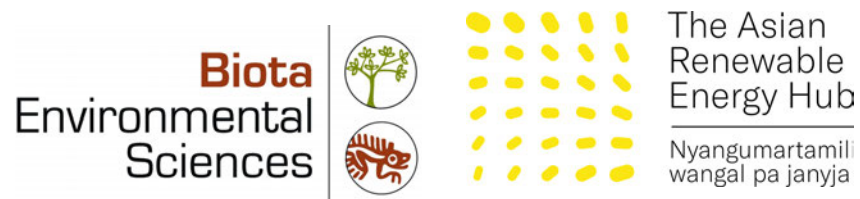


Asian Renewable Energy Hub



Environmental Management Plan

February 2020



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Asian Renewable Energy Hub Environmental Management Plan

Contents

1.0	Summary	7
2.0	Context, Scope and Rationale	9
2.1	Proposal	9
2.2	Key Environmental Factors	9
2.3	Condition Requirements	15
2.4	Rationale and Approach	15
2.5	Rationale for Provisions Choice	15
3.0	Management-based Provisions	23
4.0	References	33

Appendices

Appendix 1: Marine Fauna Species

Appendix 2: Vegetation Types of the Development Envelope

Tables

Table 1.1:	Summary of key project details.	7
Table 2.1:	Key environmental factors, proposed activities, site-specific values and actual or potential impacts.	12
Table 2.2:	Summary of Threatened and Priority flora recorded from the development envelope requiring species-specific management.	18
Table 3.1:	EMP management-based provisions for Benthic Communities and Habitats.	25
Table 3.2:	EMP management-based provisions for Marine Environmental Quality.	25
Table 3.3:	EMP management-based provisions for Marine Fauna.	26
Table 3.4:	EMP management-based provisions for Flora and Vegetation.	27
Table 3.5:	EMP management-based provisions for Terrestrial Fauna.	29
Table 3.6:	EMP management-based provisions for Social Surroundings.	32

Figures

Figure 2.1:	Location map for the project.	11
Figure 2.2:	Project development envelope, footprint and conceptual design.	12

1.0 Summary

This Asian Renewable Energy Hub Environmental Management Plan (EMP) is submitted by NW Interconnected Power Pty Ltd in accordance with the content of the proposal Environmental Review Document (ERD) (NW Interconnected Power 2019) (Table 1.1).

This EMP also follows the format set out in the current Environmental Protection Authority (EPA) Instructions and Templates for Part IV Environmental Management Plans (EPA 2018).

Table 1.1 below provides a summary table for the EMP, consistent with those instructions.

Table 1.1: Summary of key project details.

Proposal Name:	Asian Renewable Energy Hub
Proponent:	NW Interconnected Power Pty Ltd
Ministerial Statement Number	Not yet issued at time of EMP preparation
Assessment Number:	2140
EPBC Act Reference No.:	EPBC 2017/8112
Purpose:	This EMP documents the mitigation measures and management requirements inherent in residual impact conclusions presented in the Asian Renewable Energy Hub ERD. It sets out the environmental management measures that the proponent will implement during the construction of the project.
Key Environmental Factors:	Benthic Communities and Habitat Marine Environmental Quality Marine Fauna Flora and Vegetation Terrestrial Fauna Social Surroundings
Condition Clauses:	No specific conditions to cite as Ministerial Statement not yet issued at time of EMP preparation, but based on expected requirements for key environmental factors.
Key Provisions:	Management-based provisions

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2.0 Context, Scope and Rationale

2.1 Proposal

NW Interconnected Power Pty Ltd ('the proponent') is planning to develop the Asian Renewable Energy Hub ('the project'). The project will involve the construction and operation of a large-scale wind and solar renewable energy project at a site approximately 220 km east of Port Hedland and 270 km southeast of Broome, in the northwest of Western Australia (Figure 2.1). The development envelope and indicative footprint of the proposal are delineated in Figure 2.2

The proposal consists of the following components:

- **Wind Turbines** – Up to 1,743 wind turbines with each turbine being up to 260 m tall from ground to the top limit of the highest blade tip.
- **Photovoltaic (PV) Solar Panels**– 2,000 MW worth of solar PV capacity that will be divided into 37 x 55 MW modules, each of which will be up to 180 ha in size, placed adjacent to a step-up substation.
- **HVDC Converter Station** – An HVDC converter station will convert the AC current generated onsite into DC current, so that it can be exported from the site.
- **Overhead/Underground Transmission Line** – Up to 50 m tall pylons spaced every 450 m along the transmission corridor. The transmission cables will be undergrounded before reaching the coast and buried below the foredune and beach.
- **Offshore Transmission Lines** – The four HVDC transmission cables will be buried along the offshore cable route to the edge of State waters.
- **Site Tracks** – Up to 1,514 km of site access tracks will be constructed, linking the wind turbines and other infrastructure. The track alignments will be cleared to a width of 15 m, and a compacted gravel surface approximately 10 m wide will be completed in the centre to assist with operations and fire management.
- **Onsite electrical infrastructure** – Up to 37 step-up substations will be distributed over the site, together with overhead power lines connecting the turbines to the substations and the substations to the converter station.
- **Onsite Operational Compound and Control Centre** - A site compound and control centre will be established to provide a base for construction and operations personnel.

Components of the wind turbines manufactured outside of Australia will be shipped into the existing commercial ports of Dampier or Port Hedland, and the materials will then be transported along the Great Northern Highway to the site.

2.2 Key Environmental Factors

Management of the following key environmental factors is included in this EMP:

- Benthic Communities and Habitat;
- Marine Environmental Quality;
- Marine Fauna;
- Flora and Vegetation;
- Terrestrial Fauna; and
- Social Surroundings.

Table 2.1 describes the activities, values and actual or potential impacts on these factors.

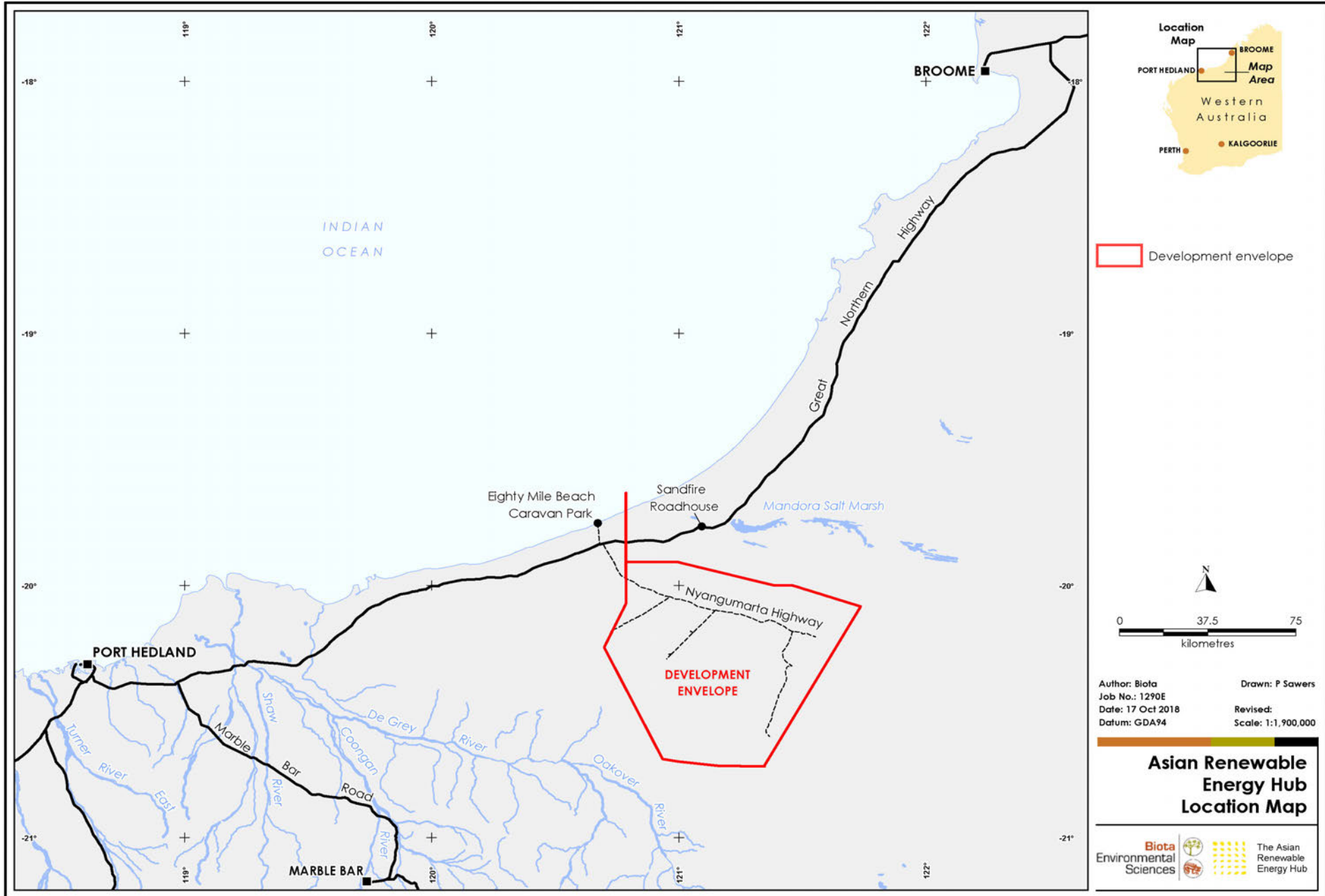


Figure 2.1: Location map for the project.

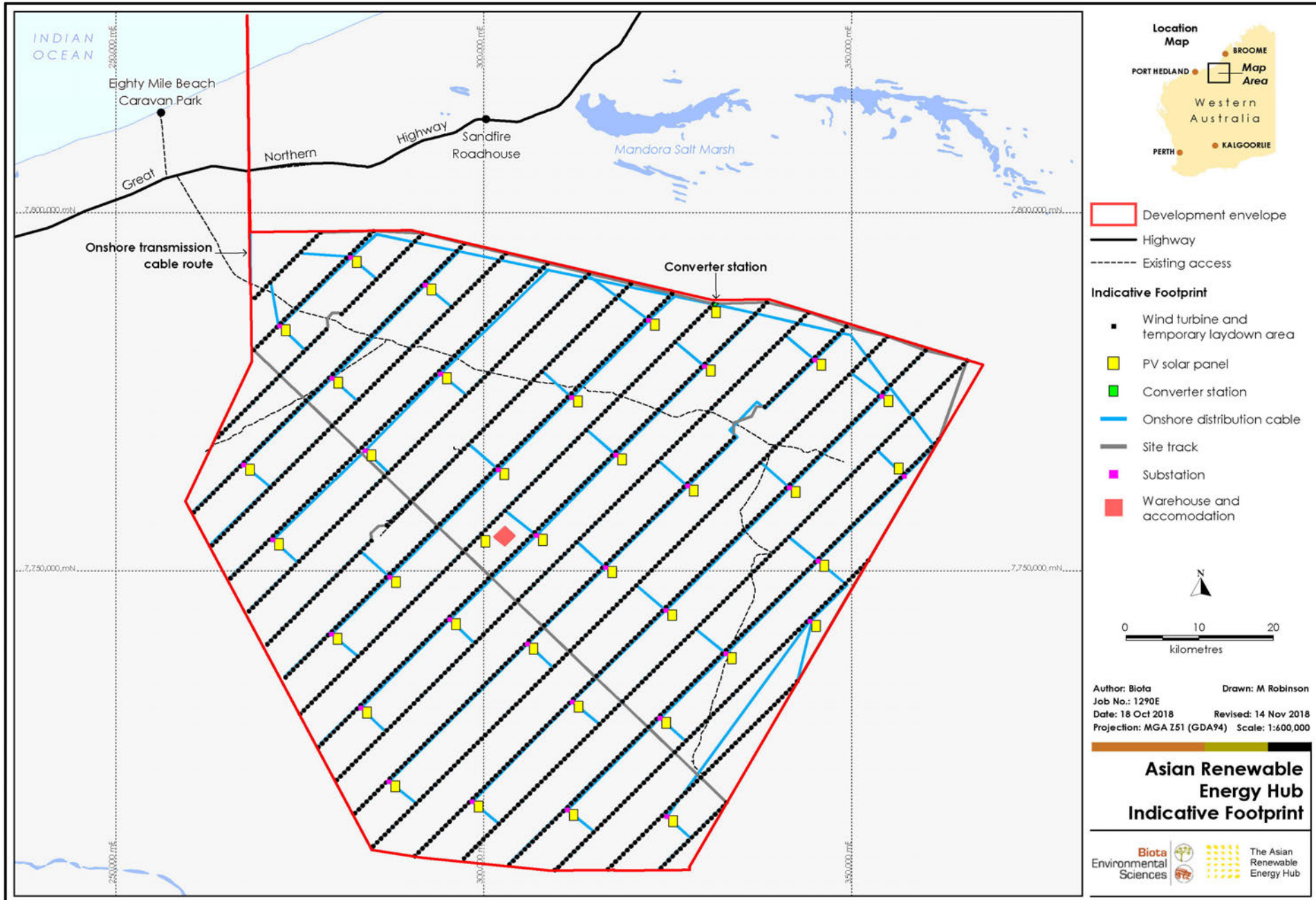


Figure 2.2: Project development envelope, footprint and conceptual design.

Table 2.1: Key environmental factors, proposed activities, site-specific values and actual or potential impacts.

Factor	Activities	Values	Impacts
Benthic Communities and Habitat	Installation, operation, maintenance and decommissioning of subsea export cables through State Waters.	Seabed within State Waters (no significant BCH recorded).	<p>Direct disturbance to seabed as a result of hydroploughing to install, maintain and remove the subsea export cable.</p> <p>Direct disturbance of sediments resulting in changes to water quality and turbidity during cable installation, maintenance or removal.</p> <p>Release of sediment contaminants.</p> <p>Hydrocarbon spills and waste generation from vessels.</p> <p>Introduced marine species from vessel biofouling or ballast water exchange.</p>
Marine Environmental Quality	Installation, operation, maintenance and decommissioning of subsea export cables through State Waters.	<p>Eighty Mile Beach Marine Park.</p> <p>Nearshore State Water quality.</p>	<p>Release of sediment contaminants.</p> <p>Hydrocarbon spills and waste generation from vessels.</p> <p>Introduced marine species from vessel biofouling or ballast water exchange.</p> <p>Chlorine formation during monopole operations.</p> <p>Sediment contamination related to cable deterioration.</p>
Marine Fauna	<p>Installation, operation, maintenance and decommissioning of subsea export cables through State Waters.</p> <p>Incoming vessel movements associated with the importation of wind turbines and solar panels.</p>	<p>11 marine mammals.</p> <p>Six marine reptiles (five turtles and one sea snake).</p> <p>Five species of elasmobranch fish (three sawfish and two shark species).</p>	<p>Introduced marine species from vessel biofouling or ballast water.</p> <p>Hydrocarbon spills and waste generation from cable installation and maintenance vessels.</p> <p>Disturbance from vessel movements (collisions/noise), both in relation to international shipping for the project and cable installation vessels.</p> <p>Direct disturbance of beach nesting areas for marine turtles.</p> <p>Behaviour modification from artificial lighting on vessels.</p> <p>Electromagnetic field generation during cable operation.</p> <p>Heat dissipation during cable operation.</p>

Factor	Activities	Values	Impacts
Flora and Vegetation	<p>Clearing of native vegetation in the construction footprint to accommodate the proposal infrastructure, including access roads, turbine pads, solar panel arrays, substations and transmission lines.</p> <p>Deployment and use of plant and equipment into the development envelope during construction and operations from other locations where introduced flora or soil pathogens may be present.</p> <p>Construction and maintenance activities with potential to ignite bushfires.</p> <p>Long-term (approximately 50 years) presence of finished access roads in linear corridors within the development envelope.</p>	<p>Eighty Mile Land System PEC (Priority 3).</p> <p>One species of threatened flora: <i>Seringia exastia</i> (Threatened; Critically Endangered).</p> <p>Eight species of Priority flora (one Priority 1 and seven Priority 3 species).</p>	<p>Permanent clearing of 11,962 ha of native vegetation (representing 1.81% of total vegetation within the development envelope).</p> <p>Temporary clearing of 612.4 ha during construction for short-term use as laydown areas and for the burial of transmission cables in the coastal portion of the development envelope.</p> <p>Potential direct clearing impacts on the Eighty Mile Land System PEC.</p> <p>Potential direct clearing impacts on populations of <i>Seringia exastia</i>.</p> <p>Potential direct clearing impacts on populations of Priority listed species.</p> <p>A risk of weed introduction and spread during earthworks and construction activities.</p> <p>Other impacts typically associated with construction and operations impacts, such as risk of project-induced bushfires and off-road driving impacts on vegetation.</p> <p>The long-term presence of the site access tracks, partitioning vegetation into blocks and thereby altering fire regimes within the development envelope (in terms of frequency, extent, intensity), leading to consequent changes in vegetation structure and floristic compositions.</p>
Terrestrial Fauna	<p>Clearing of fauna habitat to create the construction footprint to accommodate the proposal infrastructure.</p> <p>Installation of the export cable through beach and intertidal habitat.</p> <p>Deployment of plant and equipment into the development envelope from other locations where introduced flora may be present.</p> <p>Installation of 26 solar panel modules distributed across the development envelope, each of which will be up to 300 ha.</p> <p>Operation of up to 1,743 wind turbines, in rows 4 km apart across the development envelope, spaced at approximately 800 m within the rows.</p> <p>The long-term (approximately 50 years) presence of finished access roads and infrastructure in linear corridors within the landscape of the development envelope, including ongoing vehicle movements.</p> <p>General construction and maintenance activity over a 10 year period.</p>	<p>Four species of Threatened fauna within development envelope:</p> <ul style="list-style-type: none"> • Black-footed Rock-wallaby (Schedule 2; Endangered); • Northern Quoll (Schedule 2; Endangered); • Bilby (Schedule 3; Vulnerable); • Oriental Pratincole (Schedule 5; Migratory) <p>Five species of Priority listed vertebrate fauna.</p> <p>Three potential short-range endemic (SRE) trapdoor spiders.</p> <p>34 migratory shorebird species of conservation significance recorded at Eighty Mile Beach and Mandora Marsh.</p>	<p>Clearing of 11,962 ha of fauna habitats within the development envelope to accommodate the proposal infrastructure.</p> <p>Temporary clearing of 612.4 ha during construction for short-term use as laydown areas and for the burial of transmission cables in the coastal portion of the development envelope.</p> <p>Potential for migratory shorebirds, other avifauna or bat impacts through interaction with wind turbines and distribution and transmission pylons and cables.</p> <p>Potential direct and indirect impacts on four Threatened and five Priority fauna species (including the risk of direct loss or displacement of individuals during clearing or as a result of operational vehicle movements).</p> <p>Risk of weed introduction and spread during earthworks and construction activities, modifying fauna habitats with potential flow-on effects to fauna community structure.</p> <p>Other impacts typically associated with construction and operations, such as risk of project-induced bushfires and off-road driving impacts on habitat.</p> <p>Potential for increased feral fauna movement through the landscape.</p> <p>The long-term presence of access tracks altering fire regimes within the development envelope (in terms of frequency, extent, intensity) and consequent changes to habitats, and local abundance and distribution of species responsive to fire ecology.</p>

Factor	Activities	Values	Impacts
Social Surroundings	<p>A total of 11,962 ha of ground disturbance within the development envelope to accommodate the proposal infrastructure.</p> <p>Construction of wind turbines, which are likely to be visible from parts of the Great Northern Highway.</p> <p>Ongoing operation of the wind turbines.</p>	<p>Visual and Noise sensitive receivers within 30 km of the development envelope:</p> <ul style="list-style-type: none"> • View across marshlands driving south on the Great Northern Highway. • Great Northern Highway tourist rest stop. • Turn-off onto the Nyangumarta Highway. • Dwellings within 30 km (Wallal Station, Mandora Station, Eighty Mile Beach Caravan Park, Sandfire Roadhouse). • View from Nyangumarta Highway driving through the project area. • Construction and operations accommodation facilities within the development envelope. <p>Rock art and areas of cultural heritage importance.</p>	<p>Visual</p> <p>Temporary movement of construction vehicles and busy vehicles in an otherwise remote and natural landscape.</p> <p>During the operational phase of the project, the presence and operation of the wind turbines has the potential to change the existing viewsheds from limited locations.</p> <p>Noise</p> <p>Potential Impacts from noise can arise during operational activities and during construction, major maintenance and decommissioning.</p> <p>The only operational noise considerations are in relation to the wind turbines. Wind turbines can create noise from the turbine gearbox or generator (mechanical noise), and movement of the blades (aerodynamic noise). Mechanical noise has been eliminated as a concern in modern wind turbines, which are well insulated, leaving aerodynamic noise as the only concern when considering potential impacts on sensitive receivers.</p> <p>Heritage</p> <p>Risk of disturbance or destruction of known or unknown Aboriginal sites or objects during construction and operation activities.</p>

2.3 Condition Requirements

The EPA is currently assessing the proposed project (assessment number 2140) and a Ministerial Statement is therefore yet to be issued, with condition requirements therefore also pending at the time of preparing this EMP.

2.4 Rationale and Approach

As part of the proposal for the project, the proponent has committed to the development and implementation of an EMP. The purpose of this EMP is to document the environmental management objectives and mitigation measures to be implemented during the construction of the project, including:

- measures to avoid, reduce and minimise any potential environmental impacts of the proposal on key environmental factors;
- specifying timing and responsibilities for implementation of these measures; and
- specifying monitoring and reporting procedures to provide for continuous improvement, consistent with an adaptive management approach.

Sections 2.3 to 2.5.6 detail key results of baseline surveys, and assumptions and uncertainties that inform the management approach for meeting environmental outcomes and objectives.

2.5 Rationale for Provisions Choice

The proponent recognises that the EPA prefers outcome-based provisions. However, given the early stage of the project, and that no baseline monitoring data have been collected that could inform trigger and threshold levels for an outcomes-based approach, this EMP as adopted the alternative acceptable management-based provisions EMP structure provided for by EPA (2018).

Management objectives identified here relate to the EPA's environmental objective for each relevant factor, management actions are designed to meet these objectives, and management targets aim to assess the effectiveness of management actions. This EMP also describes the monitoring and reporting approach that will be undertaken to assess the effectiveness of the management actions in meeting management-based objectives. As part of adaptive management and future review of the EMP, the proponent intends to assess whether it is possible to develop outcomes-based provisions in future versions of the EMP.

The proponent has followed the example management-based provisions table in the EPA (2018) guidance to the extent possible at the present time. Key survey results, uncertainties and management approaches for each environmental factor follow in Sections 2.5.1 to 2.5.6, consistent with the template in EPA (2018).

The overall management approach for the proposal is to avoid direct disturbance, as far as practicable, to key environmental values (outlined in Table 2.1). Where avoidance is not practicable, the management approach adopted is to minimise and reduce disturbance to key environmental values.

2.5.1 Benthic Communities and Habitat

2.5.1.1 Survey and Study Findings

BMT (2018a) mapped the benthic communities and habitat (BCH) of the cable corridor portion of the development envelope. Overall, the area was a homogenous sand flat with no significant topographic features (BMT 2018a). No significant BCH was found during the survey (BMT 2018a). The seabed habitat that was present was sand-dominated and moderate to high energy with significant turbidity throughout the cable corridor portion of the development envelope.

2.5.1.2 Key Assumptions and Uncertainties

The following uncertainties arose from the survey:

- naturally high turbidity in the majority of the survey area limited the underwater visibility to <1 m (BMT 2018a); and
- due to the high levels of turbidity, not all towed video footage could be used to identify benthic habitats.

Broader information (e.g. (Department of Parks and Wildlife 2014) suggests that the survey data are representative and the uncertainties therefore have no bearing on the relevant provisions of this EMP.

2.5.2 Marine Environmental Quality

2.5.2.1 Survey and Study Findings

BMT (2018b) conducted an assessment of the cable corridor portion of the development envelope through the Eighty Mile Beach Marine Park. That near-shore State Waters marine environment is very turbid due to high energy macro-tidal flows, as well as episodic river runoff in the region, particularly during cyclone events. Sea temperatures in the region range from 24 to 32°C throughout the year (BMT 2018b). Past history and current land use in the hinterland terrestrial catchment indicate a very low likelihood of any stored sediment contaminants that could be mobilised during cable installation (BMT 2018b).

2.5.2.2 Key Assumptions and Uncertainties

Given the nature of the marine environment and adjoining terrestrial catchment, it is assumed that the risk of sediments containing stored contaminants is low. The small uncertainty associated with this will be resolved with pre-construction sampling to confirm this expectation.

2.5.3 Marine Fauna

2.5.3.1 Survey and Study Findings

BMT (2018b) conducted a search of the EPBC Act Protected Matters Search Tool, identifying 26 listed threatened species and 61 listed migratory species that may occur in the development envelope locality. Excluding migratory shorebirds, which are addressed separately in Section 2.5.5, the listed marine fauna species of potential relevance include:

- 11 marine mammal species;
- six marine reptiles (five turtle and one seasnake species); and
- five species of elasmobranch fish (three sawfish and two shark species) (BMT 2018b).

These species and their conservation status are listed in Appendix 1.

2.5.3.2 Key Assumptions and Uncertainties

The following limitations applied to the marine impact assessment:

- Current knowledge of the distribution, migratory habits and local importance of the Eighty Mile Beach Marine Park for whales and dolphins is limited, though some species are known or considered likely to occur (BMT 2018b); and
- Information on dugongs in the Kimberley region is limited and the Western Australian Marine Science Institute is currently completing a program that will integrate indigenous knowledge, aerial surveys and tagging to develop a baseline dugong management plan for the region (BMT 2018b).

2.5.4 Flora and Vegetation

2.5.4.1 Survey and Study Findings

Nine vegetation types were identified for the development envelope, associated with five broad landforms (Biota 2018a). Of the nine vegetation types, four were only recorded from the cable corridor portion of the development envelope (S1, D1, P1 and P2; Appendix 2). One of these vegetation types is formally listed as being of elevated conservation significance, being representative of the Eighty Mile Land System Priority Ecological Community (PEC) (Biota 2018a). Virtually all of the development envelope was accounted for by the remaining five vegetation types, with the great majority of that represented by vegetation type P3 at over 91% of the development envelope. None of the five vegetation types from the main development envelope represent Threatened Ecological Communities (TECs) or PECs (Biota 2018a). However, vegetation type R1 is of local conservation significance; this occurs on the scattered isolated rocky outcrops, which would act as refugia during fires drought, and contains species restricted to such habitats (Appendix 2).

With the exception of the near-coastal areas within the cable corridor, the majority of the vegetation in the development envelope was in Excellent or Very Good condition, with little historical clearing (Biota 2018a). There was heavy grazing and trampling by cattle through the cable corridor near the coast.

A total of 315 native vascular flora taxa from 138 genera and 48 families were recorded from the development envelope during the survey, and four additional taxa have previously been recorded from the area (Biota 2018a). Nine of the species confirmed are listed as conservation significant taxa (Table 2.2). The confirmed records of *Seringia exastia* from the surveys extends its known range by 290 km, from near Broome to the eastern section of the development envelope.

Recent taxonomic advice indicates *Seringia exastia* will soon be synonymised with the common *S. elliptica*, and will not be considered Threatened in future. However, until such time as formal delisting occurs, they are retained in this EMP as per their current status at both State and Commonwealth levels.¹

¹ Specific management actions will no longer apply if taxa are in future removed from all Threatened and Priority flora species lists.

Table 2.2: Summary of Threatened and Priority flora recorded from the development envelope requiring species-specific management.

Species	Status	No. of Individuals / % Cover and No. of Locations (Broad Distribution)
Threatened Flora		
<i>Seringia exastia</i>	Critically Endangered	334 individuals recorded from six locations. In addition, 146 additional individuals of a sterile <i>Seringia</i> were recorded from 15 other locations.
Priority Flora		
<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	Priority 1	4% cover at 1 location (southwestern section of main development envelope)

2.5.4.2 Key Assumptions and Uncertainties

The following potential constraints and limitations were made during the survey;

- there has been only limited botanical survey work in the vicinity of the study area, and no previous systematic surveys within the study area itself. Local level information is considered to be a limiting factor for the survey;
- targeted survey work for conservation significant flora was undertaken, however systematic searches were not possible over the entire study area;
- it was not possible to survey the entire study area systematically for flora, given the lack of vehicle access and the large size of the area. Additional flora species and additional populations of the conservation significant flora would undoubtedly be recorded with additional survey work.

2.5.5 Terrestrial Fauna

2.5.5.1 Survey and Study Findings

Six broad fauna habitats occur within the development envelope (Biota 2018b), which broadly aligned with the land systems present:

- shrub and spinifex on sandplain;
- gravelly lateritic rises;
- east-west oriented dunes;
- rock outcropping;
- paleo-tidal coastal plains; and
- beach and foredune.

Sand dunes and plains were differentiated into coastal and inland habitat types, while the gravelly lateritic rises and rock outcropping habitats were only present inland in the main development envelope (Biota 2018b).

The combined trapping and search effort over the two phases recorded a total of 176 species. Thirty-one mammal species were recorded from the development envelope, comprising 18 native non-volant (ground-dwelling) species, nine bats and five introduced species (Biota 2018b). The conservation significant mammal species were recorded:

- Black-footed Rock-wallaby (*Petrogale lateralis lateralis*) – Schedule 2; Endangered;
- Northern Quoll (*Dasyurus hallucatus*) – Schedule 2; Endangered;
- Bilby (*Macrotis lagotis*) – Schedule 3; Vulnerable;
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus*) – Priority 3;
- Brush-tailed Mulgara (*Dasyercus blythi*) – Priority 4;
- Northern Marsupial Mole (*Notoryctes caurinus*) – Priority 4; and
- Western Pebble-mound Mouse (*Pseudomys chapmani*) – Priority 4 (Biota 2018b)

Sixty-eight bird species from 26 families were recorded from the development envelope. One species of elevated conservation significance, the Oriental Pratincole (*Glareola maldivarum*; Schedule 5; Migratory), was recorded opportunistically during the migratory shorebird study (Biota 2018b), but was recorded within terrestrial habitat feeding over spinifex.

The recorded herpetofauna of the development envelope consisted of 77 species inclusive of four frogs, one turtle, 16 geckos, five legless lizards, nine dragons, 24 skinks, six goannas, three blind snakes, two pythons and seven elapid snakes. Two conservation significant reptiles were recorded:

- Flatback Turtle (*Natator depressus*) – Schedule 3; Vulnerable, Marine, Migratory; and
- Dampier Plain Slider (*Lerista separanda*) – Priority 2.

Three species of trapdoor spiders were conservatively treated as potential SREs (Biota 2018b). While the three newly recorded trapdoor spiders have been conservatively treated here as potential SREs, it is possible that they are also more widely distributed based on the land system they were recorded from; all three species were recorded from widely-connected sandplain habitats with no barriers to dispersal.

Two species of waterbird were observed within the development envelope during the terrestrial fauna surveys and targeted avifauna surveys: Australian Pelican (*Pelecanus conspicillatus*) and White-necked Heron (*Ardea pacifica*) (Biota 2018b). Only one migratory shorebird species listed under the EPBC Act was recorded from the development envelope: 35 individuals of the Oriental Pratincole (Biota 2018c).

2.5.5.2 Key Assumptions and Uncertainties

The following potential limitation applied to the fauna survey;

- systematic fauna sampling was completed in all fauna habitats, but it was not possible to ground-truth every part of the study area. Some areas were inaccessible by vehicle, so installation and regular checking of fauna traps in these areas was not possible. This limitation applied primarily to the southern-most extent of the study area, which was largely inaccessible by vehicle, but this limitation was addressed by means of helicopter ground-truthing to confirm the habitats sampled systematically were representative of inaccessible areas.

2.5.6 Social Surroundings

2.5.6.1 Survey and Study Findings

Visual and Landscape

The development envelope is sited in a large-scale landscape setting in a remote part of the northeast Pilbara. The land is gently sloping, rising very gradually as it goes inland.

Generally, there is little variability in the extensiveness of viewsheds or the type of landform visible across the entire extent of the development envelope.

There are four residences within 30 km of the development envelope boundary:

- Wallal Station, located 24 km from the nearest turbine;
- Mandora Station, located 18 km from the nearest turbine;
- Eighty Mile Beach Caravan Park, located 24 km from the nearest turbine; and
- Sandfire Roadhouse, located 18 km from the nearest turbine.

A Zone of Visual Influence (ZVI) assessment was undertaken to calculate geographical locations where turbines would be visible from and the number of turbines visible from each location. The ZVIs allow the following broad conclusions to be reached:

- there is medium to high visibility of the total number of wind turbines within the development envelope itself;
- the topographic characteristics of the area are generally such that the visibility of the wind turbines will be primarily limited to seeing blade tips against a flat horizon at distances beyond 10 km; and
- the areas from which the project will be more visible are generally to the northwest of the development envelope.

Potential sensitive receivers were identified within 30 km of the project, including:

1. View across marshlands driving south on the Great Northern Highway;
2. Great Northern Highway tourist rest stop
3. Turn-off onto the Nyangumarta Highway
4. Residents to the northwest (Wallal Station, Madora Station and Eighty Mile Beach Caravan Park);
5. Nyangumarta Highway within the development envelope (driving through the finished project).

For observers at viewpoints 1 to 4, visible elements of the turbines will appear as small, indistinct, pin-like elements. For observers at viewpoint 5, the wind turbines will be very obvious and will contrast with the overwhelmingly horizontal characteristics of the landscape at closer viewing range. The observer will also occasionally be able to see solar PV arrays at various points along the track.

Noise

Wind turbines can create noise from the turbine gearbox or generator, and movement of the blades. Mechanical noise has been eliminated as a concern in modern wind turbines, which are well insulated, leaving aerodynamic noise as the only concern when considering potential impacts on sensitive receivers. In the case of the current proposal there are no sensitive receivers located close to the development envelope, so noise is not expected to be an issue.

Heritage

No sites of non-Aboriginal heritage importance were identified within the development envelope. However, a limited number of sites of known Aboriginal heritage value are known to exist within the development envelope. These sites are related to rock art and areas of cultural importance around watering holes.

2.5.6.2 Key Assumptions and Uncertainties

The following assumptions and limitations were made during the assessment of visual, noise and heritage aspects of the project;

- The Zone of Visual Influence (ZVI) assessment assumes that there is no vegetation cover that might obstruct visibility. On the ground, many areas that have theoretical visibility in the ZVI analysis would in reality not have any, due to the presence of low trees or high shrubs relatively close to the observer;
- The ZVI assessment also assumes that a turbine tower or blade is included in the count even if only the smallest part is visible in the model. Not all of the turbine tower hubs or blade tips would in reality be visible but have registered as being visible on the ZVI due to very small inclusions; and
- No targeted and comprehensive heritage survey was completed within the development envelope, however the currently known sites of cultural importance have been identified.

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3.0 Management-based Provisions

This section identifies the management provisions that the proponent will implement via this EMP.

Table 3.1 to Table 3.6 detail the management objectives, associated actions and targets for each key environmental factor. Consistent with the approach recommended by EPA (2018), the provisions for this EMP are detailed in tabular format, setting out objectives, actions and monitoring (Table 3.1 to Table 3.6).

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Table 3.1: EMP management-based provisions for Benthic Communities and Habitats.

Key Environmental Factor: Benthic Communities and Habitat						
EPA Objective: To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
Seabed within State Waters (no significant BCH recorded).	Direct disturbance to seabed as a result of hydroploughing to install, maintain or remove the subsea export cable.	Temporary disturbance to the sea floor of no more than 15.3 ha of bioturbated sediments and sands, with no loss of significant BCH.	<ol style="list-style-type: none"> 1. Implement procedures to ensure that cable installation only occurs within the surveyed cable corridor and that the finished cable is buried to the specified depth below the seabed. 2. Navigational aids on the installation vessel to track cable lay operations and ensure that works are done within design limits. 	Ensure that seabed disturbance only occurs within the surveyed cable corridor as part of the proposal.	Global Positioning System (GPS) tracking implementation. Responsibility: hydroploughing contractor. Frequency/Timing: once during relevant activities.	Hydroploughing close-out report.

Table 3.2: EMP management-based provisions for Marine Environmental Quality.

Key Environmental Factor: Marine Environmental Quality						
EPA Objective: To maintain the quality of water, sediment and biota so that environmental values are protected.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
Water quality of the Eighty Mile Beach Marine Park and nearshore State Waters.	Release of contaminants from seabed during cable installation, operation, maintenance and decommissioning.	No significant increase in sediment contaminants that have the potential to deteriorate the water quality of the marine environment.	<ol style="list-style-type: none"> 1. The risk of contaminants being released into the water column is considered negligible given that the cable corridor traverses a locality with no history of urban or industrial development, but pre-construction sediment testing will be conducted to confirm this, consistent with Australian Government (2009). 	Maintain pre-project implementation water quality levels.	Sediment sampling prior to cable installation. Water sampling post cable installation. Responsibility: cable installation contractors. Frequency/Timing: once during relevant activities.	Sampling analysis reports.
	Sediment contamination related to cable damage or deterioration during operational phase.	No significant increase in sediment contaminants that have the potential to deteriorate the water quality of the marine environment.	<ol style="list-style-type: none"> 2. Burial of the cables to a depth of 5-10 m below the seabed (which will result in cable weathering due to wave action or currents being negligible). 3. Implementation of a monitoring and maintenance schedule. 	Maintain pre-project implementation water quality levels.	Maintenance schedule and periodic water quality sampling. Responsibility: environmental representative. Frequency/Timing: once every five years or as agreed with regulator	Sampling analysis report.
	Hydrocarbon spills and waste generation from vessels.	No significant risk of hydrocarbon and waste pollution of the marine environment.	<ol style="list-style-type: none"> 4. Industry standard housekeeping and spill prevention protocols detailed and contractually required. 	Ensure standard environmental procedures guiding appropriate spill prevention and waste management measures are followed.	Compliance with contractor requirements and procedures. Responsibility: vessel contractors. Frequency/Timing: ongoing during construction.	Contractor procedure compliance.
	Introduced marine species from vessel biofouling or ballast water exchange.	No significant risk of introduction of IMS establishment.	<ol style="list-style-type: none"> 5. Complete a risk assessment on contracted vessels resulting in a low risk rating. 6. All work vessels will comply with the current Department of Fisheries Aquatic Biosecurity Policy vessel management procedures in line with Australian Government Department of Agriculture, Fisheries and Forestry marine pest management guidelines. 	Reduce the risk of IMS to the Eighty Mile Beach Marine Park and nearshore State Waters.	Risk assessment and compliance with guidelines prior to work commencing. Responsibility: vessel contractors. Timing/Frequency: ongoing during construction.	Risk rating report.
	Chlorine formation during monopole operations; potential release into water to produce hypochlorous acid.	No release of chlorine gas into water.	<ol style="list-style-type: none"> 7. Anodes to be excluded from the Eighty Mile Beach Marine Park and the potential impacts of hypochlorous acid on marine flora and fauna, and marine water quality will be avoided. 	Avoid risk of hypochlorous acid release into the marine environment.	Project design and implementation Responsibility: detailed design engineers. Timing/Frequency: once prior to project implementation.	Detailed project design

Table 3.3: EMP management-based provisions for Marine Fauna.

Key Environmental Factor: Marine Fauna						
EPA Objective: To protect marine fauna so that biological diversity and ecological integrity are maintained.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
11 marine mammals, six marine reptiles, and five species of elasmobranch and cartilaginous fish.	Introduced marine species from vessel biofouling or ballast water.	No significant risk of introduction of IMS establishment.	1. Complete a risk assessment on contracted vessels resulting in a low risk rating. 2. All work vessels will comply with the current Department of Fisheries Aquatic Biosecurity Policy vessel management procedures in line with Australian Government Department of Agriculture, Fisheries and Forestry marine pest management guidelines.	Reduce the risk of IMS to the Eighty Mile Beach Marine Park and nearshore State Waters to the extent practicable.	Risk assessment and compliance with guidelines prior to work commencing. Responsibility: vessel contractors. Timing/Frequency: ongoing when required during construction.	Risk rating report.
	Disturbance from vessel movements (collisions/noise), both in relation to international shipping for the project and cable installation vessels.	No significant risk of marine fauna collisions or cable entanglement.	3. Implementation of monitoring and stop work protocols during cable installation.	Reduce risk of marine fauna collisions to the extent practicable.	Marine fauna observers and stop work authority implementation. Responsibility: vessel crew. Frequency/Timing: when required during construction	Construction sampling and analysis plan and marine fauna observers log
	Electromagnetic field generation during cable operation.	Negligible generation of electromagnetic field (EMF).	4. Burial of the cables to a depth of 5-10 m below the seabed. 5. Proponent to specify cable shielding requirements. 6. Pre-installation modelling of EMF. 7. Post-installation verification of EMF generation at or above seabed level.	Mitigate potential for electromagnetic field generation.	EMF verification monitoring. Responsibility: cable installation contractors. Frequency/Timing: once post cable installation.	EMF modelling report and EMF verification report.
	Heat dissipation during cable operation.	No significant heat dissipation	8. Burial of the cables to a depth of 5-10 m below the seabed. 9. Post-installation verification of temperatures at and above the seabed level.	Ensure no elevation of water temperatures beyond natural water conditions.	Water temperature monitoring prior to, during and post-installation. Responsibility: cable installation contractors. Frequency/Timing: during construction and once post cable installation.	Water temperature compliance report.
Flatback Turtle	Trenching through beach nesting areas for the Flatback Turtle.	No significant impact on Flatback Turtle nesting habitat on Eighty Mile Beach.	10. Cable installation to avoid peak turtle breeding period.	Avoid impact to Flatback Turtle nesting habitat.	Timing of trenching activities. Responsibility: environmental representative. Frequency/Timing: once during construction in non-breeding season.	Procedure compliance records.
Sawfish	Hydroploughing through intertidal pupping habitat.	No significant impact on sawfish intertidal pupping habitat.	11. Cable installation to avoid pupping period for sawfish.	Avoid impact to sawfish pupping habitat.	Timing of Hydroploughing activities. Responsibility: environmental representative. Frequency/Timing: once during construction in non-pupping season.	Procedure compliance records.
Marine turtles	Behaviour modification from artificial lighting on vessels	No significant impact on marine turtle behaviour.	12. Cable installation to avoid peak turtle breeding period. 13. Works preferentially scheduled for daylight. 14. Implementation of lighting controls in the event night work is required during cable installation.	Avoid behaviour modification response to artificial light wherever practicable.	Timing of construction works. Responsibility: environmental representative and construction contractors. Frequency/Timing: daily during construction activities.	Procedure compliance records.

Table 3.4: EMP management-based provisions for Flora and Vegetation.

Key Environmental Factor: Flora and Vegetation						
EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
Vegetation and flora	Permanent clearing of native vegetation.	No more than 11,962 ha (1.81% of development envelope extent) of native vegetation cleared, with all individual vegetation types permanently cleared by <2% of their current extent within the development envelope	<ol style="list-style-type: none"> 1. Definition of clearing limits on all design drawings and specifications. 2. Surveying in, erecting bunting or other clear boundary markers on-site. 3. Erosion control, revegetation and dune stabilisation in locations where civil works intersect dune habitat. 4. Rehabilitation of all clearing upon decommissioning of the project. 5. Develop and implement a decommissioning and rehabilitation management plan a minimum of 10 years prior to closure. 	Reduction of the vegetation clearing footprint during the design stage to the minimum practicable.	Cumulative extents cleared using GPS tracking systems. Responsibility: site superintendent. Frequency/Timing: ongoing during construction phase.	Vegetation clearing records and annual environmental reporting.
	Temporary clearing of native vegetation during construction for short-term use as laydown areas and for the burial of transmission cables in the coastal portion of the development envelope	No more than 612.4 ha of native vegetation to be temporarily cleared.	<ol style="list-style-type: none"> 6. Use of scrub rolling or slashing to retain rootstock wherever possible in temporary laydown areas 7. Immediate rehabilitation of temporary disturbance areas. 8. Implementation of direct return topsoil management protocols. 9. Monitoring of rehabilitation success post completion, with remedial action if revegetation does not meet completion targets. 	Allow the natural return of temporarily cleared areas to pre-impact vegetation composition as far as practicable as rapidly as practicable.	Rehabilitation success and weed monitoring. Responsibility: environmental representative. Frequency/Timing: immediately post-construction. Ongoing timing dependent on vegetation structure and composition. May include annual monitoring for weeds and response, and biennial monitoring once stability is reached. Requirement reassessed after every monitoring phase.	Vegetation rehabilitation monitoring annual reporting.
	Risk of weed introduction and spread during earthworks and construction activities.	Low risk of novel weed introduction with provision for monitoring and control contingency response.	<ol style="list-style-type: none"> 10. Comprehensive weed hygiene and topsoil management plan, including: <ol style="list-style-type: none"> a. Creation and use of formalised inspection and clean down points prior to plant and vehicles entering site. b. Inspection and sign-off protocols by project environmental staff prior to equipment accessing the site. c. preferentially sourcing materials from within the development envelope or from certified weed-free sources if externally sourced. d. Annual monitoring and control program to eliminate any weed recruits, following current DPIRD recommended control protocols. 	Minimise establishment of weeds throughout the development envelope.	Weed monitoring. Responsibility: environmental representative. Frequency/Timing: ongoing during construction and operation.	Weed hygiene management plan compliance.
	Risk of project-induced bushfires.	No significant risk of fire starting as a result of construction activities.	<ol style="list-style-type: none"> 11. Design and implementation of a fire management plan within the development envelope for the construction phase of the project, consistent with the project fire management strategy. 12. Implementation of controlled procedures for spark generating activities. 13. Implementation of a fire emergency response plan prepared to the satisfaction of the Shire of East Pilbara and FESA. 	Minimise the risk of unplanned project-induced fires.	Construction activity compliance with fire management plan and controlled procedures. Responsibility: construction contractors. Frequency/Timing: ongoing during construction phase.	Compliance with fire management plan and controlled procedures.
	Risk of off-road driving impacts on vegetation.	No significant impacts to vegetation outside of authorised extent of disturbance.	<ol style="list-style-type: none"> 14. Development and implementation of authorised access procedures. 	Minimise risk of impact to vegetation beyond authorised extents.	Compliance with access procedures. Responsibility: all contractors and personnel. Frequency/Timing: ongoing during construction and operation.	Procedure compliance records.

Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
	The long-term presence of the site access tracks, partitioning vegetation into blocks and thereby altering fire regimes within the development envelope (in terms of frequency, extent, intensity), leading to consequent changes in vegetation structure and floristic compositions.	Improve landscape scale habitat quality, heterogeneity and resilience compared to current unmanaged fire regime.	15. Design and implementation of landscape-scale fire management plan for the construction and operational life of the project, consistent with the project fire management strategy. 16. Design and implementation of a biodiversity monitoring program.	Active management of fire regime with the aim of enhancing biodiversity and protecting infrastructure.	Compliance with the fire management plan. Responsibility: environmental representative. Frequency/Timing: during construction and periodically during operation dependent on requirement for active management of fauna distribution and habitats. Requirement and effectiveness reassessed after implementation of mosaic burning.	Compliance with fire management plan.
Eighty Mile Land System PEC.	Potential direct clearing impacts on the Eighty Mile Land System PEC.	No more than 0.2 ha (0.01% of its regional extent) of the PEC to be temporarily cleared and no direct disturbance to the PEC that results in an irreversible impact, other than authorised disturbance.	17. Design project alignment to reduce extent of impact to PEC. 18. Trenching width kept to minimum possible. 19. Immediate rehabilitation after cable burial. 20. Develop and implement a decommissioning and rehabilitation management plan a minimum of 10 years prior to closure.	Project design minimises temporary clearing of PEC relative to other crossing points and temporarily cleared areas are returned to pre-impact vegetation composition as far as practicable.	Rehabilitation monitoring. Responsibility: environmental representative. Frequency/Timing: immediately post-construction. Ongoing timing dependent on vegetation structure and composition. May include annual monitoring for establishment and persistence of key species relative to the PEC. Requirement reassessed after every monitoring phase.	Vegetation rehabilitation monitoring report.
One species of threatened flora: <i>Seringia exastia</i> ²	Potential direct clearing of individual <i>Seringia exastia</i> plants. ²	No loss of individuals of <i>Seringia exastia</i> ²	21. Targeted searches and design refinement to avoid clearing any currently unknown populations. 22. Design project to avoid clearing of any known populations.	Avoid loss of <i>Seringia exastia</i> ² individuals or populations.	Threatened flora searches. Responsibility: environmental representative, detailed design engineers. Frequency/Timing: once prior to final project design and construction.	Targeted threatened flora report.
One Priority 1 flora species: <i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	Potential direct clearing of individual <i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114) plants.	No loss of individuals of <i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114).	23. Targeted searches and design refinement to avoid clearing any currently unknown populations. 24. Design project to avoid clearing of any known populations.	Avoid loss of <i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114) individuals or populations.	Threatened flora searches. Responsibility: environmental representative. Frequency/Timing: once prior to final project design and construction.	Targeted threatened flora report.
Seven species of Priority 3 flora recorded (<i>Bonamia oblongifolia</i> , <i>Croton aridus</i> , <i>Indigofera ammobia</i> , <i>Polymeria</i> ?sp. Broome (K.F. Kenneally 9759), <i>Seringia katatona</i> , <i>Terminalia kumpaja</i> and <i>Tribulopsis marliesiae</i>) and two species of Priority 3 flora likely to occur (<i>Goodenia hartiana</i> and <i>Corynotheca asperata</i>). ³	Potential direct clearing impacts on populations of Priority listed species.	No changes to conservation status of any Priority flora species	25. Undertake targeted surveys for flora of conservation significance once final design completed. 26. Modify conceptual design to avoid any Priority flora populations where practicable.	Minimise impact to Priority flora species where practicable.	Threatened flora searches. Responsibility: environmental representative. Frequency/Timing: once prior to final project design and construction.	Targeted threatened flora report.
	Potential direct clearing impacts on populations of Priority listed species.	No changes to conservation status of any Priority flora species	27. Implementation of rehabilitation protocols where disturbance to Priority flora cannot be avoided, including erosion control and dune stabilisation, where required. 28. Develop and implement a decommissioning and rehabilitation management plan a minimum of 10 years prior to closure, including specific measures relevant to any Priority flora species impacted during ground disturbance.	Allow natural return of cleared areas to pre-impact vegetation composition as far as practicable, including re-establishment or expansion of any affected Priority Flora species.	Rehabilitation and weed monitoring. Responsibility: environmental representative. Frequency/Timing: post-construction or decommissioning. Ongoing timing dependent on vegetation structure and composition. May include annual monitoring for detection of weeds and response, and biennial monitoring once ecological stability is reached. Requirement reassessed after every monitoring phase.	Vegetation rehabilitation monitoring report.

² Noting that taxonomic advice indicates that *S. exastia* will no longer be considered a Threatened species by the time of EMP implementation, so this action may no longer be required.

³ Specific management actions will no longer apply if taxa are in future removed from Priority flora species lists.

Table 3.5: EMP management-based provisions for Terrestrial Fauna.

Key Environmental Factor: Terrestrial Fauna						
EPA Objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Targets	Monitoring	Reporting
Vertebrate and invertebrate fauna, including Threatened and Priority listed fauna, and potential SRE species	Permanent clearing of fauna habitats within the development envelope to accommodate the proposal infrastructure.	No more than 11,962 ha (1.81% of development envelope extent) of fauna habitat cleared and no more than 2% of current extents of individual habitat types cleared.	<ol style="list-style-type: none"> 1. Design project footprint to reduce extent of habitat cleared, including utilising existing tracks and co-locating infrastructure, where feasible. 2. Erosion control, revegetation and dune stabilisation in locations where civil works intersect dune habitat. 3. Rehabilitation of all clearing upon decommissioning of the project. 4. Develop and implement a decommissioning and rehabilitation management plan a minimum of 10 years prior to closure. 	Reduction of the habitat clearing footprint during the design stage to the minimum practicable.	Cumulative extents cleared tracked via GPS technology. Responsibility: environmental representative. Frequency/Timing: ongoing during construction phase.	Vegetation clearing permit and compliance.
	Temporary clearing of fauna habitat during construction for short-term use as laydown areas and for the burial of transmission cables in the coastal portion of the development envelope.	No more than 612.4 ha of fauna habitat to be temporarily cleared.	<ol style="list-style-type: none"> 5. Immediate rehabilitation of temporary construction areas. 	Allow natural return of temporarily cleared areas to pre-impact fauna habitat as far as practicable.	Rehabilitation monitoring. Responsibility: environmental representative. Frequency/Timing: immediately post-construction. Ongoing timing dependent on vegetation structure and composition. Requirement reassessed after every monitoring phase.	Vegetation rehabilitation monitoring report.
	Risk of weed introduction and spread during earthworks and construction activities, modifying fauna habitats with potential flow-on effects to fauna community structure.	Low risk of novel weed introduction with provision for monitoring and control contingency response.	<ol style="list-style-type: none"> 6. Comprehensive weed hygiene and topsoil management plan, including creation of formalised clean down points prior to plant and vehicles entering site. 7. Monitoring and control program to eliminate any weed recruits. 	Minimise establishment of weeds throughout the development envelope.	Weed presence. Responsibility: environmental representative. Frequency/Timing: ongoing during construction and operation.	Weed hygiene management plan compliance.
	Potential for migratory shorebirds, other avifauna or bat impacts through interaction with wind turbines.	No significant impacts on fauna from interactions with wind turbines and associated infrastructure.	<ol style="list-style-type: none"> 8. Best practice wind farm design; turbines to be separated by approximately 800 m and rows of turbines to be spaced in excess of 4 km. 9. Implementation of bird radar and real-time high definition video avifauna monitoring during operations, with protocols to shut down operation of individual turbines in advance if significant flocks of birds are detected. 10. Design and implementation of an avifauna impacts monitoring programme. 	Minimise risk of fauna interactions with wind turbines.	Bird radar and avifauna monitoring data. Responsibility: environmental representative. Frequency/Timing: ongoing throughout operation. Avifauna impacts monitoring programme reviewed, revised and updated where required.	Avifauna impacts monitoring programme compliance.
	Risk of project-induced bushfires.	No significant risk of fire occurrence as a result of construction activities.	<ol style="list-style-type: none"> 11. Design and implementation of a fire management plan within the development envelope for the construction phase of the project. 	Minimise the risk of unplanned project-induced fires.	Construction activity compliance with fire management plan. Responsibility: construction contractors. Frequency/Timing: ongoing during construction phase.	Compliance with fire management plan.
	Risk of off-road driving impacts on vegetation.	No significant impacts to vegetation outside of authorised extent of disturbance.	<ol style="list-style-type: none"> 12. Development and implementation of authorised access procedures. 	Minimise risk of impact to fauna habitats beyond authorised extents.	Compliance with authorised access procedures. Responsibility: all contractors and personnel. Frequency/Timing: ongoing during construction and operation.	Compliance with procedures.

Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Targets	Monitoring	Reporting
Vertebrate and invertebrate fauna, including Threatened and Priority listed fauna, and potential SRE species (continued)	Potential for increased feral fauna movement through the landscape.	No significant risk of increased feral fauna impacts on native fauna, particularly threatened species.	13. Implementation of targeted feral fauna monitoring and control in areas of higher risk, such as around accommodation. Measures will include: <ul style="list-style-type: none"> a. appropriate waste management, particularly of food; b. prohibiting feeding of fauna or disposal of food outside of allocated waste disposal points. c. targeted pest species control. 14. Implementation of feral fauna monitoring and control in areas of higher risk, such as around accommodation. Measures will include	Reduce exacerbating feral fauna presence within the development envelope.	Waste management procedure compliance. Responsibility: all contractors and personnel. Frequency/Timing: weekly and ongoing throughout construction and operation.	Annual compliance report
d	The long-term presence of access tracks altering fire regimes within the development envelope (in terms of frequency, extent, intensity) and consequent changes to habitats, and local abundance and distribution of species responsive to fire ecology	Improve landscape scale habitat quality, heterogeneity and resilience compared to current unmanaged fire regime.	15. Design and implementation of landscape-scale fire management plan for the operational life of the project, in consultation with DBCA and other stakeholders 16. Design and implementation of biodiversity monitoring programme to measure the effectiveness of the fire management plan and provide feedback.	Active management of fire regime with the aim of enhancing biodiversity and protecting infrastructure protection.	Compliance with the fire management plan. Responsibility: environmental representative. Frequency/Timing: during construction and periodically during operation dependent on requirement for active management of fauna distribution and habitats. Requirement and effectiveness reassessed after active implementation of mosaic burning.	Compliance with fire management plan.
d	Two of the three potential SREs are located outside of the proposed clearing footprint, however the footprint includes a distribution line intersecting the location of the third potential SRE species (<i>Aname</i> sp. N138).	Avoid the current known location of the potential SRE species <i>Aname</i> sp. N138.	17. Relocate distribution pylon and associated access track to avoid the location of the species.	Avoid potential direct impact to the species currently known only from a single location.	Compliance with final project design during construction. Responsibility: proponent. Frequency/Timing: once during construction.	Confirmation of construction records.
d	Direct clearing of habitat critical to the survival of the species (rock pile habitat), foraging habitat surrounding rock pile core habitat and movement corridors between rock piles.	No significant population decline of Black-footed Rock-wallaby attributable to the project.	18. Application of a minimum 1 km no development buffer around confirmed and potential core habitat. 19. Conceptual design modification to avoid clearing of core habitat, foraging habitat and movement corridors. 20. Targeted searches and further design refinement to avoid clearing of any other currently unknown populations.	Avoid and mitigate potential direct loss of Black-footed Rock-wallaby habitat.	Targeted searches for additional populations. Responsibility: environmental representative. Frequency/Timing: once prior to final project design and construction works.	Additional targeted Black-footed Rock-wallaby survey report.
d	Road kill impacts and loss of individuals from increased vehicle and plant movements during construction and operations.	Negligible risk of road kill impact on Black-footed Rock-wallaby.	21. Conceptual realignment of the existing Nyangumarta Highway, currently running between core habitat areas. 22. Speed limits and environmental awareness inductions for all site personnel.	Minimise and avoid road kill impact on Black-footed Rock-wallaby populations.	In Vehicle Monitoring System (IVMS) or speed camera use. Responsibility: proponent, all contractors and personnel. Frequency/Timing: daily ongoing throughout construction and operation.	Driver compliance report and fauna incident report.
d	Changes to fire regimes that reduce landscape heterogeneity and increase risk of extensive or very hot fires.	No significant population decline of Black-footed Rock-wallaby attributable to changed fire regimes.	23. Design and implementation of landscape-scale fire management plan for the operational life of the project, in consultation with DBCA and other stakeholders 24. Design and implementation of biodiversity monitoring programme to measure the effectiveness of the fire management plan and provide feedback.	Provide continuous feedback to fire management for long-term maintenance of Black-footed Rock-wallaby populations.	Monitor response (e.g. behaviour, persistence) of Black-footed Rock-wallaby post fire. Responsibility: site environmental representative with potential for Aboriginal community involvement. Frequency/Timing: in consultation with prescribed fire management practices. Adaptively review and reassess	Biodiversity monitoring programme.

Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Targets	Monitoring	Reporting
					management.	
	Increased risk of feral fauna spread, particularly foxes; a known predator of the species.	No significant population decline of Black-footed Rock-wallaby attributable to increased feral fauna predation.	25. Implementation of a targeted fox monitoring and control programme in consultation with DBCA.	Minimise and avoid feral predation impact on Black-footed Rock-wallaby populations.	Annual survey for fox presence within core habitat areas. Baiting in consultation with the DBCA if fox populations establish. Responsibility: feral animal control specialists. Frequency/Timing: Once annually or as required depending on outcome of surveying.	Annual compliance report (or as required).
Bilby	Permanent clearing of fauna habitats within the development envelope to accommodate the proposal infrastructure.	No significant reduction in potential Bilby habitat,	26. Final design of project footprint to reduce extent of habitat cleared, including utilising existing tracks and co-locating infrastructure, where feasible.	Minimise clearing of potential Bilby habitat, with over half a million hectares remaining within the development envelope.	Cumulative extents cleared tracked via GPS technology. Responsibility: environmental representative. Frequency/Timing: ongoing during construction phase.	Vegetation clearing permit and compliance.
	Changes to fire regimes that reduce landscape heterogeneity and increase risk of extensive or very hot fires.	No significant population decline of Bilby attributable to changed fire regimes.	27. Design and implementation of landscape-scale fire management plan for the operational life of the project, in consultation with DBCA and other stakeholders 28. Design and implementation of biodiversity monitoring programme to measure the effectiveness of the fire management plan and provide feedback.	Improvement of landscape heterogeneity and resilience through re-establishment of a mosaic of fire age habitat units to benefit the Bilby	Monitor response (e.g. behaviour, persistence) of Bilby post fire. Responsibility: site environmental representative with potential for Aboriginal community involvement. Frequency/Timing: in consultation with prescribed fire management practices. Adaptively review and reassess management.	Biodiversity monitoring programme.
	Potential direct loss of individual Bilby during construction.	No significant mortality of individual Bilby attributable to construction activities.	29. Implementation of prescribed burning to manage Bilby ahead of construction via behavioural ecology, in consultation with DBCA. 30. Pre-clearing targeted survey and contingency management to confirm effectiveness, in consultation with DBCA.	Minimise potential for direct loss of individual Bilby.	Targeted pre-clearance survey. Responsibility: site environmental representative with potential for Aboriginal community involvement. Frequency/Timing: immediately prior to construction activities.	Pre-clearance targeted Bilby survey report.
	Increased risk of feral fauna spread, particularly foxes.	No significant population decline of Bilby attributable to increased feral fauna predation.	31. Implementation of a targeted feral fauna monitoring and control programme, in consultation with DBCA.	Minimise and avoid feral predation impact on Bilby populations.	Annual survey for fox presence within suitable habitat areas. Baiting in consultation with the DBCA if fox populations establish. Responsibility: feral animal control specialists. Frequency/Timing: Once annually or as required depending on outcome of surveying.	Annual compliance report (or as required).
Oriental Pratincole	Potential for collisions with wind turbines.	No significant impacts on the Oriental Pratincole from collisions with wind turbines.	32. Best practice wind farm design; turbines to be separated by approximately 800 m and rows of turbines to be spaced in excess of 4 km. 33. Implementation of bird radar and real-time high definition video avifauna monitoring during operations, with protocols to shut down operation of individual turbines in advance if flocks of birds are detected on approach. 34. Design and implementation of an avifauna impacts monitoring programme.	Minimise risk of collisions with wind turbines for the Oriental Pratincole.	Bird radar and avifauna monitoring data. Responsibility: environmental representative. Frequency/Timing: ongoing throughout operation. Avifauna impacts monitoring programme reviewed, revised and updated where required.	Avifauna impacts monitoring programme compliance.

Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Targets	Monitoring	Reporting
Migratory shorebirds and waterbirds (including Oriental Pratincole)	Potential for migratory shorebirds or waterbird impacts through interaction with distribution and transmission pylons and cables.	Negligible residual risk of significant impacts on flyway populations of any migratory shorebird species	35. Pylons and overhead power lines built between 30-50 m in height. 36. Undergrounding transmission line from the Great Northern Highway to coast (approximately 14 km). 37. All overhead power lines to be designed with bird shielding and line visibility devices consistent with industry standard spacing.	Minimise risk of collisions and electrocution for migratory shorebirds and waterbirds (in addition to other avifauna species).	Bird radar and avifauna monitoring data. Responsibility: environmental representative. Frequency/Timing: ongoing throughout operation. Avifauna impacts monitoring programme reviewed, revised and updated where required.	Avifauna impacts monitoring programme compliance.
	Trenching through beach and intertidal dune habitat.	No significant impact on migratory shorebird habitat at Eighty Mile Beach	38. Cable installation works through the coastal zone scheduled to avoid seasons of peak activity at Eighty Mile Beach.	Minimise potential disturbance to foraging and breeding of migratory shorebirds and waterbirds.	Timing of trenching activities. Responsibility: environmental representative. Frequency/Timing: once during non-breeding season.	Procedure compliance.
	Potential disturbance to foraging and breeding behaviours during construction.	No risk of construction disturbance on migratory shorebirds.	39. Maintain siting of the development envelope to provide distance of 26 km between coastal portion of the Ramsar site, and 16 km from the Mandora Salt Marsh and the nearest wind turbine.	Avoid potential disturbance to migratory shorebirds.	Compliance with final project design during construction. Responsibility: construction contractors. Frequency/Timing: once in construction.	Confirmation of construction records.

Table 3.6: EMP management-based provisions for Social Surroundings.

Key Environmental Factor: Social Surroundings						
EPA Objective: To protect social surroundings from significant harm.						
Key Environmental Values	Key Impacts and Risks	Outcome	Management Actions	Management Target	Monitoring	Reporting
Visual sensitive receivers within 30 km of the development envelope	Temporary busy movement of vehicles during construction and change to existing viewsheds from key locations during operation.	No significant change to the visual character of the landscape from nearest sensitive receiver locations.	1. Development envelope to be kept more than 15 km from nearest sensitive receivers 2. Wind turbines industry best practice to reduce visual impact	Minimise visual obstruction to sensitive receiver locations.	Compliance with final project design during construction. Responsibility: proponent. Frequency/Timing: once during construction.	Confirmation of construction records.
	Altered state of landscape upon decommissioning of the project.	No significant change to the visual character of the landscape from visual sensitive receiver locations.	3. Develop and implement a decommissioning and rehabilitation management plan a minimum of 10 years prior to closure.	Minimise visual disturbance to landscape.	Compliance with decommissioning and rehabilitation management plan. Responsibility: proponent. Frequency/Timing: once during decommissioning.	Vegetation rehabilitation report.
Noise sensitive receivers within 30 km of the development envelope	Noise associated with construction, major maintenance and decommissioning.	No significant contribution to noise levels at nearest sensitive receiver locations.	4. Development envelope to be kept more than 15 km from nearest sensitive receivers	No impact of project related noise on sensitive receiver locations.	Compliance with final project design during construction. Responsibility: proponent. Frequency/Timing: once during construction.	Confirmation of construction records.
	Wind turbine operational noise.	No significant contribution to noise levels at nearest sensitive receiver locations.	5. Development envelope to be kept more than 15 km from nearest sensitive receivers	No impact of project related noise on sensitive receiver locations.	Compliance with final project design during construction. Responsibility: proponent. Frequency/Timing: once during construction.	Confirmation of construction records.
Rock art and areas of cultural importance around watering holes.	Risk of disturbance or destruction of known or unknown Aboriginal sites or objects during construction and operation activities.	No impact on sites of cultural heritage significance.	6. Conceptual design footprint avoids all known sites of significance. 7. Pre-clearance surveys with further design refinement to avoid impacts on any currently unknown sites.	Minimise risk of disturbance to cultural heritage sites.	Pre-clearance survey for additional heritage sites. Responsibility: heritage representative. Frequency/Timing: once prior to construction activities.	Additional heritage survey report.

4.0 References

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Appendix 1: Marine Fauna Species

Marine Fauna Species

Species	Conservation Status
Marine Mammals	
Blue whale (<i>Balaenoptera musculus</i>)	Endangered/Migratory
Humpback whale (<i>Megaptera novaeangliae</i>)	Vulnerable/Migratory
Bryde's whale (<i>Balaenoptera edeni</i>)	Migratory
Dugong (<i>Dugong dugon</i>)	Migratory
Killer whale (<i>Orcinus orca</i>)	Migratory
Spotted bottlenose dolphin (<i>Tursiops aduncus</i>)	Migratory
Common dolphin (<i>Delphinus delphis</i>)	Listed
Risso's dolphin (<i>Delphinus delphis</i>)	Listed
Indian ocean bottlenose dolphin (<i>Tursiops aduncus</i>)	Listed
Bottlenose dolphin (<i>Tursiops truncatus</i>)	Listed
Indo-pacific humpback dolphin (<i>Sousa chinensis</i>)	Migratory
Marine Reptiles	
Loggerhead turtle (<i>Caretta caretta</i>)	Endangered/Migratory
Green turtle (<i>Chelonia mydas</i>)	Vulnerable/Migratory
Leatherback turtle (<i>Dermochelys coriacea</i>)	Endangered/Migratory
Hawksbill turtle (<i>Eretmochelys imbricata</i>)	Vulnerable/Migratory
Flatback turtle (<i>Natator depressus</i>)	Vulnerable/Migratory
Short-nosed seasnake (<i>Aipysurus apraefrontalis</i>)	Critically Endangered
Elasmobranch Fish	
White shark (<i>Carcharodon carcharias</i>)	Vulnerable/Migratory
Dwarf sawfish (<i>Pristis clavata</i>)	Vulnerable/Migratory
Large-tooth sawfish (<i>Pristis pristis</i>)	Vulnerable/Migratory
Green sawfish (<i>Pristis zijsron</i>)	Vulnerable/Migratory
Whale shark (<i>Rhincodon typus</i>)	Vulnerable/Migratory
Narrow sawfish (<i>Anoxypristis cuspidata</i>)	Migratory
Reef manta ray (<i>Manta alfredi</i>)	Migratory
Giant manta ray (<i>Manta birostris</i>)	Migratory

Appendix 2: Vegetation Types of the Development Envelope

Vegetation Types

Broad Landform	Type	Description
Drainage areas	D1	<i>Melaleuca glomerata</i> , <i>M. lasiandra</i> , <i>M. alsophila</i> , <i>Acacia ampliceps</i> tall shrubland over <i>Trianthema turgidifolium</i> , <i>Solanum esuriale</i> low open shrubland
	D2	<i>Grevillea refracta</i> , <i>G. wickhamii</i> , <i>Acacia coleii</i> var. <i>coleii</i> , <i>A. monticola</i> tall shrubland to tall open scrub over <i>A. adoxa</i> var. <i>adoxae</i> , (<i>Indigofera monophylla</i>) low shrubland over <i>Triodia epactia</i> open hummock grassland with <i>Eulalia aurea</i> , (<i>Sorghum plumosum</i> var. <i>plumosum</i>) open tussock grassland
		<i>Acacia tumida</i> var. <i>kulparn</i> , (<i>Grevillea refracta</i>) tall shrubland to tall open scrub over <i>Indigofera monophylla</i> low open shrubland over <i>Triodia epactia</i> very open hummock grassland
Sand dunes	S1	<i>Triodia epactia</i> , <i>Spinifex longifolius</i> open hummock grassland with <i>Whiteochloa airoides</i> open tussock grassland
	S2	<i>Grevillea stenobotrya</i> , <i>G. wickhamii</i> , <i>Acacia anaticeps</i> tall open shrubland over <i>A. tumida</i> var. <i>kulparn</i> , <i>Cyanostegia cyanocalyx</i> , <i>Sida</i> sp. Western sand dunes (P.K. Latz 11980) open shrubland over <i>Dicrastylis doranii</i> , (<i>Dampiera cinerea</i> , <i>A. stellaticeps</i> , <i>Gompholobium simplicifolium</i> , <i>Newcastelia cladotricha</i>) low open shrubland over <i>Triodia schinzii</i> very open hummock grassland and <i>Eriachne obtusa</i> , <i>Aristida holathera</i> var. <i>holathera</i> very open tussock grassland
		<i>Grevillea wickhamii</i> tall open shrubland over <i>Acacia tumida</i> var. <i>kulparn</i> , <i>Cyanostegia cyanocalyx</i> open shrubland over <i>Gompholobium simplicifolium</i> , <i>Jacksonia aculeata</i> , (<i>Dicrastylis doranii</i> , <i>Dampiera cinerea</i>) low open shrubland over <i>Triodia schinzii</i> very open hummock grassland
Plains	P1	<i>Sida fibulifera</i> scattered shrubs over <i>*Cenchrus ciliaris</i> , <i>*C. setiger</i> tussock grassland
	P2	<i>Acacia coleii</i> var. <i>coleii</i> , <i>A. sericophylla</i> , tall open shrubland over <i>Corchorus incanus</i> subsp. <i>incanus</i> low open shrubland over <i>Triodia epactia</i> open hummock grassland
	P3	<i>Owenia reticulata</i> , <i>Erythrophleum chlorostachys</i> scattered low trees over <i>Acacia eriopoda</i> , <i>A. sericophylla</i> scattered tall shrubs over <i>Acacia stellaticeps</i> , <i>Androcalva loxophylla</i> low open shrubland over <i>Triodia schinzii</i> , (<i>T. epactia</i>) open hummock grassland
		<i>Erythrophleum chlorostachys</i> scattered low trees over <i>Acacia ancistrocarpa</i> , <i>A. monticola</i> tall open shrubland over <i>Triodia schinzii</i> , (<i>T. epactia</i>) open hummock grassland
		<i>Corymbia zygomphala</i> , <i>Erythrophleum chlorostachys</i> scattered low trees over <i>Grevillea eriostachya</i> , <i>G. wickhamii</i> scattered tall shrubs over <i>Gompholobium simplicifolium</i> , <i>Jacksonia aculeata</i> , (<i>Dicrastylis doranii</i> , <i>Dampiera cinerea</i> , <i>Acacia stellaticeps</i>) low open shrubland over <i>Triodia schinzii</i> very open hummock grassland
		<i>Erythrophleum chlorostachys</i> scattered low trees over <i>Grevillea refracta</i> scattered tall shrubs over <i>Acacia ancistrocarpa</i> , <i>A. monticola</i> , <i>A. tumida</i> var. <i>kulparn</i> open shrubland over <i>Triodia epactia</i> open hummock grassland
<i>Grevillea refracta</i> , <i>Acacia monticola</i> , <i>A. coleii</i> var. <i>coleii</i> tall open shrubland over <i>Acacia hilliana</i> , <i>A. adoxa</i> var. <i>adoxae</i> scattered low shrubs over <i>Triodia epactia</i> open hummock grassland		
Low stony rises	H1	<i>Acacia hilliana</i> , (<i>A. adoxa</i> var. <i>adoxae</i>) low open shrubland over <i>Triodia epactia</i> open hummock grassland
Rocky outcrops and breakaways	R1	<i>Ficus brachypoda</i> low open woodland over <i>Acacia monticola</i> , <i>A. coleii</i> var. <i>coleii</i> , <i>Grevillea pyramidalis</i> tall open shrubland over <i>Triodia epactia</i> open hummock grassland