrastructure removal), and the ability for the option to better meet the Project objectives (e.g. to minimise adverse impacts on the environment and to maximise beneficial effects). Both routes are shown on **Figure 4.14**.

Non-OD/OSOM equipment would be shipped to the Port of Geelong and transported to site via the existing heavy vehicle transport network, as the Port of Portland is not designed for shipping containers. As shipping containers would be delivered by standard heavy vehicles (e.g. B-doubles), this route was not subject to a detailed route assessment.

The Port of Portland route assessment identified three pinch points along the transport route that may require modification to accommodate delivery of the turbine blades to the storage yard. These modifications would involve vegetation trimming/removal, temporary pavement to widen the road, and/or removal of infrastructure such as signs. A swept path analysis was not undertaken for the Port of Geelong option, but at least two of the pinch points identified for the Port of Portland route would be applicable to the Port of Geelong option. The significantly longer route from the Port of Geelong to the storage yard increases the likelihood that additional pinch points would be identified and that road modifications would be needed.

Vegetation would need to be removed at four of the ten site access points, with temporary pavement to be constructed at all nine of the OD/OSOM intersections. These modifications are applicable to both transport route options.

There are two potential OD/OSOM transport route options from the Port of Portland to the storage area at 211 Portland-Nelson Road, depending on the height of the components to be delivered (see **Figure 4.14**):

- Route 1 for components less than 4.4 m in height.
- Route 2 for components more than 4.4 m in height.

Both options were included in the Port of Portland route assessment and are part of the Project as assessed in this EES.

The transport route assessment would be revised during detailed design once the exact turbine dimensions are known and the OD/OSOM transport contractor has been engaged. This would be incorporated into the Traffic Management Plan for implementation during Project construction, operation and decommissioning.

4.11 ‘No Project’ alternative

Renewable energy projects such as the Kentbruck Green Power Hub will play an important role in providing energy security, and directly contributing to State renewable energy and emissions reductions targets. The Project would also generate significant economic and social benefits to Victoria, including to Portland and the local community.

As outlined in **Chapter 2 *Project rationale***, there is a strong legislative and policy justification for the development of the Kentbruck Green Power Hub, including the contribution to Victoria’s legislated renewable energy targets. Specifically, the Project could contribute approximately 5 % of Victoria’s electricity generation. If the Project was not to proceed, this would be a significant loss for the State’s renewable energy targets.

The Project not proceeding would also result in the following consequences:

- Approximately 2,000 gigawatt-hours (GWh) of renewable source electricity would not be available in the grid, leaving the Government to fill this void other projects, potentially with less optimal generation capacity.
- The local area and state of Victoria more broadly would not benefit from the potential economic boost the Project would provide to local service providers and businesses.
- The provision of training and upskilling for local people, and local employment and procurement opportunities as a result of the Project would not be realised. Up to 350 employees would be required during construction, 52 of which are expected to be apprentices and trainees.
- The Proponent’s Community Benefit Fund would not proceed, which would be a loss of $150,000 per year for local projects and initiatives throughout the Project’s lifetime.
- Landowners of residential dwellings within 3.5 km of a wind turbine would not receive payments under the Neighbour Benefit Plan.

- The Proponent's Ecology Fund for the sponsorship of ecological studies, protection activities and species recovery projects worth $1 million per year from the commencement of operations for the 30-year expected life of the Project would not be realised.

Overall, if the Project did not proceed a significant amount of renewable energy would not be available for the State of Victoria which would hinder the State in achieving its aggressive renewable energy targets. It would also mean several social and economic benefits would not be realised, by removing community funding, opportunities for local service providers and business to benefit from the Project, and opportunities for local employment and trainee opportunities.

4.12 Summary

The Project has undergone significant design changes since 2019 when the Project comprised 157 wind turbines, a BSF and two potential transmission line corridors. It now comprises 105 turbines, no BSF and one transmission line route.

Biodiversity constraints accounted for a significant proportion of these design changes, with 91 turbines moved or removed to minimise potential biodiversity impacts. Planning considerations associated with zoning and overlays also resulted in the relocation or removal of 29 turbines.

The BSF was removed from the Project to focus on progressing the wind farm component, given Victoria's imminent need for renewable energy generation. This has also reduced the bushfire and noise amenity risks of the Project.

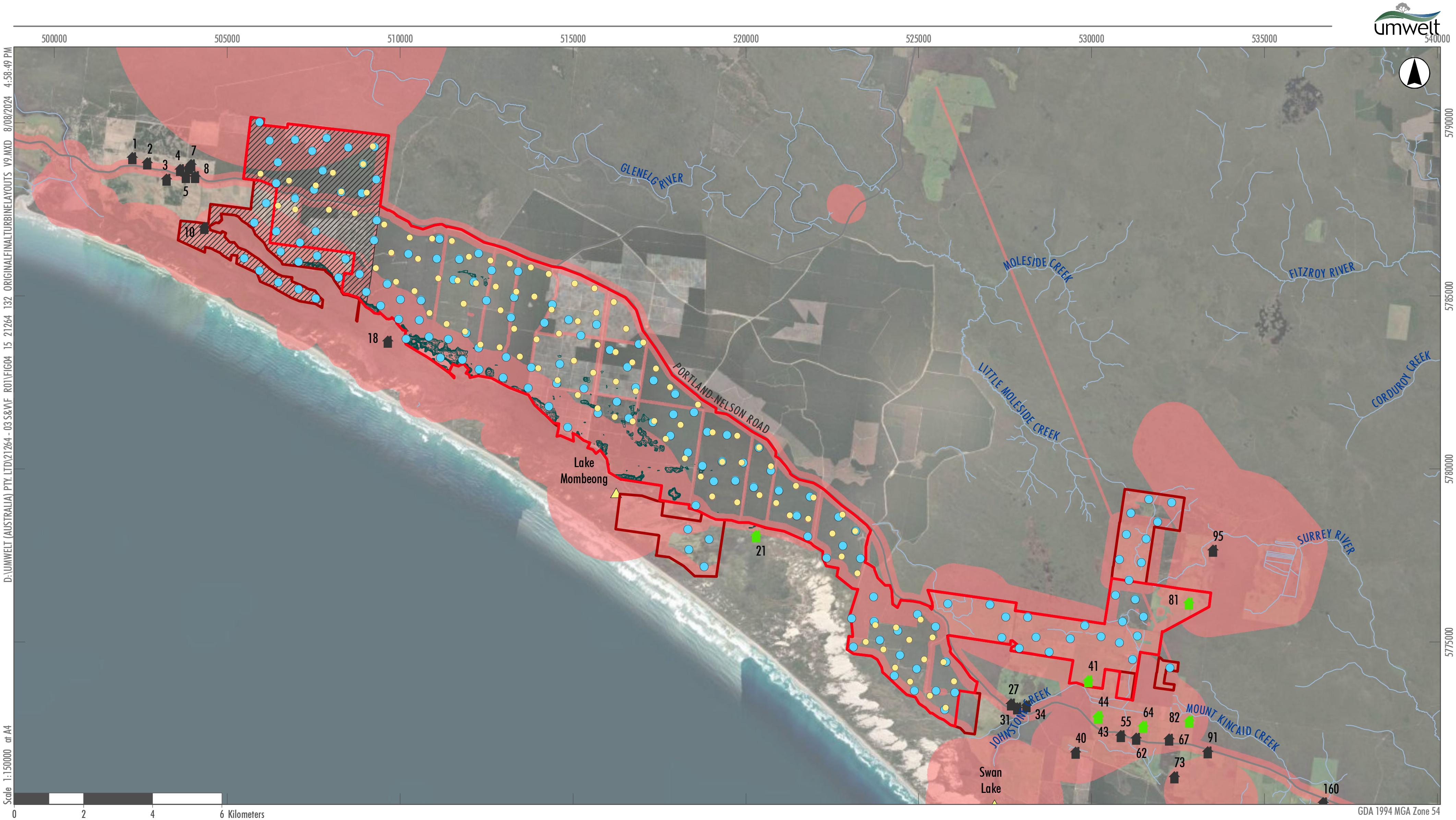
The underground Heywood transmission line route was identified as the preferred transmission line route option for the Project for a range of reasons, particularly due to the existing infrastructure at the Heywood Terminal Station for connecting the wind farm to the electricity network; and the potential to minimise impacts associated with social and cultural considerations, visual amenity, existing land uses, the Portland Aerodrome, and the environment more broadly.

The Heywood transmission line route was subject to in-depth design investigations which identified a construction methodology that would allow the underground line to have minimal impacts on native vegetation and threatened flora species within the Parks. The small construction footprint of the machinery would also minimise disruption along Boiler Swamp Road and allow for emergency vehicles to pass the construction site.

Figure 4.15 shows all the constraints that were taken into consideration when reviewing the turbine layout. The constraints ultimately resulted in the removal of 52 turbines and reduction in the wind farm site area by 14 % (all within farmland).

Other changes made to the Project throughout its development include:

- Changes to the route and configuration of the high voltage powerline to avoid impacts on Brolga, native vegetation and Aboriginal cultural heritage, and to avoid visual amenity impacts on the Hedditch Hill lookout.
- Changes to the location of ancillary infrastructure such as the substations, to avoid impacts on the Ramsar site, native vegetation and threatened flora species; minimise clearance of pine plantation and impacts on GTFP; and for bushfire mitigation purposes.
- Use of an onsite quarry to minimise the quantity of raw materials delivered to site for wind farm construction and associated traffic impacts.
- Selection of site access points that would allow for efficient delivery of Project components to site during construction, and to minimise the need for removal of vegetation at OD/OSOM access points.
- Selection of the Port of Portland for delivery of overseas components to the wind farm site due to its proximity to the Project Area, extensive history with delivery of wind farm projects, and greater economic benefits to the local community.



Legend
- Final Turbine Layout
- Original Turbine Layout
- Original Wind Farm Site
- BrolgaBuffers_MovementCorridors
- Schedule 1 to the Significant Landscape Overlay (not a full turbine exclusion area)
- Groundwater Depths Less than 6m
- Dwellings - involved
- Dwellings - non-involved
- Campsite

FIGURE 4.15

Original and Final Turbine Layouts

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

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