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NEOEN

PRELIMINARY CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Mount Hopeful Wind Farm

FINAL

March 2024

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Mount Hopeful Wind Farm

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

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Environmental & Social Consultants

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1.0 Introduction

Umwelt was commissioned by Neoen Australia Pty Ltd (Neoen) to complete a preliminary Construction environmental Management Plan (CEMP) for the Mount Hopeful Wind Farm (the Project). The purpose of this preliminary CEMP is to provide an overview of key infrastructure required for the Project, construction methodology, the potential impacts that may occur during construction, and how these impacts may be mitigated and monitored.

This document will support the development application requirements of the Project and be used as a foundation for the detailed Construction Environment Management Plan (CEMP) which will be developed later as the Project progresses to the detailed design phase. A conceptual Erosion and Sediment Control Plan (ESCP) has been developed as a separate document and complements this preliminary CEMP.

1.1 Project Locality

The Project is situated approximately 15 kilometres (km) south-east of Mount Morgan, in Central Queensland, within a largely rural and sparsely settled landscape mostly used for light grazing and livestock production. The nearest population centres are Rockhampton, located 45 km north and Gladstone, located 65 km east. The Project occurs along the Ulam Range, between Mount Hopeful on the Dee Range and Mount Alma on the Mount Alma Range. The terrain within the area varies from undulating rises to steep hills and mountain ranges surround.

Several protected areas occur in the immediate vicinity of the Project including Gelobera State Forest to the west, Ulam Range State Forest to the east and Don River State Forest to the south-east.

1.2 Assessment Boundaries

1.2.1 Study Area

The Study Area refers to the boundaries of the 17 freehold land parcels which encompass the infrastructure that has been designed for the proposed wind farm, as well as the boundary of the access road corridor (inclusive of the local road reserve for Glengowan Road, Playfields Rd and McDonalds Rd and small area of one additional adjacent land parcel) and a connection to the switching station in the road reserve at South Ulam Road. The area covers approximately 16,976 hectares (ha) and extends approximately 25 km north-south at the longest point and 42 km east-west at the widest point (this includes approximately 30 km of access road). The Study Area represents the limit of the vegetation and habitat mapped for the Project. It should be noted however, that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area).

Lot and plans relevant to the Study Area include:

- Those relevant to the proposed wind farm:
    - 148/DS151, 2420/DT4077, 21/RN46, 30/RN72, 50/DT40144, 1933/RAG4058, 21/RN1345, 100/SP289441, 33/DT40123, 2039/RAG4056, 23/RN25, 38/DT40131, 2057/RAG4059, 24/RN34, 25/RN25, 15/RN1089 and 2345/DT4077.

- That relevant to the access road corridor:
    - 17/RAG4094.

1.2.2 Development Corridor

The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,564.6 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access.

The Project has not yet undergone detailed design. This will occur following a competitive tender and contract award for equipment supply and construction. The detailed design process will rely heavily on future technical assessments, including but not limited to, additional ecological field surveys. The process will give certainty to the final positioning of Project infrastructure as well as the final Disturbance Footprint. Allowing for the Disturbance Footprint to be adjusted within the Development Corridor will allow for further avoidance and management of specific on-ground constraints that are identified in future technical assessments.

1.2.3 Disturbance Footprint

The Disturbance Footprint covers approximately 883.6 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works. The impact assessment on MNES values (see Appendix E of Attachment B4 of the Preliminary Documentation) refers to clearing areas that are based on the Disturbance Footprint.
As infrastructure will be micro-sited within the Development Corridor, the final clearing areas are anticipated to be lower than detailed in this assessment (described further in Section 9.0 of Attachment B4 of the Preliminary Documentation).

1.3 Existing Environment

As the Study Area runs along the western edge of Dee Range and Ulam Range and extends west to valleys, the general topography is rugged with elevation ranging from 500 m Australian Height Datum (AHD) to 120 m AHD. There are several prominent hills and mountains within the Study Area, namely Mt Helen at 633 m (east), Mt Isabel at 508 m (east), Mt Gelobera / Reilly's Hill at 539 m (west), and North Pimple at 454 m (centre). The land surrounding the Study Area is also steep, with several other prominent mountains nearby (including Mt Hopeful at 634 m to the north).

The Study Area is located in a largely rural and sparsely settled landscape that is mostly used for light grazing and livestock production. The closest localities are Fletcher Creek and Nine Mile Creek. The closest towns are Hamilton Creek (13 km north-west), Mount Morgan town (19 km north-west), and Bajool (15 km north-east).

There are no protected areas within the Study Area, however there are several adjacent to or in the surrounding areas including Gelobera State Forest, Ulam Range State Forest, Don River State Forest, and Mount Hopeful Conservation Park.

There are three residential dwellings located within the Project boundaries (one in the south-west, one in the east and one in the north). The number of dwellings within 9.5 km of the closest turbine are listed below:

- No non-participating residences within 3.5 km of the closest turbine.
- 1 residence located within 3.5 to 4 km of the closest turbine.
- 2 residences located between 4 and 5 km of the closest turbine.
- 1 residence located within 9.5 km of the closest turbine.

There are eight mapped dams in the south-west of the Study Area and numerous watercourses across the Study Area. These watercourses contain regulated vegetation which is mapped as matters of state environmental significance (MSES). Many of the watercourses are ephemeral, unnamed streams. Some of the named watercourses (and their relative location within the Study Area) are:

- Capella Creek (north-west) which is non-perennial and stream order 3.
- Ginger Creek (centre) which is non-perennial and stream order 1–2.
- Centre Creek (centre and south) which is non-perennial and stream order 2–3.
- Don River (south) which is non-perennial and stream order 5–6.
- Pomegranate Creek (south-west) which is non-perennial and stream order 2.

2.0 Project Infrastructure

It is important to note that the proposed layout may change as part of the detailed design of the Project. Decisions on the final location of infrastructure (micro-siting) during detailed design and construction will potentially allow for the further protection of species, habitat and features of localised conservation significance. To accommodate on-site constraints, the wind turbines, as well as the required supporting infrastructure (roads and overhead/underground reticulation), may be micro-sited up to 100 m (i.e., within the Development Corridor).

As shown in **Table 2.1**, the Study Area has a total area of approximately 16,976 ha. The Disturbance Footprint will be approximately 5% (883.6 ha) of this area. Land occupied by temporary infrastructure will be rehabilitated following construction.

2.1 Wind Turbines

The power output from an operational wind farm largely depends on the strength of the wind across the site at the time. During the operation of the Project, the turbines will automatically start, stop and alter their output as determined by wind speed and other environmental and electrical conditions.

Usually, wind turbines start to generate electricity at a wind speed of between 3 metres per second (m/s) and 5 m/s, and the output increases up to their maximum rated power at a wind speed which varies significantly between the various turbine models. The wind turbines will also have a wind speed at which they automatically shut down. This also varies amongst the different turbine models available.

The final selection of turbine technology will be determined as part of the detailed design following approval of the Project. However, the Project has been designed to accommodate the following turbine dimensions so any potential impacts of the Project on environmental values can be adequately considered.

The Project will accommodate up to 63 turbines with approximately 6.5 MW in generation capacity each, however this may change as further models are developed between now and construction.

The turbines will be of the horizontal axis type, with a rotor consisting of three blades with a maximum blade length of up to 90 m. The maximum height of the turbine to blade tip is up to 260 m. Blade length chosen and wind turbine hub height will be configured so that the tip height does not exceed 260 m. These maximum specifications are summarised in **Table 2.1**.

Table 2.1 Key Generation and Turbine Specifications

Feature	Statistic
Project generation capacity	Up to 400 MW*
Turbine electrical output	Approximately 6.5 MW
Maximum number of turbines	63
Tip height**	Up to 260 m
Rotor diameter**	Up to 180 m

** The actual output of the wind farm will depend on the number, size and type of turbine chosen during the detailed design phase.*

*** Dimensions are approximate to allow for innovation in turbine design prior to construction. Final dimensions will be confirmed during the detailed design phase of the Project.*

The turbines will be coloured light grey or white with a semi-matt finish to reduce their contrast with the background sky and minimise reflections. The turbines will be uniform in colour and will not contain any prominent company logos.

The maximum turbine tip height and rotor diameter listed in **Table 2.1** is based on estimated wind turbine dimensions to allow for future flexibility and innovation in wind turbine design and development. Generally, larger turbine models on higher towers will more efficiently harness the available wind resource. Furthermore, larger wind turbines are generally installed in lower numbers, thereby reducing the on-ground impacts for a given level of energy generation.

The final choice of turbine will be based on an assessment of the most suitable turbine available at the time of procurement taking the following criteria into account:

- Ability of the turbine to maximise power output based on the wind resource at the Project Site.
- Availability of the turbine will also affect the final choice of turbines.
- Turbine which provides the optimal financial outcome for the Project.

One of the key selection criteria for final turbine choice will be the ability to satisfy the environmental constraints and approval conditions.

2.2 Wind Turbine Foundations

Each turbine foundation will comprise a reinforced concrete slab, the dimensions of which will be finalised after the wind turbine generator (WTG) is chosen. Turbine foundations may vary in size depending on imposed loadings, ground conditions, construction methodology and the drainage design. Each turbine manufacturer has individual foundation requirements which will need to be adhered to.

The detailed design of the foundations will be undertaken following approval of the Project and following the final selection of turbine model to be installed at the Project Site. The final design will also take into account the geotechnical conditions identified through detailed, micro-siting site investigation.

Any of the material excavated to create the foundations will be stockpiled and reused to cover the foundations. It is envisaged that any surplus material will be reused on site.

The concrete for the foundations will be mixed at concrete batching plants which are currently proposed to be part of laydown areas on-site. Concrete batching material will be sourced off-site.

2.3 Hardstands

Turbine locations will require an area of gravel capped hardstand adjacent to each turbine foundation, (approximately 100 m by 50 m, depending on turbine type). These hardstand areas are intended to provide a stable base on which to place turbine components ready for assembly and erection, and to locate the crane necessary to lift the turbine components into place. In addition to this, some hard standing areas will be used for rock crushing purposes, stockpiling of material and temporary laydown areas. Due to the undulating topography requiring batters from the hardstand to the natural ground level, and space required to lay down the blades, a further 100 m by 50 m area is required.

The total clearing per turbine hardstand will vary across the 63 turbines, depending on the extent of vegetation at each location and the topography. If the three blades are joined on the ground to form the rotor, clearing an area to accommodate each blade length will be undertaken to allow construction.

These areas will be left in place following construction to allow for the use of similar plant in case major components need replacing during the life of the Project, and for use during decommissioning at the end of the operational period.

The total area of proposed hardstands (including laydown areas, turbine foundations etc.) is approximately 150 ha.

2.4 Electrical Connections, Substation and Grid Connection

The electricity generated by harnessing the wind's energy must go through a transformer kiosk adjacent to (or within) each turbine to increase its voltage and efficiently transfer it to a substation.

It is likely that two substations will be located throughout the Study Area; however, this will be further refined as the Project's detailed design progresses. The current preliminary design identifies one substation in the north-east of the Study Area within Lot 21 RN46, with the second substation located to the south on Lot 24 RN34. All substations will connect to the National Electricity Market (NEM) via the 275 kV transmission line east of the Study Area.

A switching station is proposed at the connection point with the transmission line to the east of the Study Area. An area of flat, empty land is available to locate this substation, the battery storage system, and the corridor for the easement to the transmission line (which will be 20 to 30 m wide). It is expected that this area will also be used for a battery storage system, a possible synchronous condenser area, and a parking lot. The precise location, configuration and size of the infrastructure will be finalised in the detailed design phase.

The wind turbines will be connected by either overhead or underground cables to the main transformer located in a substation. Power and communication cables will be installed as either overhead lines or underground between the turbines and will connect back to the substation and the operational and maintenance facility. If underground power and communication cables are used, they will be laid in cable trenches of approximately 0.5 m to 1.5 m in width and a minimum fill of 500 mm to allow for continued agricultural activities. The route of the underground/overhead cables will typically be adjacent to the internal access roads, with no additional clearing of Regulated Vegetation required beyond that proposed for the road corridor. In cleared land the cables may be located away from the road.

The total length of cable reticulation required will depend on the final layout of the substations, turbines and operational and maintenance facility. Once the trenched areas have been backfilled, the disturbed area will be reinstated to promote the establishment of vegetation.

2.5 Operational and Maintenance Facility

The proposed area for the substation in Lot 21 RN46 is also proposed to include the operational and maintenance facility. These areas typically contain vehicle parking spaces, septic ablutions and wash down areas as appropriate.

2.6 Construction Compound and Laydown Areas

There are two proposed laydown areas for the Project, which will also function as construction compound areas. The construction compound areas will be used to manage construction. These compounds will likely include portacabins (site offices, first aid facilities, canteen facilities, waste disposal and toilets); storage containers for tools and equipment; storage areas for plant, fuel storage, material and components; wash down facilities; and sufficient parking for the workforce, deliveries and visitors. Temporary offices, lunchrooms, and ablutions may also be established on turbine hardstands during the construction period.

These areas will also accommodate temporary storage of construction plant equipment, wind farm components and construction materials prior to moving to their ultimate destination. The areas may also be used for rock crushing and stockpiles, and concrete batching equipment.

The temporary construction compounds and laydown areas will be formed into hardstand. Prior to forming the hardstand area, the topsoil will be removed and stockpiled adjacent to the hardstand area. The exact locations, nature and number of the temporary construction compounds and laydown areas will be established in consultation with the relevant landowners when a full construction methodology is determined.

Following the completion of the construction phase, these areas may be reinstated using the stockpiled topsoil depending on the landowner's requirements.

2.7 Meteorological Masts

Up to ten permanent and ten temporary meteorological masts (also known as wind monitoring towers) are proposed to be developed for the Project. They have been assessed to measure the free stream wind from all directions and, where possible, to meet the criteria in the International Electrotechnical Commission (IEC) 61400-12-1 for power performance testing.

The towers will be powered and contain measurement instruments and telecommunication equipment. They will either be free standing or guyed lattice structures with concrete footings at mast base and anchor points. The total disturbance required is estimated to be up to 2.5 ha for each permanent guyed wind monitoring tower. The tower will reach up to the hub height of the wind turbines which is up to 180 m. Restrictions on the distance between mast and turbine will be adhered to.

After a period of concurrent wind speed and direction monitoring during the construction period, the temporary wind monitoring towers will be removed and permanent wind turbines constructed in their place. This reduces unnecessary clearing and also provides the benefit of having location specific meteorological data for ten of the turbine locations. Full engineering design and certification will be carried out for permanent meteorology masts during detailed design once the turbine type and layout of the wind farm has been confirmed.

The weather data from both the temporary and permanent wind monitoring towers will create a record of the wind before and after the wind turbine is installed to allow effective measurement of the performance of the turbines.

2.8 External Site Access

Major highways in proximity to the Study Area include the Bruce Highway to the east, Burnett Highway to the west, and the Dawson Highway to the south. These major transport corridors link the Study Area to the cities of Rockhampton and Gladstone, and to the Port of Gladstone which is where the wind turbine components will be shipped to.

A Preliminary Transport Route Assessment has been undertaken to consider two road haulage routes of the wind turbine components from the Port of Gladstone to the Project site. It is currently proposed that the main access for Project traffic from the state-controlled road network will be via the existing intersection of McDonalds Road with the Burnett Highway. From this existing intersection with the Burnett Highway, it is proposed that Project traffic will travel along an access road corridor, the Council controlled sections of McDonalds Road, Playfields Road and Glengowan Road to the proposed Project site entrance at the south-western part of the Study Area. An access point to the switching station will also be established on South Ulam Road.

The final transport corridors to be used during construction and operation of the Project will be outlined in the detailed Traffic Assessment and Route Analysis completed during the detailed design phase.

Within the south-western part of the Study Area, Playfields Road becomes Glengowan Road which provides access to the residential dwelling in Lot 21 RN1345. The residential dwelling on Lot 1933 RAG4058 is accessed via Mount Hopeful Road to the north-east of the Study Area.

Appropriate signage will be installed on relevant roads during the construction period for health and safety purposes.

New fencing alignments, together with grids and gates, will be installed on site. The clearing requirements for this infrastructure will be accounted for in the areas proposed to be cleared as part of the road and access areas and no additional clearing will be required.

2.9 Internal Access Roads

The onsite access track layout will be designed to utilise the existing topography of the land, avoiding steep areas where possible and minimising the amount of land required. The following design criteria and mitigation measures were applied to the access track layout to mitigate potential impacts:

- The access tracks will be an average of 40 m wide, however widths will vary depending on topography and cabling requirements.
- Regular passing places and turning areas.
- Minimise watercourse crossings.
- Tracks will not be sealed.
- Tracks will be constructed from locally sourced aggregate.
- Track margins will be vegetated to reduce potential sediment-laden run-off.

The construction of access tracks will vary depending on localised ground conditions. Conditions impacting construction include the existing vegetation, nature of the topsoil, level of moisture in the ground, geotechnical base and localised topography.

Post construction, the areas that were cleared to create batters and corners will be rehabilitated. Roads will be maintained and need to remain passable for oversize over mass (OSOM) loads in the event of a blade replacement during operation. Therefore, trees that could grow to become future obstructions will not be planted where large oversailing blades could be transported in.

2.10 Utilities

A supply of water for firefighting purposes will be maintained on site during construction in accordance with bushfire management guidelines.

The management of sewage will be finalised in the detailed design phase; however it is likely to be managed by a septic system and removed off-site by a certified contractor. Alternatively, an in-ground septic system with treated liquid influent through ground bio-irrigation (or equivalent) will be installed to comply with the Building Code of Australia and will be positioned adjacent to the operations and maintenance compound.

2.11 Temporary Workers Accommodation

Temporary workers accommodation will be provided for the construction of the Project to house the expected workforce of up to maximum of 450 staff. The temporary accommodation camp is proposed to be developed near the site access located on Lot 21 RN1345 and is expected to be up to 9.8 ha in area.

3.0 Preliminary Construction Methodology

The chosen Engineering, Procurement and Construction (EPC) contractor will be responsible for the detailed construction methodology for the Project. The following sections describe a typical construction methodology for wind farm development that could apply to the Project.

3.1 Project Delivery Timeframes

The construction period for the Project will be agreed between the EPC contractor and Neoen and will be subject to change depending on weather conditions, availability of materials and construction speeds. A present, the construction timeframe is estimated to be between 22–28 months. However, a 22-month timeframe has been assumed for the purposes of this report to represent a 'worst case' in terms of potential construction impacts. Subject to Project approvals, construction is anticipated to commence in Quarter 4 of 2024 and conclude in Quarter 3 2026. Commissioning of the Project is scheduled to start in Quarter 3, 2026.

During the construction phase, works will typically occur for six days each week (Monday to Saturday), and up to 12 hours per day (06:30 to 18:30). During certain construction activities, such as foundation pours and turbine lifts, works may be required to run longer than 12 hours for safety and quality purposes. It may also be necessary for construction activities to take place on a Sunday or during the evening/night. In such instances, appropriate mitigation and management measures will be incorporated into the CEMP. These assumptions will be revisited and modified as necessary during detailed design.

Preliminary details of the proposed construction phase activities have been provided, with a high-level summary of the key construction tasks, the likely order of completion and anticipated timeframes provided in **Table 3.1** below.

Table 3.1 Typical Construction Schedule

ID	Task	Duration	Month																												
			Oct 24	Nov 24	Dec 24	Jan 25	Feb 25	Mar 25	April 25	May 25	Jun 25	Jul 25	Aug 25	Sep 25	Oct 25	Nov 25	Dec 25	Jan 26	Feb 26	Mar 26	Apr 26	May 26	Jun 26	Jul 26	Aug 26	Sep 26	Oct 26	Nov 26	Dec 26	Jan 27
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		
			Q4 2024			Q1 2025			Q2 2025			Q3 2025			Q4 2025			Q1 2026			Q2 2026			Q3 2026			Q4 2026			Q1	
A	Mobilisation	1M																													
B	Access roads and site entrances	17 M																													
C	Substation and construction compound	12 M																													
D	Cabling	14 M																													
E	Turbine foundations	17 M																													
F	Turbine transportation	12 M																													
G	Turbine erection	13 M																													
H	Finalisation/commissioning/demobilisation	4 M																													
I	Float	1 M																													

Some enabling works will be required between approval of the Project and commencement of construction. This will include:

- Detailed site investigations (e.g., geotechnical investigations) for the purposes of micro-siting the turbines.
- Obtaining all necessary permits and consents for construction.

For the construction of the Project, the following activities are expected to occur:

- Site establishment (temporary site facilities, lay down areas, equipment and materials).
- Earthworks for access roads and wind turbine hardstands.
- Excavation for the foundations.
- Construction of wind turbine foundations (bolt cage, reinforcement and concrete).
- Installation of electrical and communications cabling and equipment (including overhead feeders from cable marshalling points to the substation).
- Installation of wind turbine transformers, in parallel with electrical reticulation works.
- Installation of towers for the wind turbines, and delivery of the wind turbine components to the Project site.
- Erection of wind turbines, using high-level mobile cranes.
- Commissioning of wind turbines, followed by reliability testing.

The activities listed above will predominately occur in the order listed, however some of these activities may be carried out concurrently to minimise the overall length of the construction program.

3.2 Equipment and Machinery

The major equipment and machinery that is likely to be used for each component of construction of the Project includes:

- For site mobilisation: track loader, grader, backhoe, trucks, small crane and generators.
- For access roads and hardstands: track loaders, excavators, graders, trucks (with trailer), water carts and rollers.
- For wind turbines: excavators, rock breaker, concrete trucks, trucks (with trailer and vacuum), larger crawlers cranes, medium crawler cranes, small crawler cranes and generators.
- For electrical reticulation works: trencher, backhoe, excavator, grader, tractor and small terrain crane.

Other equipment and machinery may be required, depending on the construction techniques nominated in the detailed design phase.

It is expected that one of each turbine component type will be delivered in a single day during the haulage operation (i.e., one blade, one tower section, nacelle, cooling tower, and turbine hub). Each individual component will be carried on a single oversize overmass (OSOM) vehicle.

3.3 Construction Workforce

The Project is anticipated to generate multiple employment opportunities. However, it is estimated that the maximum (peak) workforce will comprise approximately 450 staff throughout the 22-month construction period, with 8 to 12 permanent staff to be employed during operations.

3.4 Construction Water Supply

The provision of water will be essential for the construction of the Project. The construction activities likely to require water are:

- Bulk earthworks and material conditioning.
- Stripping.
- Dust suppression.
- Concrete batching.

Water demand will vary over time, depending on the stages of the work. The expected water requirement during construction will be calculated during the detailed design of the Project.

Water demands for the Project will require different water quality standards. Potable water fit for human consumption will be required at the site offices, while both medium quality (suitable for use in the concrete batching) and low-quality raw water (for earthworks and dust suppression) may be used for construction purposes. Water will be tested from various supply options and allocated to the most appropriate use. Neoen aims to require no on-site treatment, however this will depend on the quality of water available.

A water sourcing strategy will be developed so that water used during the construction phase does not cause issues to landowners or other stakeholders. Generally, potable water will be obtained from the local government water reticulation network where possible, while the proposed source of raw water (medium and low quality) is likely to be sourced from:

- Groundwater (including artesian and sub-artesian).
- Surface water (including watercourses, springs and overland flow).
- Offsite, and trucked in.

In order to avoid interfering with stream flow in the riparian zone, water for construction and for irrigation of revegetated areas will be obtained from a source other than local waterways.

Construction water supply options will be determined during the detailed design of the Project and confirmed with the Department of Resources (DoR) prior to construction.

4.0 Environmental Impacts and Mitigation Measures

The potential impacts involved with construction of the Project are outlined in the following sections for each relevant environmental aspect. The primary objective for management of each aspect is included, along with broad mitigation measures for the design, construction, and operation phases of the Project to minimise potential adverse impacts.

Where 'nil' is recorded in the tables below, this is due either to there being no relevant mitigation measures for that stage of the Project, or because the risk of impacts in that stage are so low that mitigation is not considered necessary.

4.1 Air Quality

Table 4.1 Air Quality Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Exhaust emissions from site equipment and vehicles	Minimise exhaust emissions	**Prevention**	Consider choosing vehicles and equipment with low emissions.	• Vehicle engines to be switched off when not in use. • Avoid idling vehicles where possible.	The vehicle emissions generated from a wind farm during operation is minimal, so nil measures are considered necessary.
Fugitive dust emissions from site activities (e.g. construction of access tracks and hardstand areas) causing dust nuisance or human health impacts	Minimise fugitive dust emissions to reduce dust nuisance and human health impacts	**Prevention**	• Develop a formal CEMP with consideration of sensitive receptors (including surrounding landowners), and formulation of appropriate mitigation and control measures. • Identify a responsible person for dust management.	• Plan construction by locating dust generating activities away from sensitive receptors where possible. • Access tracks are to be dampened on a regular basis with water, especially during prolonged dry periods. • Install washing facilities to prevent mud from construction operations being transported onto adjacent public roads. • Regular cleaning of Project Site entrances. • Ensure that dusty materials are stored and handled appropriately by: wind shielding or complete enclosure, storage away from site boundaries, restricting drop heights of materials, using water sprays where practicable.	Fugitive dust emissions generated from a wind farm during operation is minimal, so nil measures are considered necessary.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
				• Ensuring that dusty materials are transported appropriately (e.g. sheeting of vehicles carrying spoil and other dusty materials). • Minimise dust generating activities on windy and dry days. • Restrict vehicle access and/or vehicle speed on haul roads and other unsurfaced areas of the Project Site. • No fires on the Project Site.	
		Contingency Measures	Nil.	If dust is generated, ensure that a water truck is used to dampen down all access tracks and public access roads.	
		Monitoring	Nil.	• If dust presents a problem, conduct regular air quality monitoring around the site to ensure that it is in accordance with relevant standards. • Include appropriate dust monitoring within site management practices, to inform site management of the success of dust control measures used.	

4.2 Aviation

Table 4.2 Aviation Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Increased risk of collisions by aircraft with wind turbines or meteorological masts	No increase to risk profile for aviation	**Prevention**	Consultation with appropriate authorities, including CASA, Airservices Australia, RAAF, AAAA, GFA and Hang Gliding Federation of Australia regarding the Project.	Notify Airservices Australia, CASA and RAAF when construction commences. Have the Project included on aeronautical charts.	Wind farm operator to provide avenues for consultation with aviation stakeholders if any issues arise during the operation of the Project with respect to aviation related factors.
		Contingency Measures	Consider inclusion of obstacle lighting on wind turbines if they penetrate navigable airspace in accordance with International Civil Aviation Organisation requirements.	Operate obstacle lighting in accordance with International Civil Aviation Organisation requirements if required.	

4.3 Cultural Heritage

Table 4.3 Cultural Heritage Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Disturbance of sites or items of cultural heritage	Minimal impact to cultural heritage values	**Prevention**	Establish a dialogue with the Traditional Owners. Develop a Cultural Heritage Management Agreement/Plan which includes construction and operational phases.	Undertake construction and operation in accordance with the Cultural Heritage Management Agreement/Plan.	
		Contingency Measures	Nil.	• If items of potential cultural heritage significance are discovered during construction, work is to cease immediately in the vicinity of the construction works and a cultural heritage professional is to be invited to investigate prior to works recommencing in that area. • Cultural Heritage Management Agreement/Plan to potentially include recommendations for Traditional Owners on site during construction activities.	Investigate any heritage related complaints and address accordingly. Implement a complaint recording, investigation and reporting system.
		Monitoring	Nil.	Visual inspection of items of cultural heritage value in the event of a complaint.	Nil.

4.4 Electromagnetic Interference

Table 4.4 Electromagnetic Interference Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Disruption to Radio frequency identification (RFID) in proximity to the wind farm	No electromagnetic interference (EMI) impacts or disruption	**Contingency Measures**	Nil.	• Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator. • Investigate these complaints appropriately. • Implement a complaint recording, investigation and reporting system.	
Disruption to Citizen band (CB) radio and mobile phone signals	Minimal and temporary disruption to signals	**Prevention**	Educate landowners and stakeholders about potential interference to CB radio and mobile phone signals.	Nil.	Nil.
		Contingency Measures	Nil.	Encourage CB radio and mobile phone users to move a short distance when experiencing signal interference.	
Disruption to satellite and digital TV reception	No satellite or digital TV reception interference	**Prevention**	Ensure that any changes during detailed design to the wind farm layout are investigated for potential disruption to satellite or digital television.	Nil.	Educate residents experiencing interference issues on how to tune household antennas to alternative sources.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
		Contingency Measures	Nil.	Establish a feedback process whereby stakeholders can raise concerns about EMI impacts with the wind farm operator. Investigate complaints accordingly and where mitigation measures are necessary, consider undertaking one or more of the following: • Tune the householder's antenna into alternative sources of the same or suitable TV signal. • Install a more directional and/or higher gain antenna at the affected dwelling. • Relocate the antenna to a less-affected position. • Install satellite TV at the affected dwelling. • Where all else fails, install a TV relay station.	

4.5 Fauna

Table 4.5 Fauna Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Mortality of native fauna	No significant impact on native fauna populations directly attributable to the Project	**Prevention**	Avoid the removal of habitat trees (including hollow-bearing trees or stags, trees with DBH >30 cm and trees containing potential animal breeding places) and terrestrial habitat features (including complex boulder piles, hollow logs).	• Speed limits will be clearly signed on roads during construction. • Movement within the Study Area will be via approved access tracks with speed limits enforced. The requirement to enter and traverse the Study Area will be minimised and limited to those required for essential Project activities. • Known fauna crossing points will be highlighted with signage. • A qualified fauna spotter-catcher will be present at all times during clearing. • Where hollow bearing trees cannot be retained they will be slow-felled to minimise the chances of injury or death and will be inspected after felling by a qualified fauna spotter-catcher to confirm no injured wildlife are present. • Removal and translocation of hollows containing wildlife from habitat trees shall be conducted using a cherry picker, arborist and spotter/catcher.	Maintain fauna exclusion systems and structures designed for safe fauna passage, to enable these systems to function effectively.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				• Fauna exclusion fencing will be installed around infrastructure that may pose a hazard (i.e. substation, laydown areas). Elsewhere, fencing will only be installed as required and will be 'fauna friendly' (i.e. not barbed wire). • All nests and dreys shall be safely removed from trees prior to any trees being felled. • All animal breeding places will be managed under the protocols developed under an approved high-risk or low-risk Species Management Program (SMP). • All site personnel shall be made aware of sensitive fauna/habitat areas and the requirements for the protection of these areas. • In accordance with statutory obligations/policies, construction activities will be monitored in accordance with a standardised Flora and Fauna Monitoring Program. • Avoid disturbing, removing or breaking up fallen timber (especially larger logs) or other habitat features (including large stones and boulders) wherever possible. • Where it is unavoidable to disturb fallen timber and other habitat features, relocate them to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance).	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
		Contingency Measures	Nil.	• Investigate the cause of any fauna injury or death. • Information gained through investigations to be applied in adaptive management to prevent or minimise further losses or injuries.	
		Monitoring	Prepare a Flora and Fauna Monitoring Program that includes assessment of mortality of native fauna and adaptive management processes to prevent or minimise further losses or injuries and/or identifies measures to be implemented as compensatory actions.	• Continued visual inspection of wind farm for fauna mortality in conjunction with scheduled maintenance works and according to the requirements established in the Flora and Fauna Monitoring Program. • Records of all mortalities should be kept to ensure that mortality rates are kept to an acceptable level.	
Impediment to movement of at-risk wildlife (birds and bats) through natural wildlife corridors	Compliance with the EPBC Act, NC Act, VM Act, and EP Act	**Prevention**	Develop a pre-construction and post-construction monitoring plan for bats and birds. Any turbine lighting is to be minimised, and red lights used to prevent the attraction of insects.	Construction and clearing of vegetation will be staged to allow for continued wildlife movement outside the immediate danger of the construction site.	Nil.
		Contingency Measures	Nil.	In accordance with statutory obligations, spotter/catchers will be present at all vegetation clearing to ensure minimal disturbance to onsite fauna and recover and rescue any injured or orphaned fauna during construction.	Nil.

4.6 Flora

Table 4.6 Flora Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Direct loss of 'Of Concern' Regional Ecosystem (RE)	Compliance with the EPBC Act, NC Act, VM Act, and EP Act	**Prevention**	• Minimise disturbance to areas of 'Of Concern' and 'Endangered' RE unless there is no suitable alternative. • Detailed design of the Project to promote the retention of remnant vegetation. • Co-locate infrastructure where possible to reduce area of vegetation clearing required. • Micro-siting of Project infrastructure will maximise the use of existing breaks in vegetation and areas of previously cleared land as much as practical. • Micro-siting of Project infrastructure will aim to retain a vegetated buffer around the vine thicket communities up to 5 m, to limit edge effects. In cases where the final Disturbance Footprint intersects the vine thicket communities, a 5 m buffer will not be possible.	• A Vegetation Management Plan will be developed and implemented. • Site preparation must include the demarcation of areas to be cleared as well as 'no-go' zones to avoid inadvertent clearing. • Pre-clearance surveys in areas of potential threatened flora habitat will include targeted searches for these species. • Where watercourses intersect linear areas of the Project, the clearing width will be reduced to 25 m or less wherever it is feasible for safe transport of Project components. • To minimise further loss of vegetation, trees will be felled away from areas of retained vegetation where practicable. Where trees unavoidably fall into retained areas, they will be left in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna. • Dust suppression measures will be implemented as required i.e. on high wind days during extended dry periods. • Impose strict no-go zones for construction workers and machinery within remnant vegetation outside of the Disturbance Footprint.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
		Contingency Measures	• Research viability of compensatory planting. • Develop and implement a Rehabilitation Management Plan.	• All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements. • Educate all contractors on the importance of the vegetation and ensure there is no encroachment on surrounding vegetation. • Implement the Rehabilitation Management Plan.	Nil
		Monitoring	Nil	Daily visual inspection of vegetation clearing boundaries.	Nil
Direct loss of regrowth vegetation	Compliance with the EPBC Act, NC Act, VM Act, and EP Act. Maintain the current extent of regrowth vegetation.	**Prevention**	• Avoid all regrowth vegetation outside of the Disturbance Footprint. • Detailed design of the Project to promote the retention of remnant vegetation. • Co-locate infrastructure where possible to reduce area of vegetation clearing required.	• Minimise construction activities within regrowth vegetation. • Impose strict no-go zones for construction workers and machinery within regrowth vegetation outside of the Disturbance Footprint.	Nil
		Contingency Measures	Develop a Rehabilitation Management Plan.	• All vegetation to be removed is clearly marked and clearing contractors briefed on clearing requirements. • Educate all contractors on the importance of the vegetation and ensure there is no encroachment on surrounding vegetation. • Implement the management and rehabilitation plan.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
		Monitoring	Nil.	Regular visual inspection of vegetation clearing boundaries.	Nil.
Degradation of vegetation communities and habitats through indirect impacts, including edge effects, spread of weeds, introduced pests, modified surface water drainage, light and noise intrusion	Compliance with the EPBC Act, NC Act, VM Act, and EP Act. No new infestations of weeds or pests attributable to the Project.	**Prevention**	• Avoid further fragmentation of existing small patches (< 5 ha). • Maintain, as far as practicable, existing surface drainage paths. • Develop and implement a Weed and Pest Management Plan that includes specific controls for environmental and noxious weeds.	• Pre-construction and post-construction weed surveys will be undertaken within the Disturbance Footprint plus 5 m buffer. The identification and location of restricted weeds and high-biomass grasses will be prioritised. • Restricted weeds and high-biomass grasses identified within the Disturbance Footprint inclusive of a 5 m buffer will be removed or treated prior to ground disturbance. • Monitoring of the Disturbance Footprint will be completed to identify any new incidence of weed and pest infestation. • Ongoing weed control measures will be implemented in high-traffic areas including tracks and laydown areas and at newly established watercourse crossings. • Biosecurity requirements and protocols must be established in consultation with the relevant landholders, noting areas north of the central range are relatively free of parthenium (Parthenium hysterophorus*). These will include: ○ A certified weed and seed wash down will be required for any vehicles or machinery entering the wind farm area.	Implement the Weed and Pest Management Plan.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				○ Site vehicles to be washed down after working in areas where infestations are noted within applicable areas (where identified) and where weed control measures have not been implemented. ○ Prior to entering the Study Area, the origin of construction materials, machinery and equipment will be determined and certified where applicable. • Further detailed weed management methods will be confirmed at a later stage in conjunction with the EPC contractor. • Implement the Weed and Pest Management Plan.	
		Monitoring	Nil	Visual inspections in accordance with the requirements set out in the Weed and Pest Management Plan.	
Removal of prescribed environmental matters that are regulated vegetation communities	Compliance with Planning Act, VM Act and *Environmental Offsets Act 2014*	**Contingency Measures**	• Determination of offsets (if required). • Confirmation on delivery of offsets. • Delivery of financial offset (if appropriate).	Nil	Nil

4.7 Hazard and Risk

Table 4.7 Hazard and Risk Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Increase in prevalence and severity of bushfires	No increase in bushfire risk in the Study Area	**Prevention**	• Prepare a Bushfire Management Plan in consultation with Queensland Fire and Emergency Services (QFES). • Develop a fuel management strategy, including planned fuel reduction burns. • Avoid higher risk areas when siting buildings or other infrastructure. • Keep electricity services underground where possible (e.g. between turbines). • Select equipment and machinery (including the turbines) with high safety standards. • Develop emergency provisions for neighbouring property owners. • Design roads to carry fully loaded fire fighting vehicles. • The detailed Project design will be in accordance with relevant industry standards, including requirements for emergency vehicle access.	• Maintain fire breaks around construction site. • Visual inspection of construction areas for presence of dry fuel. • Incorporate Bushfire Management Plan into the CEMP. • Ensure buildings meet specifications and requirements of AS3959. • Install lightning protection devices in wind turbines. • Observe fire warnings and notices. • Maintain fire extinguishers at site offices and in construction vehicles.	• Observe fire warnings and notices. • Maintain vegetation levels to remove any potential high-risk forest fuels.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
		Contingency Measures	• Provide suitable ingress and egress to the Project Site and escape routes. • Prepare an Emergency Response Plan which covers construction and operation.	• Ensure appropriate water supply is available on site. • Implement the Emergency Response Plan. • Investigate the cause of any fire, and update facilities or procedures to prevent further incidents. • Monitor Fire Danger Index (FDI) daily. • Regularly maintain and service equipment and turbines.	
		Monitoring	Nil.	Regular inspections of fire break areas.	
Potential creation of artificial breeding sites for mosquitos	Compliance with the *Public Health Act 2005*	**Prevention**	Provide a mosquito management component in the Weed and Pest Management plan.	A Pest Management Technician, licensed under the *Pest Management Act 2001*, will be engaged when pest control activities are required to be undertaken.	
		Contingency Measures	Nil.	Maintenance activities as set out in the Weed and Pest Management Plan.	
		Monitoring	Nil.	Visual inspections in accordance with the requirements set out in the Weed and Pest Management Plan.	

4.8 Land Use

Table 4.8 Land Use Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Loss of Good Quality Agricultural Land. Disruption to agricultural practices.	Minimal reduction in rural production or output caused by construction or operation of the wind farm.	**Prevention**	• Consult with landowners to determine methods to prevent disrupting current agricultural practices. • Minimise development in areas classified as Class A and B under the Agricultural Land Class (ALC) scheme.	Develop and implement a CEMP, outlining how disruption of agricultural practices will be minimised during construction, based on discussions with landowners during the design phase.	Operate the wind farm in accordance with measures identified during the design phase.
		Contingency Measures	Where some disruption cannot be avoided, consult with landowners to identify ways to minimise impacts to agricultural practices.		Nil.
			Nil	• Investigate the cause of complaints relating to disrupted agricultural activities, and address the issue appropriately. • Implement a complaint recording, investigation and reporting system for construction and operation.	

4.9 Landscape and Visual

Table 4.9 Landscape and Visual Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Reduced visual amenity of the Study Area and surrounds for residents and visitors	Nil complaints relating to reduced visual amenity	**Prevention**	• Minimise vegetation removal, where possible. • Design facilities to minimise visual impact on surrounds, such as turbines with white or off-white colouring and semi-matte finishes to minimise reflections. • Use the natural line of the existing landscape wherever practicable to reduce visibility and assist integration of the wind farm infrastructure.	• Manage construction lighting used for night-works to minimise visual effects on sensitive receptors. • Use of spoil from excavation sites for incorporation into bunding for buffer planting zones. • Limit works compounds and restrict to areas of lower visual sensitivity and/or lesser visibility where possible to avoid unnecessary visual impact.	Maintain access roads in a tidy manner.
		Contingency Measures	Nil	• Construct overhead electrical infrastructure below the ridgeline, where possible. • Consider native plantings to assist in visual screening, where necessary.	Nil

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				• Ensure any screening consists of mixed plants of local provenance including some fast-growing species, as appropriate to the landscape character. • Implement the CEMP to control landscape and visual effects. • Site waste management plan will be enacted to ensure waste is minimised and reduces impacts to landscape character.	
		Monitoring	Nil	• Regular visual inspection of construction areas for new infestations of weeds. • Regular inspections of weed treatment areas to determine efficacy of measures.	• Regular visual inspections of rehabilitation areas for weed invasion for 12 months, or until established. • Inspection of the Project Site during scheduled maintenance for weed infestation. • Prepare a post-decommissioning rehabilitation plan to reinstate the Project Site to determined rehabilitation outcomes.

4.10 Noise and Vibration

Table 4.10 Noise and Vibration Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Impacts on sensitive receptors such as residential dwellings	Compliance with Queensland Wind Farm State Code and Planning Guideline	**Prevention**	• Ensure that any wind turbine layout within the Project Site is compliant with the applicable noise criteria. • Use of low-noise plant and equipment. • Preparation of a CEMP.	• Determine schedule for construction activities. • Consult with stakeholders about scheduling of construction activities. • Limit construction hours to Monday to Saturday where practicable. • Construction work on Sunday will be specifically addressed in the CEMP. • Maintain construction equipment in good working order. • Use low-impact construction methods, where practicable.	Nil.
		Contingency Measures	Nil.	• Maintain a noise and vibration complaints procedure and register. • Investigate any construction or operational noise complaints appropriately.	
		Monitoring	Nil.	Noise monitoring in accordance with the CEMP.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guidelines.

4.11 Shadow Flicker

Table 4.11 Shadow Flicker Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Nuisance caused by shadow flicker experienced at sensitive receptors	No exceedance of guideline limits for shadow flicker at non-participating sensitive receptors	**Prevention**	• Detailed design to be informed by shadow flicker modelling if turbine layout is altered. • If modelling demonstrates shadow flicker occurrence, arrange a site visit to modelled affected dwellings to investigate and determine site-specific conditions. This will enable further modelling of the detailed design layout to incorporate site conditions at these locations, and will identify the need for mitigation measures at these locations.	Nil.	If determined to be necessary, implement control strategies to shut down certain turbines when shadow flicker is likely to occur at particular dwellings.
		Contingency Measures	Nil.	Nil.	• Enable landowners with concerns about shadow flicker to contact the wind farm operator. • Any complaints to be investigated appropriately. • Install screening structures or plant trees to block shadows cast by turbines during operation, where required.

4.12 Socio-Economic

Table 4.12 Socio-economic Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Noise exceedances at sensitive receptors surrounding the wind farm	Compliance with all applicable noise criteria	**Prevention**	• Final turbine layout within the Project Site will ensure compliance with operational noise criteria. • Application of operational noise criteria and setbacks from sensitive receptors.	Nil.	Nil.
		Monitoring	Nil.	Nil.	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guideline.
Missed opportunities in relation to local employment and use of local contractors	Maximise local employment and contractor opportunities	**Prevention**	• Develop a workforce management arrangement and a Local Procurement Plan. • Develop a Stakeholder Consultation and Engagement Plan.	• Implement workforce management arrangement and Local Procurement Plan. • Implement and revise where necessary the Stakeholder Consultation and Engagement Plan. • Use of local contractors wherever feasible and economic for all associated construction work.	• Maximise local employment during operational phase wherever feasible and economic. • Implement and revise where necessary the Stakeholder Consultation and Engagement Plan.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
				• Maximise local employment during construction phase wherever feasible and economic.	
Reduced safety within the area.	No reduction in safety indicators within the Project Site.	**Prevention**	Ensure that the final turbine layout minimises bushfire risk.	Implement the Bushfire Management Plan to control bushfire risk appropriately.	
Nuisance impacts associated with operation.	No nuisance impacts.	**Contingency Measures**	• Ensure that the final turbine layout is compliant with noise guidelines, shadow flicker guidelines and minimises EMI impacts.	• Undertake activities in accordance with the CEMP to control nuisance impacts appropriately. • Implement a complaint recording, investigation and reporting system for construction and operation. • Investigate the source of complaints and address the issue appropriately.	
		Monitoring	Nil	Undertake compliance noise measurements at sensitive receivers located in proximity to the Project to ensure compliance with the Queensland Wind Farm State Code and supporting Planning Guideline.	

4.13 Surface Water, Riparian Areas and Groundwater

Table 4.13 Water Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
Sediment from disturbed areas may enter nearby waterways and reduce water quality	• Compliance with current State and Commonwealth legislation and standards. • No visible evidence of sediment leaving construction sites. • No visible increase in turbidity attributable to construction or operation of the wind farm.	**Prevention**	Develop an Erosion and Sediment Control Plan in accordance with Engineers Australia's Soil Erosion and Sediment Guidelines for Queensland Construction Sites.	Operate in accordance with the Erosion and Sediment Control Plan.	Maintain vegetation along easements to prevent soil erosion.
		Contingency Measures	Nil.	• Implement erosion and sediment control measures if areas are causing high sediment loads or turbidity in nearby waterways. • Maintain, repair or reinstate damaged erosion and sediment control infrastructure. • Investigate cause of increased turbidity or released sediment and address accordingly.	
		Monitoring	Nil.	• Regular visual inspections of sediment control infrastructure, discharge water sources, and receiving water bodies. • Visual inspections of discharge water and receiving water bodies after rainfall. • Turbidity monitoring in the event of turbid plumes.	
Physical damage or alteration to riparian areas	No net degradation of riparian areas	**Prevention**	• Locate structures outside riparian areas where practicable. • Design activities to minimise scour and erosion of riparian areas.	• Minimise vegetation removal and construction activities within waterways. • Operate in accordance with the CEMP.	Nil.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
			• Develop CEMP to clarify guidelines on activities around riparian areas in the Project construction zone.		
		Contingency Measures	Nil.	If unforeseen impacts on riparian areas occur during construction or operation, appropriately address the impacts using best available technical information.	
		Monitoring	Nil.	• Regular visual inspection of construction site for clearing or construction activities beyond designated areas. • Regular visual inspection of rehabilitated areas until construction period is complete.	Nil.
Interference with stream flow in the riparian zone	No interference with stream flow	**Prevention**	• Locate structures outside riparian areas where practicable. • Develop CEMP to clarify guidelines on activities around riparian areas in the Project construction zone. • Assess construction water supply requirements as part of design.	Obtain construction water from sources other than local waterways.	Obtain water for irrigation of revegetated areas from a source other than local waterways.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
			• Use the Department of Agriculture and Fisheries self-assessable codes for low-impact development activities to design waterway barrier developments.		
		Contingency Measures	Nil	• Cease abstraction of water from local waterways if necessary. • Acquire construction water from an alternative source.	
		Monitoring	Develop a monitoring program for streamflow including location and frequency of monitoring.	• Regularly gauge streamflow at pre-determined points. • Should streamflow reduce in the immediate vicinity of the Project, investigate if Project activities are the cause.	
Introduction of weeds and pests in the riparian zone	No introduction of weeds or pests into riparian areas	**Prevention**	Locate structures outside riparian areas where practicable.	• Develop and implement a Weed and Pest Management Plan, detailing procedures for cleaning and checking construction vehicles entering the construction site. • Minimise vegetation removal and construction activities within waterways.	• Maintain vegetation within the Project Site to prevent the establishment of weed species.
		Contingency Measures	Nil	• Treat or remove weed species in riparian areas within and adjacent to wind farm infrastructure. • Remove overabundant or notifiable pest species in accordance with advice from the Department of Agriculture and Fisheries.	

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
		Monitoring	Nil	• Regular visual inspection of construction areas for new infestations of weeds or pests. • Regular visual inspections of weed or pest treatment areas to determine efficacy of measures.	• Inspection of Project Site during maintenance activities for weed infestation.
Degradation of groundwater resource	No significant variation to local groundwater levels due to construction. No contamination of local groundwater system.	**Prevention**	• Determine water requirements for construction and identify suitable water sources. • Identify surface water bodies sensitive to groundwater movement (i.e. dams).	• All chemicals, fuel and oil will be stored in above ground tanks in bunded areas, with accurate records maintained of volumes purchased and stored, to ensure any contamination of land or water is prevented, and any spill is detected quickly. • Contain poor quality discharge water and treat prior to disposal, subject to achieving water quality guidelines.	
		Contingency Measures	Nil.	In the event of a spillage/leak of potentially hazardous substances: • Comply with the Emergency Spill Containment Plan. • Investigate the nature and extent of the spillage/leakage, and implement clean-up and mitigation measures, as necessary.	
		Monitoring	Develop a monitoring program for groundwater levels and quality, including location and frequency of monitoring.	• Regularly monitor groundwater levels in nearby privately owned and registered bore holes (with permission). • Regularly conduct groundwater quality sampling, using the existing registered bore hole network, and also following a major spillage/leakage event. • If a decrease in groundwater quality is observed in the immediate vicinity as a result of the Project's activities, monitor down-gradient groundwater quality.	

4.14 Topography, Geology and Soils

Table 4.14 Soil Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Erosion	Effective erosion and sediment control measures implemented and maintained	**Prevention**	• Incorporation of stable embankments and cuts, with catch drains to minimise longer term erosion. • Prepare a Project specific Erosion and Sediment Control Plan. • Determine the erosion potential of soils in planned construction areas.	• Operate in accordance with the Erosion and Sediment Control Plan, including installing erosion controls to stabilise the site. • Keep land clearance to a minimum. • Avoid, where possible, clearing areas with a high erosion potential. • If more than one contractor is working on a site, coordinate work schedules so that there are minimal delays in construction activities resulting in disturbed land remaining destabilised. • Schedule construction activities so that the area of exposed soil is minimised during times of the year when the erosion potential is increased (e.g. during summer when intense rainstorms are common). • Keep vehicles to well-defined access roads. • Avoid locating access roads on sloping terrain, wherever practical.	Operate in accordance with the Erosion and Sediment Control Plan.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
		Contingency Measures	Nil.	• Identify and investigate the site of erosion and address in accordance with the Erosion and Sediment Control Plan. • Maintenance of road surfaces and cleared footprints will be conducted prior to and immediately following extreme rainfall events during the construction phase and throughout the life of the Project, reducing the potential of mass movement of sediment. • A land rehabilitation program will be established progressively, to reinstate a suitable soil profile.	
		Monitoring	Nil.	• Document erosion and sediment control measures undertaken. • Regular visual inspection and check sheets maintained. • In-situ turbidity monitoring of local receiving surface waters, in accordance with the requirements of the Erosion and Sediment Control Plan.	
Mass Wasting	No mass wasting / landslip events	**Prevention**	• Geological and geotechnical investigations in areas requiring cuts – areas for turbine foundations and hardstand, and access roads. • Determine geological profile of slopes, with slope stability reports issued prior to undertaking earthworks. • Incorporate rock bolting, retaining walls and stable cuts with associated catch drains if required to maintain slope stability.	Construction activities undertaken in accordance with relevant work method statements.	Visual inspection of susceptible areas following heavy rainfall or landslip inducing event.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
		Contingency Measures	Nil.	Identify and investigate the site of mass wasting and provide suitable remediation.	
		Monitoring	Nil.	• Document mass wasting and landslip control measures undertaken. • Regular visual inspection and check sheets maintained.	
Generation of Acidic Material	No generation of acidic waste water or other acidic material	**Prevention**	Conduct a geotechnical investigation which includes inspection of intrusive igneous rock bodies for disseminated sulphides.	Any exposed acid producing material will be neutralized and contained according to the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines.*	Nil.
		Contingency Measures	Nil.	• Divert potentially acidic surface run-off away from local waterways, into established sedimentation basins. • Neutralise the contained surface run-off by chemical/biological means, in accordance with the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines.*	Nil.
		Monitoring	Nil.	• pH monitoring of surface run-off generated from operational construction sites, at times and in locations where generation of acidic runoff is likely. • pH monitoring of local surface waters receiving surface run-off from construction sites, at times and in locations where generation of acidic runoff is likely. • Submit samples of suspected acidic material to a NATA accredited laboratory for characterisation.	Nil.

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	**Design**	**Construction**	**Operation**
Land contamination by on-site construction activities or by export of contaminated material from site or importation of contaminated material	No contamination of land	**Prevention**	• Determine whether any Notifiable Activities will be undertaken as part of the Project. • Search the Project properties for listing on the Contaminated Land Register or Environmental Management Register. • Develop an Emergency Spill Containment Plan. • Design storage areas to consist of a compacted base, bunding to contain spillages and roofing to prevent contamination and infiltration of stormwater (as per AS1940 and AS3780).	• Record the nature, quantity and location of all hazardous materials on-site in a manifest. • Residual hazardous materials will be removed from the construction site and returned to an appropriate storage area or a suitable waste facility. • Spillages of all dangerous goods and contaminated materials will be rendered harmless through investigation, collection and disposal at a suitable disposal facility. • Fill material imported from offsite will be procured from a licensed quarrying facility and accompanied by relevant documentation to verify it is contaminant/acid sulfate soil free. • Contaminated fill material exported from site will be disposed at a facility licensed for the disposal of such material.	Apply good practice in the storage and handling of dangerous and hazardous goods and appropriate responses to manage impacts from potential spills.
		Contingency Measures	Nil.	• If potentially contaminated soils are encountered, investigation by a qualified contaminated land specialist should be undertaken. • Visual and olfactory observation of all in-situ material excavated during construction.	
		Monitoring	Nil.	Submission of samples of suspected contaminated material to a NATA accredited laboratory for characterisation.	

4.15 Traffic

Table 4.15 Traffic Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Traffic delays on State-controlled roads (SCRs) and local roads	Manage increased traffic volumes appropriately	**Prevention**	• Preparation of a Road Use Management Plan or Traffic Management Plan in consultation with the Department of Transport and Main Roads (TMR) and local councils. • Investigate opportunities to use alternative routes for deliveries avoiding school bus routes and populated areas.	Implementation of the Road Use Management Plan or Traffic Management Plan for construction and operational traffic.	
		Contingency Measures	Specific traffic planning elements to be considered will include road diversions, construction route options and scheduling of deliveries, services and shift patterns.	• Any necessary road closures will be described within the Road Use Management Plan or Traffic Management Plan and necessary approval obtained from TMR and local councils. • Access points will be located with adequate sight lines and advance warning signs provided.	Nil.
Disruptions to stock movement along stock routes	No disruptions to stock movement along mapped stock routes	**Prevention**	Investigate detailed design solutions to minimise impact on existing roads and mapped stock routes.	• Ensure all mapped stock routes remain open during construction phase. • Any works or improvements to the road infrastructure must consider potential stock movement.	Ensure all mapped stock routes remain open throughout the operational period where possible.

4.16 Waste Management

Table 4.16 Waste Impacts and Mitigation Measures

Potential Impact	Primary Objective	Mitigation Measures			
		Stage of Mitigation	Design	Construction	Operation
Excessive waste generation, causing over-demand on local landfills or requirement for transport to larger landfills, and loss of resources	Minimise waste generation	**Prevention**	• Detailed design for infrastructure to carefully specify material needs to avoid over-estimating requirements. • Develop a site waste management plan.	• Use a hierarchical approach to waste management, from the most preferable (reduce, reuse or recycle wastes) to the least preferable (disposal), and prioritise waste management strategies to avoid waste generation. • Implement site waste management plan.	
		Contingency Measures	Nil	Where waste cannot be avoided, waste materials will be segregated by type for collection and removal (for processing or disposal) by licensed contractors.	

5.0 Conclusion

This preliminary CEMP has been developed for the Project to establish a framework for the management of construction impacts on environmental and social values within and adjoining the Study Area.
This document outlined the potential impacts that may occur as a result of the construction of the wind farm and how these impacts are planned to be mitigated and monitored.

As the Project continues through its design and development stages and details are finalised, construction management requirements will be reviewed and updated. Further, a detailed Construction Environment Management Plan (CEMP) will be prepared by a suitably qualified person prior to the commencement of construction activities for the Project.

The CEMP will consider the measures put forward in this preliminary CEMP and any conditions of approval applied to the Project. The CEMP will include details of the construction programme, construction techniques to be employed, location of sensitive receptors, specific environmental mitigation measures to control construction impacts, description of the methods to be used to monitor performance and receive, record and respond to complaints, and contact details for queries and reporting incidents.

6.0 References

Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) 2022, *State Development Assessment Provisions v3.0 – State code 23: Wind farm development,* https://planning.statedevelopment.qld.gov.au/__data/assets/pdf_file/0027/67284/sdap-v3.0-state-code-23-wind-farm-development.pdf

Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) 2022, *State Development Assessment Provisions February 2022 – State code 23: Wind farm development – Planning guidance,* https://dsdmipprd.blob.core.windows.net/general/state-code-23-wind%20farm%20development-planning-guidance.pdf

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