



# Asian Renewable Energy Hub





**Biota**  
Environmental  
Sciences



THE   
ASIAN RENEWABLE  
ENERGY HUB

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# Asian Renewable Energy Hub Section 38 Referral

## Contents

<b>1.0</b>	<b>Introduction</b>	<b>7</b>
1.1	Proposal	7
1.2	Purpose of this Document	7
1.3	Proponent Details	7
<b>2.0</b>	<b>Land Use and Tenure</b>	<b>9</b>
2.1	Land Use	9
2.2	Tenure	9
2.3	Native Title	9
<b>3.0</b>	<b>Proposal Description</b>	<b>11</b>
3.1	Overview	11
3.2	Proposal Description	13
<b>4.0</b>	<b>Environmental Investigations</b>	<b>17</b>
4.1	Flora and Vegetation Survey	17
4.2	Terrestrial Fauna Survey	18
4.3	Migratory Shorebird Survey	20
4.4	Benthic Communities and Habitat Survey	21
4.5	Social Surroundings Investigations	23
<b>5.0</b>	<b>Assessment of Preliminary Key Environmental Factors</b>	<b>25</b>
5.1	Flora and Vegetation	25
5.2	Terrestrial Fauna	27
5.3	Benthic Communities and Habitat	30
5.4	Social Surroundings	31
<b>6.0</b>	<b>Conclusions</b>	<b>35</b>
6.1	Other Environmental Factors	35
6.2	Environmental Benefits of the Proposal	35
<b>7.0</b>	<b>References</b>	<b>37</b>
<b>Tables</b>		
	Table 3.1: Summary of the proposal.	11
	Table 3.2: Preliminary key characteristics of the proposal.	13
	Table 4.1: Key stakeholders consulted to date in the development of the proposal.	23
	Table 5.1: Potential environmental impacts of the proposal on flora and vegetation (after Part B of EPA 2016g).	25
	Table 5.2: Potential environmental impacts of the proposal on terrestrial fauna (after Part B of EPA 2016g).	27

Table 5.3: Potential environmental impacts of the proposal on benthic communities and habitat (after Part B of EPA 2016g).	30
Table 5.4: Potential environmental impacts of the proposal on social surroundings (after Part B of EPA 2016g).	32
<b>Figures</b>	
Figure 1.1: Location map for the proposal.	8
Figure 2.1: Land use and tenure.	10
Figure 3.1: Project development envelope, footprint and conceptual design.	12

# 1.0 Introduction

## 1.1 Proposal

NW Interconnected Power Pty Ltd ('the proponent') is seeking to develop the Asian Renewable Energy Hub ('the proposal'). The proposal is to construct and operate a large-scale wind and solar hybrid renewable energy project at a site approximately 220 km east of Port Hedland and 270 km southwest of Broome, in the northwest of Western Australia (Figure 1.1).

The proposal would be implemented within a development envelope approximately 6,446 km<sup>2</sup> in size (Figure 1.1).

## 1.2 Purpose of this Document

This document has been prepared to support referral of the proposal under section 38 of the *Environmental Protection Act 1986* (EP Act). It provides information on the proposal characteristics, existing environment, potential environmental impacts and proposed environmental management commitments.

This document has been prepared in accordance with Part IV Division 1 of the EP Act and the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016*.

## 1.3 Proponent Details

The proposal is being developed by NW Interconnected Power Pty Ltd, a dedicated renewable energy project company owned by:

- CWP Energy Asia (45% share): CWP Energy Asia was set up by CWP Renewables, a well-established Australian renewable energy development company;
- InterContinental Energy (45% share): InterContinental Energy is a global developer of large scale intercontinental renewable energy projects and is developing several projects similar to this proposal around the world; and
- Vestas (10%): Vestas is a Danish listed wind energy company and the world's largest manufacturer of wind turbines. Vestas is also the largest supplier of wind turbines in Australia.

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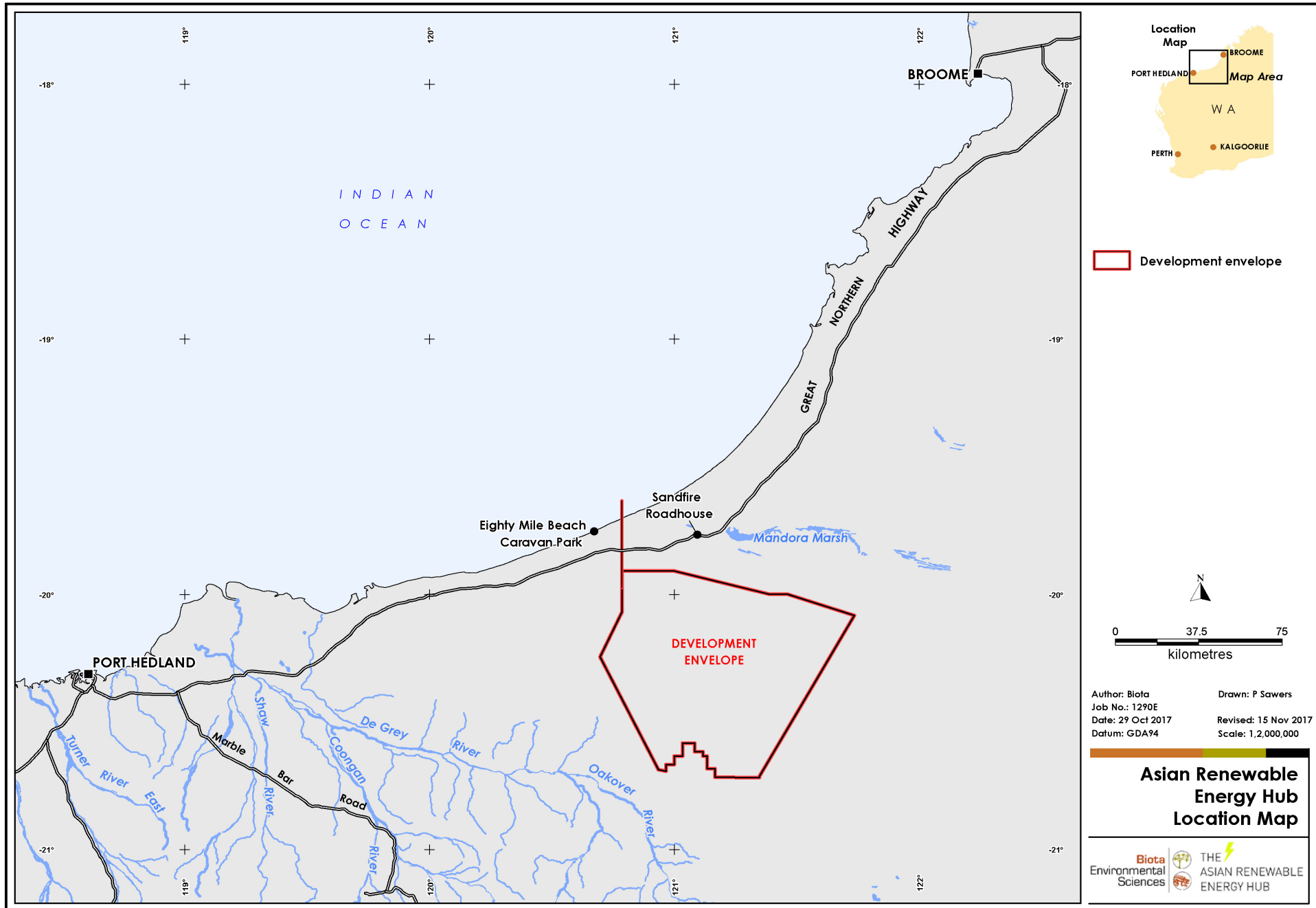


Figure 1.1: Location map for the proposal.



## 2.0 Land Use and Tenure

### 2.1 Land Use

The majority of the proposal is located in the Shire of East Pilbara, with the cable export route passing through the Shire of Broome (Figure 2.1). The development envelope that will accommodate the proposal is entirely Unallocated Crown Land, except for the cable export route, which may traverse one or two existing pastoral leases, subject to final route selection.

The development envelope for the proposed site intersects three oil and gas exploration permit applications (STP-EPA-0106, STP-EPA-0107 and STP-EPA-0131), but there are currently no mining, pastoral, or other relevant land uses within the development envelope (Figure 2.1).

The offshore section of the cable route passes through State Waters vested as the Eighty Mile Beach Marine Park (Figure 2.1; Section 4.4). The closest conservation estate to the development envelope is the recently vested Walyarta Conservation Park, situated to the immediate north (R52387; Figure 2.1). Both are managed by the Department of Biodiversity Conservation and Attractions (DBCA).

### 2.2 Tenure

The proponent has been granted a Section 91 Licence under the *Land Administration Act 1997*, covering an extent of approximately 14,000 km<sup>2</sup>, which gives it exclusive rights to develop a renewable energy project on the proposed site (FNA 12768 on Figure 2.1).

Following a detailed two-year development program, the proponent is currently finalising an Option to Lease for a reduced site area of approximately 6,446 km<sup>2</sup>, focusing in on the best available land within the Licence area from a renewable energy resource perspective. The proposed Option to Lease area represents the development envelope for the proposal for the purposes of the EP Act (Figure 2.1).

### 2.3 Native Title

The proposal lies within the Nyangumarta Native Title Claim (WCD2009/001). The proponent engaged with the Nyangumarta early in the development process and is presently negotiating an Indigenous Land Use Agreement to more formally govern ongoing obligations such as land access, tenure acquisition, heritage surveys, environmental management, consultation and ongoing communication between the parties.

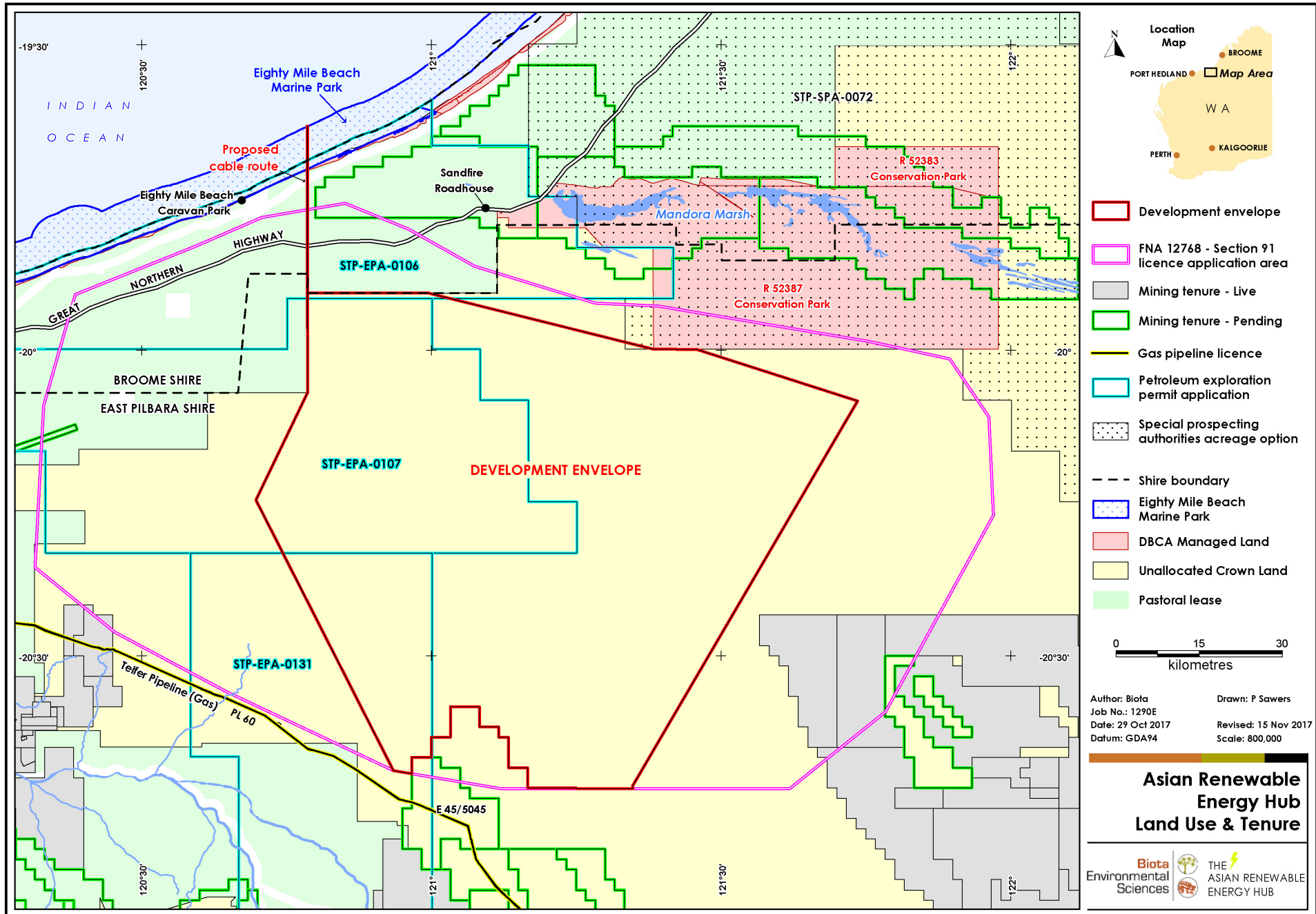


Figure 2.1: Land use and tenure.

## 3.0 Proposal Description

### 3.1 Overview

Onshore wind and solar energy are fast becoming the most cost-effective sources of additional electricity capacity in countries with abundant renewable energy resources. At the same time, High Voltage Direct Current (HVDC) transmission technology is reaching maturity, allowing efficient transmission of electricity over very long distances. The combination of these technological advancements has unlocked the possibility of developing large-scale intercontinental renewable energy hubs.

The Asian Renewable Energy Hub is an exciting clean energy project. Located in the East Pilbara, the Project will harness Western Australia's abundant wind and solar resources and export the renewable energy via a subsea power cable to Indonesia and Singapore.

A summary of the proposal is provided in Table 3.1.

**Table 3.1: Summary of the proposal.**

<b>Proposal Title</b>	Asian Renewable Energy Hub
<b>Proponent</b>	NW Interconnected Power Pty Ltd
<b>Short Description</b>	<p>The Asian Renewable Energy Hub is a proposal to construct a large-scale wind and solar renewable energy project, situated on the northeast boundary of the Shire of East Pilbara.</p> <p>The onshore components of the project will comprise a series of linear arrays of wind turbines and solar panels, with a transmission cable corridor to the coast. The offshore component of the proposal comprises two inert subsea power cables, with the marine component of the current proposal only extending to the limit of State Waters (Commonwealth Waters and international permitting will be the subject of a separate assessment).</p>

The development envelope for the proposal, and the current conceptual project design are shown in Figure 3.1, with a preliminary summary of proposal key characteristics provided in Table 3.2.

The proposal consists of the following components:

- **Wind Turbines** – Up to 1,200 wind turbines generating up to 5,000 MW, with each turbine being up to 300 m tall from the ground to the top rotation limit of the highest blade tip.
- **Photovoltaic (PV) Solar Panels** – 2,400 MW worth of solar PV capacity that will be divided into 24 x 100 MW modules, with each module placed adjacent to a step-up substation. The wind turbines and solar modules will share step-up transformers and other infrastructure to reduce the Proposal clearing footprint.
- **HVDC Converter Station** – An HVDC converter station will convert the AC current from the site into DC current, so that it can be exported.
- **Overhead/Underground Transmission Line** – Up to 50 m tall pylons will be spaced every 450 m to overhead the transmission line along the approximately 80 km export transmission route from the HVDC converter station to the coast. The two export cables will be under-grounded before reaching the coast and buried below the sand dunes and beach.

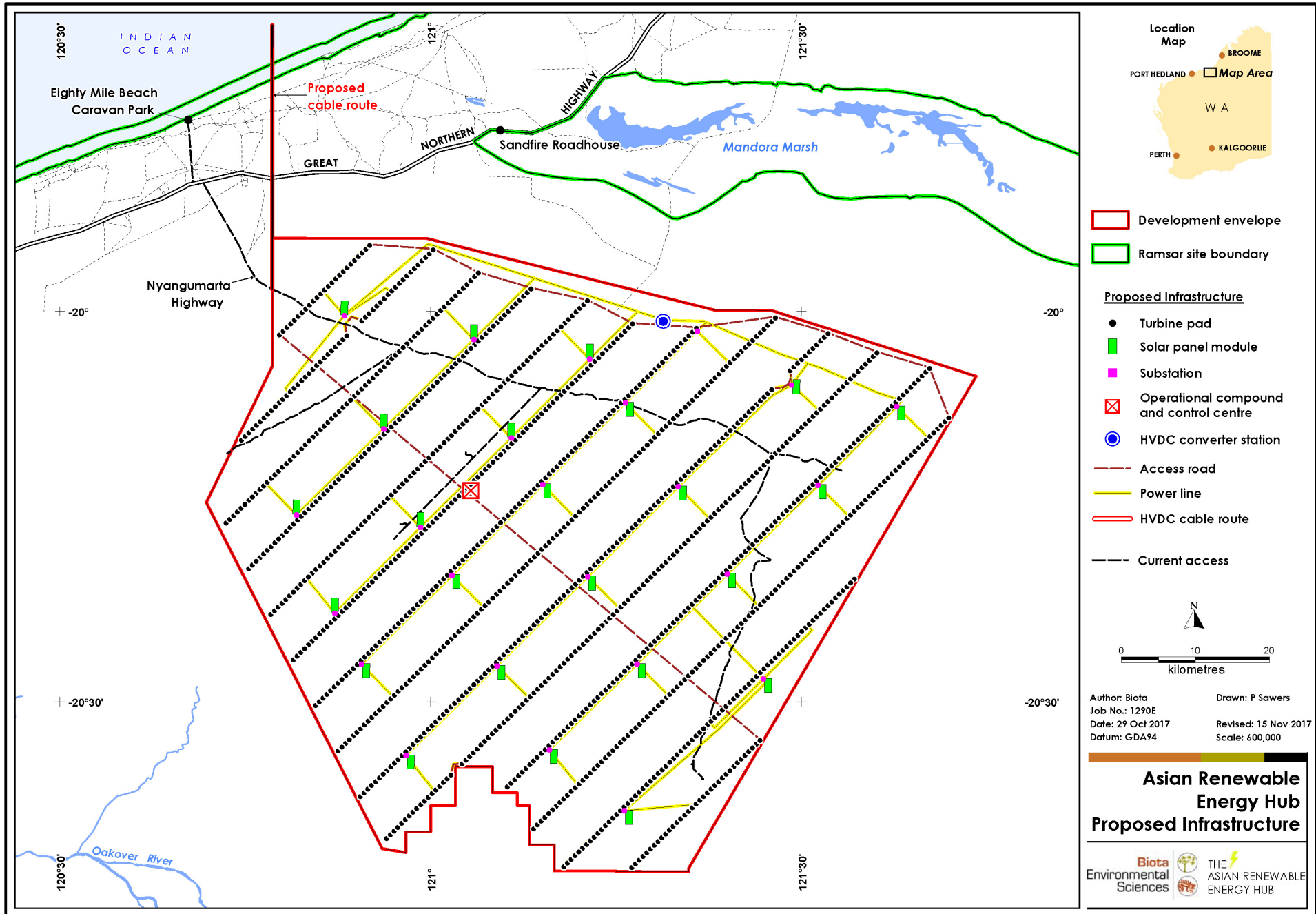


Figure 3.1: Project development envelope, footprint and conceptual design.

- **Offshore Transmission Lines** – The two HVDC transmission cables will be buried along the offshore cable route to the edge of State waters.
- **Site Tracks** – Up to 1,200 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 5-11 m wide will be completed in the centre to assist with operational fire management.
- **Onsite Electrical Infrastructure** – Up to 25 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 1 km<sup>2</sup> site compound and control centre will be established on the site to provide a base for the construction and operations personnel. This site compound will contain an administration building, workshop, fluid store, warehouse, storage compound, car parking facilities and accommodation for approximately 200 people.

**Table 3.2: Preliminary key characteristics of the proposal.**

Element	Location	Proposed Extent
<b>Physical Elements</b>		
Wind Turbines and associated electrical infrastructure	Figure 3.1	Clearing of no more than 440 ha
PV Solar Panels and associated electrical infrastructure	Figure 3.1	Clearing of no more than 4,800 ha
HVDC Converter Station	Figure 3.1	Clearing of no more than 18 ha
Overhead/Underground Transmission Line	Figure 3.1	Clearing of no more than 112 ha
Site Tracks	Figure 3.1	Clearing of no more than 1,800 ha
Substations	Figure 3.1	Clearing of no more than 100 ha
Compound and Control Centre	Figure 3.1	Clearing of no more than 100 ha
Offshore Subsea Transmission Cable	Figure 3.1	Short term disturbance to the sea floor of no more than 3 ha
<b>Operational Elements</b>		
Water Supply	To be determined	Abstraction of no more than 300m <sup>3</sup> /day of groundwater from yet to be defined borehole(s) within the development envelope

## 3.2 Proposal Description

### 3.2.1 Wind Turbines

The wind farm component of the proposal will comprise up to 1,200 turbines distributed across the development envelope (Figure 3.1). At each turbine location, an area up to 60 m by 60 m will be cleared during construction and prepared to provide suitable space for the foundations and a works area for assembly of the turbines. Some other small areas may be required for crane tables and hardstands for use during construction but the majority of these areas will be rehabilitated upon completion of construction.

The turbines will be installed in longitudinal rows, which will be spaced approximately 6 km apart, and aligned perpendicular to the predominant wind direction in order to maximise power output (Figure 3.1). Turbine pads themselves will be spaced approximately 750 m apart within the rows. Guyed towers will be used to stabilise the turbines, using inert concrete foundations.

### **3.2.2 PV Solar Panels**

The Solar PV will be deployed in 24 modules of 100 MW, with each module taking up approximately 200 ha of land immediately adjacent to the step-up transformers (Figure 3.1). The panels will be mounted on low impact steel frames and there will be between 50-100 inverters installed amongst the solar panels.

### **3.2.3 HVDC Converter and Onsite Electrical Infrastructure**

Overhead power lines will connect all wind turbines and solar panels arrays to the substations (Figure 3.1). The 25 substations themselves will be standard electrical substations that are commonly deployed around the State. These substations will then connect via overhead power line to the HVDC converter.

### **3.2.4 Transmission Cable**

An overhead HVDC transmission line with two cables will leave the site HVDC Converter following the coastal export route toward Eighty Mile Beach (Figure 3.1). The overhead line will require the establishment of a new access track, with a 50 m by 50 m area to be cleared for each pylon. The transmission cable route has been chosen to reduce potential impacts on the Eighty Mile Beach Caravan Park, users of Eighty Mile Beach, Wallal Downs Station and Mandora Station. Before reaching the coastal zone, the overhead cable will be under-grounded and buried in a trench. Once the cable reaches the tidal boundary, a hydro-plough or equivalent low impact installation technique will be used to bury the cable up to the edge of State Waters (approximately three nautical miles from the lowest astronomical tide).

### **3.2.5 Site Access Tracks**

A network of site access tracks will be established to connect the infrastructure and also act as firebreaks for infrastructure protection. Fifteen metre wide corridors will be cleared, within which compacted gravel pavements 5-11 m in width will be centrally finished.

The section of the existing Nyangumarta Highway that will be used for the proposal will be upgraded to a sealed road to improve safety, given the tourists expected to visit the project visitor centre. This will include road realignments and profile corrections where appropriate.

### **3.2.6 Onsite Compound and Control Centre**

The site compound will be utilised by operations personnel and support services for the lifetime of the proposal. As well as accommodating up to 200 people, the compound will store waste, fuel and fluids required for operation purposes. Diesel will be stored on-site for the fleet of maintenance vehicles, together with a small amount of aviation fuel for re-fuelling helicopters that may be required for specific works or emergency medi-vac. All fuel will be stored in bunded facilities in a manner that complies with relevant environmental and health and safety regulations.

Other chemicals, lubricants or fluids will be managed by the same systems that Vestas uses at its projects across Australia. All contractors must specify whether any substances brought on-site are classified as Hazardous Substances or Dangerous Goods as defined by the relevant Australian codes. If so, then defined work methodologies and storage and handling protocols will be implemented to manage such goods in a manner that is safe and environmentally responsible.

Up to 300 m<sup>3</sup>/day of groundwater will be abstracted to meet operational requirements. Water treatment for potable water supply will be designed for purpose, and is expected to be achieved via charcoal filtration.

During operations, septic tanks will be used for wastewater management and a septic tank clearance service contract entered into with a licensed contractor for maintenance and clearing. Other putrescible and recyclable waste streams will be managed, temporarily stored, and removed from site by a licensed contractor.

### **3.2.7 Construction and Temporary Works**

Due to the size of the site, up to six temporary construction compounds will be set up. These will be decommissioned and fully rehabilitated after construction is complete and will not result in any lasting environmental impacts. Each temporary compound will accommodate from 300-1,000 workers for 1-2 years. General temporary facilities required for each compound will include site parking, storage sheds and offices, accommodation, ablution facilities, crib rooms, fluid and fuel stores, and covered external areas and laydown areas. Groundwater abstraction combined with charcoal filtration will be used to supply potable water, together with septic tanks and licensed contractor putrescible waste management contracts to manage waste streams.

A temporary concrete batching plant facility will be required at each compound to facilitate the continuous pouring of concrete for the turbine and solar frame footings. Raw materials including cement, aggregate, fly ash will be trucked to the site, and stockpiled adjacent to the batching facilities.

Wind and solar infrastructure installation follows a fairly standardised method: First the civil work is completed, which includes creating the access tracks, hard stands and turbine concrete foundations. For the solar panels, frames are then installed and the PV panels are bolted on. For the wind power component of the proposal, the turbine tower, nacelle, and blades are trucked to site and then lifted into place by a large crane for assembly. At each turbine location approximately 0.36 ha of land will be temporarily cleared and surfaced to allow for the laydown of blades and towers prior to erection. Given the scale of the proposal there will be multiple installation crews working in parallel at any given time.

Construction works are currently anticipated to commence in 2023 and finish in 2027, subject to statutory approvals.

### **3.2.8 Proposal Operations and Maintenance**

Once operational, the proposal would be manned 24/7 by a dedicated team of technicians and maintenance personnel operating from a depot with a control centre, spare part stores and accommodation.

Scheduled servicing of the turbines will occur once or twice a year and a maintenance team will be present on-site to respond to any unscheduled maintenance that may be required.

The cleared area under the solar panels will be maintained throughout the life of the proposal. Waterless cleaning technology will be used if necessary for cleaning the solar panels at night, and the on-site maintenance team will also respond to unscheduled maintenance.

Although the converter and substations are essentially unmanned, the on-site maintenance team will also be available to respond to any unscheduled issues for those components of the proposal.

The proposal lifespan is expected to be approximately 60 years.

### **3.2.9 Work Force**

The proposal will create a significant number of jobs in the Pilbara and Kimberley regions. This will comprise approximately 3,000 new jobs during construction and approximately 400 new, and ongoing, jobs will be created during the operational life of the proposal.

The workforce and accommodation plan will target the hiring of local workers, and promote living locally in the Pilbara and Kimberley regions. Ideally this will involve bus-in/bus-out arrangements with staff based in Bidyadanga, Marble Bar, Broome and Port Hedland.

The proponent is also committed to working with Aboriginal communities in the region to promote the roll out of renewable energy knowledge and projects. Opportunities will be explored to assist and train Aboriginal representatives to work on the proposal, both during construction and operations.



## 4.0 Environmental Investigations

### 4.1 Flora and Vegetation Survey

Biota Environmental Sciences (Biota) was commissioned to conduct a detailed terrestrial flora and vegetation survey of the development envelope. The first phase of the terrestrial flora and vegetation survey was carried out from 24<sup>th</sup> August – 5<sup>th</sup> September 2017. The second sampling phase of the survey will be undertaken in March-April 2018, following summer rainfall.

All surveys were completed as far as practicable in accordance with relevant Environmental Protection Authority (EPA) policy, specifically:

- Environmental Factor Guideline: Terrestrial Flora and Vegetation (EPA 2016a); and
- Technical Guide - Terrestrial Flora and Vegetation Surveys (EPA 2016b).

A total of 56 flora sampling quadrats were completed within the study area, representatively sampling the range of vegetation types present. Vegetation was also sampled via relevés, and traverses were completed to search for rare flora and compile detailed vegetation mapping notes. The work was undertaken by a team of experienced botanists who have completed many past surveys in the Pilbara and Kimberley regions.

#### 4.1.1 Vegetation

The vegetation of the development envelope is in excellent condition, with virtually no weed invasion. Two land systems account for almost 90% of the development envelope by area: Nita and Little Sandy. The descriptions of these two main land systems broadly characterise the vegetation types present in the development envelope:

- Nita – Sandplains supporting shrubby spinifex grasslands with occasional trees.
- Little Sandy – Sandplains with linear and reticulate dunes supporting shrubby hard and soft spinifex grasslands.

Vegetation type delineation and mapping is currently in progress and will not be finalised until completion of the seasonal sampling work in 2018. A relatively small number of frequently repeated vegetation types were sampled during the first survey phase, mostly comprising open *Triodia* spp. hummock grasslands on sandplains, low-elevation dunes and laterite exposures, with varying densities of *Acacia*, *Hakea* and *Grevillea* spp. shrublands where an overstorey was present. None of the vegetation types present in the development envelope appear to correspond to Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs).

#### 4.1.2 Flora

Specimen identifications from the first survey phase are currently in progress and a complete flora species list is not yet available. However, preliminary estimates place the total species count in the order of 150 taxa, which is in keeping with expectations for the locality.

Three of the species confirmed to date are listed as Priority species (Section 4.1.3).

### 4.1.3 Flora Species of Conservation Significance

None of the flora species recorded during the first survey phase are listed as Threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the State *Wildlife Conservation Act 1950* (Wildlife Conservation Act).

Three species listed by the Department of Biodiversity Conservation and Attractions (DBCA) as State Priority species were recorded:

- *Phyllanthus eremicus* (Priority 3) – 14 locations;
- *Terminalia kumpaja* (Priority 3) – 34 locations; and
- *Tribulopsis marliesiae* (Priority 3) – 19 locations.

All three Priority flora species appeared relatively common within the development envelope and are also known from previous records from elsewhere in the northern Pilbara and southern Kimberley regions.

Database searches (including NatureMap<sup>1</sup> and FloraBase<sup>2</sup>), as well as previous surveys in the vicinity of the development envelope, suggest a further 14 conservation significant flora species could potentially occur, however at present none of these have been documented from the habitats present in the development envelope.

## 4.2 Terrestrial Fauna Survey

Biota was commissioned to conduct a Level 2 terrestrial fauna survey and targeted sampling for conservation significant fauna and short-range endemic (SRE) fauna. Phase 1 of the terrestrial fauna survey was carried out from 24<sup>th</sup> August – 5<sup>th</sup> September 2017. The second sampling phase of the survey will be undertaken in March-April 2018, following summer rainfall.

All surveys were completed as far as practicable in accordance with relevant State and Commonwealth policy, specifically:

- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016c);
- Technical Guide - Terrestrial Fauna Surveys (EPA 2016d);
- Technical Guide - Sampling of Short Range Endemic Invertebrates (EPA 2016e);
- Survey Guidelines for Australia's Threatened Bats (DSEWPaC 2010);
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010);
- Survey guidelines for Australia's Threatened Mammals (DSEWPaC 2011a); and
- Survey guidelines for Australia's Threatened Reptiles (DSEWPaC 2011b).

A total of 19 fauna trapping sites were installed across the development envelope, representatively sampling the range of habitat types present. Elliott, cage, pitfall and funnel traps were deployed across these sites and sampled for up to eight trap nights. Passive sampling methods (such as remote cameras and acoustic and ultrasonic recorders) were also strategically placed at locations thought to potentially support conservation significant fauna. Targeted sampling for potential SRE fauna was undertaken at prospective sites using the range of methods identified in EPA (2016e). The work was undertaken by a team of experienced zoologists who have completed many past surveys in the Pilbara and Kimberley regions.

<sup>1</sup> <https://naturemap.dpaw.wa.gov.au>

<sup>2</sup> <https://florabase.dpaw.wa.gov.au>

## 4.2.1 Vertebrate Fauna

One hundred and thirty-seven vertebrate fauna species were recorded across the development envelope, comprising one frog species, 60 reptiles, 46 avifauna and 30 mammals (including 18 ground mammals, eight bats and four introduced mammals).

The vertebrate fauna assemblage recorded in the development envelope is typical of that which would be expected for an area of similar size in this locality. The majority of species recorded are representative of the fauna commonly found within either the northern Pilbara or southern Kimberley regions. However, due to the lack of past fauna surveys in the locality, a number of species recorded, while not of elevated conservation significance, are outside of their previously known range.

### 4.2.1.1 Herpetofauna (Amphibians and Reptiles)

Sixty-one herpetofauna species were recorded, comprising one frog and 60 reptile species. The reptiles comprised seven dragon, 14 gecko, four legless lizard, 20 skink, six monitor, two blind snake, two python and five front-fanged snake species. The most abundant species recorded included the skink *Lerista bipes*, the dragon *Ctenophorus isolepis* and the gecko *Diplodactylus laevis*. One of the reptile species recorded during the first survey phase, *Lerista separanda*, is listed as a Priority species at State level (Section 4.2.2).

### 4.2.1.2 Avifauna

Forty-six avifauna species from 25 families were recorded, including 23 passerine and 23 non-passerine species. The most species-rich families were the Accipitridae (raptors) and Meliphagidae (honeyeaters and chats), each with five species. The most abundant bird species were the Singing Honeyeater (*Lichenostomus virescens*) and the Crimson Chat (*Epthianura tricolor*), which accounted for 28% and 19% respectively of all bird records from the development envelope. None of the bird species recorded during the first survey phase are of elevated conservation significance.

### 4.2.1.3 Ground Mammals

Twenty-two ground mammal species were recorded, comprising 18 native and four introduced species. The native mammal fauna consisted of three kangaroo species, nine other marsupial species, five rodent species and one canine species. Introduced mammal species recorded were the House Mouse, Camel, Fox and Feral Cat. The most abundant native mammals recorded from the development envelope were the Long-tailed Planigale (*Planigale ingrami*), the Spinifex Hopping-mouse (*Notomys alexis*) and the Sandy Inland Mouse (*Pseudomys hermannsburgensis*). Three of the native mammal species recorded are of conservation significance at both State and Commonwealth levels, and a further four are listed as Priority species in Western Australia (Section 4.2.2).

### 4.2.1.4 Bats

Eight bat species were identified from ultrasonic call recordings, including two from the family Emballonuridae, four from the family Molossididae and two from the family Vespertilionidae. The most frequently recorded species were the Common Sheath-tailed Bat (*Taphozous georgianus*) and Gould's Wattled Bat (*Chalinolobus gouldii*). Other commonly recorded species included the White-striped Free-tailed Bat (*Austronomus australis*), the Northern Free-tailed Bat (*Ozimops lumsdenae*) and the Little Broad-nosed Bat (*Scotorepens greyii*). None of the bat species recorded during the first survey phase are of elevated conservation significance.

#### 4.2.1.5 SRE Fauna

Relatively few potential SRE fauna specimens were collected during the first survey phase, which is consistent with the generally widespread and connected sandplain habitats that dominate the majority of the development envelope. A total of 22 mygalomorph spider specimens were recorded from nine locations, from a combination of burrow excavation and pitfall trapping. The specimens have not yet been identified to species-level but will be the subject of DNA sequencing to place them into context once additional material has been collected during the second survey phase in 2018.

#### 4.2.2 Fauna Species of Conservation Significance

Seven species of conservation significance were recorded in the development envelope, including three species listed as Threatened under the EPBC Act and the Wildlife Conservation Act, as well as four species listed on the DBCA Priority Fauna List: the Dampierland Plain Slider (*Lerista separanda*) (P2), Brush-tailed Mulgara (*Dasyercus blythi*) (P4), Northern Marsupial Mole (*Notoryctes caurinus*) (P4) and Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4).

The recorded species listed as Threatened at both Commonwealth and State levels were:

- Bilby (*Macrotis lagotis*) – Vulnerable (Commonwealth); Vulnerable (State) – Recorded from multiple diggings, scats and burrows, as well as automatic camera records at three locations, on sandplain habitat associated with dense *Acacia* and *Senna* spp. shrubland.
- Black-flanked Rock Wallaby (*Petrogale lateralis lateralis*) – Endangered (Commonwealth); Endangered (State) – Recorded from scats, automatic camera records and sightings associated with rock pile habitat at nine locations, all occurring in relatively close proximity in the northeast of the development envelope.
- Northern Quoll (*Dasyurus hallucatus*) – Endangered (Commonwealth); Endangered (State) – Recorded from scats only, in rocky habitat at two locations.

Database searches (including NatureMap and Atlas of Living Australia), as well as previous surveys in the vicinity of the development envelope, suggest that a further two conservation significant species may potentially occur. These include the Night Parrot (*Pezoporus occidentalis*) (Endangered (Commonwealth); Endangered (State)) and Peregrine Falcon (*Falco peregrinus*) (Other Specially Protected (State)), however there is no evidence of these species utilising the development envelope to date.

### 4.3 Migratory Shorebird Survey

Eighty Mile Beach is a Wetland of International Importance under the Ramsar Convention, and includes the Mandora Salt Marsh extending inland to the north of the development envelope (Figure 2.1).

The site is well recognised as a significant stopover area for non-breeding migratory shorebirds globally and within Australia, second only to Roebuck Bay near Broome (Hale and Butcher 2009, RIS 2009). A search of the online EPBC Act Protected Matters Reporting Tool revealed four critically endangered, three endangered, two vulnerable and 37 migratory marine and wetland bird species, most of which are listed in one or more of the following international treaties for migratory birds: the Japan-Australia Migratory Bird Agreement, the China-Australia Migratory Bird Agreement and Republic of Korea-Australia Migratory Bird Agreement.

Potential impacts on migratory shorebird species, and their level and nature of use of the southern part of the Eighty Mile Beach Ramsar site, therefore requires specific consideration as part of the terrestrial fauna factor (Section 5.2), and a targeted study addressing this has been commenced.

The current scope of the ongoing investigations comprises:

1. Desktop review and searches of relevant literature to source and collate the most current available information on wader species utilising the East Asian-Australasian flyway, shorebird species flight heights, agility and visual acuity, and other recent risk assessments and impact monitoring work from other wind farm developments within Australia and globally.
2. Consultation with local and national bird specialists familiar with this Ramsar site, along with searches of existing public databases, to access and collate all relevant existing data on shorebird utilisation specific to the Eighty Mile Beach Ramsar site.
3. Spatial analysis of existing records of shorebirds flagged at the Eighty Mile Beach Ramsar site and coordinates where they have been subsequently recorded from points further south within Australia. The objective of this will be to develop a preliminary map of the potential movement routes followed by shorebirds after their arrival at the Ramsar site during southward migration, and any inferences that may be able to be reached on their relative utilisation, and conceptual return routes to the site when mustering prior to departure on northward migration.
4. Extension of annual shorebird counts completed at the Eighty Mile Beach Ramsar site in conjunction with local monitoring programs and specialists to extend 2017-2018 monitoring to the more southern parts of the site, which are proximal to the development envelope and not otherwise well surveyed.
5. Targeted avifauna field surveys are being conducted along the northwest boundary of the development envelope, the southeast boundary of Eighty Mile Beach part of the Ramsar site, and the southern boundary of the more inland Mandora Salt Marsh. This work comprises counts and species identification of all migratory shorebird and other avifauna sighted in those locations to supplement existing data. Where possible, this will be combined with ornithologist estimates of flying heights for each species. Audible acoustic call recorders have also been deployed long term along the northern portion of the development envelope. These units passively log bird calls and have been in place initially since 5<sup>th</sup> September 2017, with the first block of data downloaded on 30<sup>th</sup> October 2017. The targeted field work will be undertaken across two field mobilisations scheduled to coincide with the timing of wader southward and northward migration.

The findings of the ongoing migratory shorebird work are currently under analysis and will not be available until the second phase of work is undertaken during northward migration.

## 4.4 Benthic Communities and Habitat Survey

BMT Oceanica was commissioned to undertake a desktop review of marine values relevant to the offshore component of the proposal and a subsequent benthic communities and habitat survey (BMT Oceanica in prep.).

The findings of the survey are still in preparation at this time, with the draft outcomes from the desktop review presented here to inform the referral.

#### 4.4.1 Eighty Mile Beach Marine Park

The proposed HDVC cable route will traverse coastal waters through the Eighty Mile Beach Marine Park ('the Marine Park'), between Port Hedland and Broome (Figure 2.1). The Marine Park is central to the Northwest Marine Bioregion (DSEWPaC 2012), covers an area of ~200,000 ha, and extends for nearly 260 km from Mulla Mulla Downs Creek in the south to Cape Missiessy in the north. The Marine Park extends seaward from the high water mark to the limit of State Waters, and includes the waters, the airspace above those waters, the seabed below those waters, and the subsoil to a depth of 200 m below the seabed.

The Marine Park was gazetted as a Class A Marine Park in January 2013 and is jointly managed by DBCA, Department of Primary Industry and Regional Development, and traditional owners, through the establishment of joint management agreements with the Karajarri, Nyangumarta and Ngarla people who have native title determinations for the lands and waters in and adjacent to Eighty Mile Beach.

All intertidal areas within the Marine Park, and the adjacent Mandora Salt Marsh that extends ~40 km inland, are listed under the Ramsar Convention as recognised feeding grounds for migratory shorebirds and waders (Department of Parks and Wildlife 2014) (see Section 4.3).

#### 4.4.2 Existing Marine Environment

The preliminary findings of the desktop review suggest that the nature of the benthic communities and habitat that the cable route will traverse comprises:

- bioturbated sediments, with very sparse filter feeders and coral rubble; and
- a sediment bed that is highly mobile due to strong tidal currents, which, combined with highly turbid water column, is likely to preclude the establishment of macroalgae, seagrass or coral communities (BMT Oceanica in prep.).

#### 4.4.3 Benthic Communities and Habitat Survey

A benthic communities survey and habitat mapping study is being completed at present, covering a study area of approximately 2 km by 6 km, within which the offshore cable route component of the development envelope is located (BMT Oceanica in prep.). Given the high turbidity of the waters of the survey area, the survey is being undertaken by means of an acoustic side-scan vessel.

Once available, the results of the benthic survey will be consolidated with the existing desktop data, and a comprehensive review of any potential operational impacts on marine fauna or other marine values identified for the Marine Park will be finalised (BMT Oceanica in prep.).

## 4.5 Social Surroundings Investigations

### 4.5.1 Stakeholder Analysis

Stakeholder analysis was carried out early in the development process, and a list of key stakeholders was drawn up so that consultation could take place and key stakeholder interests considered. The stakeholders listed in Table 4.1 have been consulted prior to the preparation of this document, and further consultation will take place during the environmental impact assessment process and ongoing development of the proposal.

**Table 4.1: Key stakeholders consulted to date in the development of the proposal.**

Stakeholder	Interest / Context
Department of Jobs, Tourism, Science and Innovation	Supporting the proposal under the Lead Agency Framework.
Department of Planning, Lands and Heritage	Important stakeholder for several aspects of the proposal.
Department of Foreign Affairs and Trade	The proposal represents a major initiative with strategic international neighbours.
Yamatji Marlpa Aboriginal Corporation (YMAC)	Representing the traditional owners of the land.
Nyangumarta People Representatives	Traditional owners of the land.
Environmental Protection Authority	Responsible for assessing and advising on all environmental aspects of the proposal, including relevant environmental factors and survey and assessment requirements.
Shire of East Pilbara	The proposal is located in the Shire of East Pilbara.
Shire of Broome	A section of the cable route passes through the Shire of Broome.
All neighbouring properties within 30 km of the development envelope	Closest commercial and residential neighbours to the proposal.
Department of Mines and Petroleum	Representing mining, oil and gas interests and responsible for Mining Act tenure overlapping and adjacent to the development envelope.
Department of Regional Development	Interest in regional development.
Department of the Premier and Cabinet	Key interest in the proposal and its successful progress.
Office of the Minister for Asian Engagement	The proposal represents a major initiative with strategic international neighbours.
Department of Biodiversity Conservation and Attractions	Manager of Eighty Mile Beach Marine Park and Walyarta Conservation Park, in addition to specialist expertise in threatened fauna species occurring in the development envelope.
Department of Primary Industries and Regional Development	Interest in regional development.
Pilbara Development Commission	Interested in promoting investment in the Pilbara.
Broome Bird Observatory	Major interest in migratory avifauna in the area, including expert opinion on migratory species.
CASA and Department of Defence	Ensuring the project will not affect aviation interests

### 4.5.2 Community Consultation

The key community consultation carried out to date includes:

- visits to all neighbouring properties within 30 km of the development envelope boundary to brief them on the proposal and seek preliminary comment;

- briefing the Councils of the Shire of East Pilbara and the Shire of Broome on the proposal; and
- attending every Elders/Directors meeting of the Nyangumarta people over the last three years.

Aboriginal Heritage is an important consideration for the proposal, and the proponent has been working with the Nyangumarta to ensure that all work to date requiring ground disturbance within the development envelope has had appropriate clearance surveys completed. Known sites of Aboriginal Heritage significance have been avoided.

### **4.5.3 Noise Assessment**

The noise generated by operating wind turbine blades can create localised noise considerations for nearby sensitive receivers. The nearest neighbour to the proposal would be approximately 18 km from the closest turbine with the current conceptual design (Figure 3.1), and the nearest public road (the Great Northern Highway) would be approximately 11 km from the nearest turbine.

Modelling has been conducted using industry standard software and the current conceptual design. The modelling showed that the noise generated by the proposal would be virtually indistinguishable from existing background noise at a range of approximately 4 km from the nearest wind turbine. Given that the separation distance to the nearest neighbour and public road is at least three times this distance, noise is not considered a factor in the proposal's assessment.

### **4.5.4 Visual Assessment**

At its closest point, the nearest turbine in the conceptual design is separated by 11 km from the nearest public road and 18 km from the nearest neighbour. There are also only four neighbours in total within a 30 km buffer on the development envelope boundary. These are:

1. Wallal Station, located 30 km from the development envelope;
2. Mandora Station, located 20 km from the development envelope;
3. Eighty Mile Beach Caravan Park, located 30 km from the development envelope; and
4. Sandfire Roadhouse, located 18 km from the development envelope.

Given wind farm visual impacts tend to be most significant at far closer separation distances than those above, visual impact is not expected to be a major consideration for the proposal. A landscape and visual assessment, which meets all applicable industry guidelines, will, however, still be completed as part of the environmental impact assessment.



## 5.0 Assessment of Preliminary Key Environmental Factors

The framework of environmental factors and objectives adopted by the EPA are detailed in the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016f). The proponent has identified the following preliminary key environmental factors that are relevant to the proposal:

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

The above factors are discussed in Sections 5.1 to 5.4. The proponent considers that the remaining environmental factors identified in EPA (2016f) are not relevant to the proposal or will not result in a significant impact (see Section 6.1).

### 5.1 Flora and Vegetation

#### 5.1.1 EPA Objective

The EPA objective for the Flora and Vegetation factor is to protect flora and vegetation so that biological diversity and ecological integrity are maintained.

#### 5.1.2 Potential Environmental Impacts

The proponent's preliminary assessment of the potential environmental impacts on flora and vegetation arising from the proposal are summarised in Table 5.1.

**Table 5.1: Potential environmental impacts of the proposal on flora and vegetation (after Part B of EPA 2016g).**

EPA factor	Flora and Vegetation
<b>EPA policy and guidance</b> – <i>What have you considered and how have you applied them in relation to this factor?</i>	Flora and Vegetation has been identified as a preliminary key factor following EPA (2016a). Survey type has been assessed in the context of the guidance provided in <i>Technical Guide - Terrestrial Flora and Vegetation Surveys</i> (EPA 2016b), with the determination that a detailed survey is required.  Surveys are currently ongoing and will be completed in accordance with the requirements of EPA (2016b).
<b>Consultation</b> – <i>Outline outcomes of consultation in relation to the potential environmental impacts</i>	A consultation meeting and subsequent discussions were held with the EPA, where the scope of the referral, likely key environmental factors and survey work required were discussed.  Traditional owners were also consulted in respect of the flora and vegetation values of the development envelope and members of the Nyangumarta Ranger Programme participated in the first survey phase.
<b>Receiving environment</b> – <i>Describe the current condition of the receiving environment in relation to this factor</i>	The vegetation of the development envelope is generally in excellent condition (Section 4.1). Two land systems dominate the development envelope, with a relatively small number of frequently repeated vegetation types occurring within these. Current estimates place floristic diversity at approximately 150 species, which is not of notable richness for the locality.  None of the flora species recorded to date are listed as Threatened at Commonwealth or State levels, and none of the vegetation types present correspond to TECs or PECs.

<p><b>Proposal activities –</b> <i>Describe the proposal activities that have the potential to impact the environment</i></p>	<p>The aspects of the proposal that may impact on flora and vegetation include:</p> <ul style="list-style-type: none"> <li>• Clearing of vegetation in the construction footprint to accommodate the proposal infrastructure, including access roads, turbine pads, solar panel arrays, substations and transmission lines (Section 3.2).</li> <li>• Deployment of plant and equipment into the development envelope from other locations where introduced flora or soil pathogens may be present.</li> <li>• The long-term (approximately 60 years) presence of finished access roads in linear corridors within the landscape of the development envelope (Section 3.2.5; Figure 3.1).</li> </ul>
<p><b>Mitigation –</b> <i>Describe the measures proposed to manage and mitigate the potential environmental impacts</i></p>	<p>Mitigation measures that will be implemented to minimise impacts on flora and vegetation have followed the Western Australian mitigation hierarchy (Avoid, Minimise, Rehabilitate, Offset; (Government of Western Australia 2014)) and will comprise:</p> <ul style="list-style-type: none"> <li>• Avoidance of Priority flora locations during project design wherever possible, with provision for pre-clearance targeted surveys of final design clearing limits.</li> <li>• Reduction of vegetation clearing footprint during the design stage to the minimum practicable, including utilisation of existing cleared tracks and co-location of infrastructure to the extent feasible.</li> <li>• Development and implementation of a construction Environmental Management Plan (EMP) addressing:             <ul style="list-style-type: none"> <li>○ Comprehensive weed hygiene management.</li> <li>○ Vegetation clearing control measures.</li> <li>○ Rehabilitation protocols (including specific consideration of Priority flora where appropriate).</li> <li>○ Erosion control and dune stabilisation where required.</li> <li>○ Rehabilitation and weed monitoring and contingency measures.</li> <li>○ General construction site matters such as waste management, fire risk management and workforce environmental inductions.</li> </ul> </li> <li>• Design and implementation of a landscape-scale fire management plan for the development envelope for the operational life of the proposal.</li> <li>• Design and implementation of a biodiversity monitoring programme to provide continuous feedback to fire management for long-term maintenance of biodiversity and infrastructure protection.</li> </ul>
<p><b>Impacts –</b> <i>Assess the impacts of the proposal and review the residual impacts against the EPA objective</i></p>	<p>The potential impacts arising from the proposal include:</p> <ul style="list-style-type: none"> <li>• Clearing of a total of 7,280ha of native vegetation within the 644,600 ha development envelope (1.1% by area) to accommodate the proposal infrastructure.</li> <li>• The long-term presence of access tracks altering fire regimes within the development envelope (in terms of frequency, extent, intensity) and consequent changes to vegetation structure.</li> <li>• A low risk of weed introduction and spread during earthworks and construction activities.</li> </ul> <p>The proposal is not expected to alter the conservation status of any of the three Priority flora species recorded from the development envelope or result in any significant reduction in the representation of vegetation types at local or regional scales.</p> <p>Existing data indicate that no TECs, PECs or Threatened Flora will be affected by the proposal as none are currently known from the development envelope.</p> <p>The proponent considers that the proposal is likely to meet the EPA objective for the Flora and Vegetation factor.</p>

<p><b>Assumptions</b> – Describe any assumptions critical to your assessment e.g. particular mitigation measures or regulatory conditions</p>	<p>This preliminary assessment of impacts on flora and vegetation assumes:</p> <ul style="list-style-type: none"> <li>• The vegetation that has been systematically sampled during the first survey phase is representative of the range of units present in the wider development envelope (to be verified via helicopter during the seasonal sampling to be completed in 2018).</li> <li>• That no currently unidentified species or communities of conservation significance occur within the development envelope (to be further informed through the completion of specimen identifications from the first survey phase, seasonal sampling following rainfall in 2018, and wider ground-truthing of inaccessible parts of the development envelope via helicopter in 2018).</li> <li>• That environmental management measures intended to mitigate or minimise construction and operational impacts on flora and vegetation are effective (high confidence, based on demonstrated successful application of control measures in other similar settings).</li> </ul>
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## 5.2 Terrestrial Fauna

### 5.2.1 EPA Objective

The EPA objective for the Terrestrial Fauna factor is to protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

### 5.2.2 Potential Environmental Impacts

The proponent's preliminary assessment of the potential environmental impacts on terrestrial fauna arising from the proposal are summarised in Table 5.2.

**Table 5.2: Potential environmental impacts of the proposal on terrestrial fauna (after Part B of EPA 2016g).**

EPA factor	Terrestrial Fauna
<p><b>EPA policy and guidance</b> – What have you considered and how have you applied them in relation to this factor?</p>	<p>Terrestrial Fauna has been identified as a preliminary key factor following EPA (2016c). Survey type has been assessed in the context of the guidance provided in <i>Technical Guide - Terrestrial Fauna Surveys</i> (EPA 2016h), with the determination that a Level 2 survey is required.</p> <p>Surveys are currently ongoing and will be completed in accordance with the requirements of EPA (2016b).</p>
<p><b>Consultation</b> – Outline the outcomes of consultation in relation to the potential environmental impacts</p>	<p>A consultation meeting and subsequent discussions were held with the EPA, where the scope of the referral, likely key environmental factors and survey work required were discussed.</p> <p>Consultation with DBCA officers has also been undertaken in respect of survey methodology and work targeting Threatened fauna species.</p> <p>Traditional owners were also consulted in respect of the terrestrial fauna values of the development envelope, and members of the Nyangumarta Ranger Programme participated in the first survey phase.</p>
<p><b>Receiving environment</b> – Describe the current condition of the receiving environment in relation to this factor</p>	<p>The fauna habitats of the development envelope are generally in excellent condition, with a relatively small range of regularly repeated landforms and substrates present. The great majority of the site is accounted for by sandplain habitat, which develops into a series of low linear dunes and broad swales in the east. Isolated rock piles and small rocky hills occur in localised parts of the northeast development envelope, and some low-elevation ridges and valleys are present in the southern sections.</p> <p>The first survey phase has documented 137 vertebrate fauna species from the development envelope, with most species representative of the fauna of the northern Pilbara or southern Kimberley regions (Section 4.2.1).</p>

	<p>Seven species of conservation significance were recorded in the development envelope, including four Priority species and three species listed as Threatened under the EPBC Act and the Wildlife Conservation Act: the Bilby (<i>Macrotis lagotis</i>) – Vulnerable (Commonwealth); Vulnerable (State); Black-flanked Rock Wallaby (<i>Petrogale lateralis lateralis</i>) – Endangered (Commonwealth); Endangered (State); and Northern Quoll (<i>Dasyurus hallucatus</i>) – Endangered (Commonwealth); Endangered (State) (Section 4.3).</p> <p>The coastal portion of the Eighty Mile Beach Ramsar site is situated 26 km northwest of the development envelope (Figure 3.1), and the Mandora Salt Marsh part of the Ramsar site, which extends inland, is 16 km north of the development envelope (Section 4.3). The site is well recognised as a significant stopover area for non-breeding migratory shorebirds and is utilised by many species listed in international conservation agreements (Section 4.3).</p>
<p><b>Proposal activities –</b> <i>Describe the proposal activities that have the potential to impact the environment</i></p>	<p>The aspects of the proposal that may impact on terrestrial fauna include:</p> <ul style="list-style-type: none"> <li>• Clearing of fauna habitat to create the construction footprint to accommodate the proposal infrastructure, including access roads, turbine pads, solar panel arrays, substations and transmission lines (Section 3.2).</li> <li>• Installation of the export cable through beach and intertidal habitat.</li> <li>• Deployment of plant and equipment into the development envelope from other locations where introduced flora or soil pathogens may be present.</li> <li>• Installation of 24 solar panel modules distributed across the development envelope, each of which will be approximately 200 ha in size (Section 3.2.2).</li> <li>• Operation of up to 1,200 wind turbines, in rows 6 km apart across the development envelope, spaced at approximately 750 m intervals within the rows (Figure 3.1).</li> <li>• The long-term (approximately 60 years) presence of finished access roads in linear corridors within the landscape of the development envelope, including ongoing vehicle movements (Section 3.2.5; Figure 3.1).</li> </ul>
<p><b>Mitigation –</b> <i>Describe the measures proposed to manage and mitigate the potential environmental impacts</i></p>	<p>Mitigation measures to be implemented to minimise impacts on terrestrial fauna have followed the Western Australian mitigation hierarchy (Avoid, Minimise, Rehabilitate, Offset (Government of Western Australia 2014)) and will comprise:</p> <ul style="list-style-type: none"> <li>• Selection and siting of the development envelope at the macro-scale to provide a separation distance of 26 km between the coastal portion of the Ramsar site and the nearest turbine (and 16 km from the Mandora Salt Marsh), reducing the risk of shorebird interaction with turbines.</li> <li>• Buffering and avoidance of mapped habitat of the Black-flanked Rock Wallaby during project design, given the species high dependence on, and effective restriction to, rock pile habitats and local connecting habitats.</li> <li>• Avoidance of current records of Bilby and Northern Quoll and their habitat in the conceptual design, with provision for specific pre-clearance surveys and the development of management measures specific to these species at final design, ahead of the commencement of construction.</li> <li>• Scheduling of cable installation works through the coastal zone to avoid disturbance during seasonal activity peaks at Eighty Mile Beach for migratory shorebirds and other marine fauna.</li> <li>• Specific recognition of the confirmed Priority fauna species in the construction EMP measures where relevant, and avoidance of known records in the project design where practicable.</li> <li>• Reduction of the habitat clearing footprint during the design stage to the minimum practicable, including utilisation of existing cleared tracks and co-location of infrastructure to the extent feasible.</li> </ul>

	<ul style="list-style-type: none"> <li>• Development and implementation of a construction EMP addressing: <ul style="list-style-type: none"> <li>○ Comprehensive weed hygiene management.</li> <li>○ Habitat clearing control measures.</li> <li>○ Rehabilitation protocols.</li> <li>○ Erosion control and dune stabilisation if required.</li> <li>○ Rehabilitation and weed monitoring and contingency measures.</li> <li>○ General construction site matters such as waste management, fire risk management and workforce environmental inductions.</li> </ul> </li> <li>• Design and implementation of an avifauna monitoring programme, documenting baseline use of the development envelope by migratory shorebirds and other avifauna, and any regular local movement patterns that may be identified, with equivalent monitoring and collection of avifauna and bat mortality data post-commissioning of the turbines.</li> <li>• Design and implementation of a landscape-scale fire management plan for the development envelope for the operational life of the proposal.</li> <li>• Design and implementation of a biodiversity monitoring programme to provide continuous feedback to fire management for long-term maintenance of biodiversity and infrastructure protection, with specific consideration provided to Bilby and Black-flanked Rock Wallaby populations.</li> </ul>
<p><b>Impacts</b> – <i>Assess the impacts of the proposal and review the residual impacts against the EPA objective</i></p>	<p>The potential impacts arising from the proposal include:</p> <ul style="list-style-type: none"> <li>• Potential for migratory shorebirds, other avifauna or bat impacts through interaction with wind turbines and individual mortality.</li> <li>• Clearing of a total of 7,280 ha of fauna habitats within the 644,600 ha development envelope (1.1% by area) to accommodate the proposal infrastructure.</li> <li>• Potential direct and indirect impacts on three Threatened and four Priority fauna species (including direct loss or displacement of individuals during clearing or as a result of operational vehicle movements).</li> <li>• Risk of weed introduction and spread during earthworks and construction activities, modifying fauna habitats with potential flow-on effects to fauna community structure.</li> <li>• 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.</li> </ul> <p>The proposal is not expected to alter the conservation status of any of the Threatened or Priority fauna species recorded from the development envelope or result in any significant reduction in the representation of habitat types at local or regional scales. Initial assessments suggest the substantial separation distances from the Ramsar site will significantly reduce the risk of shorebird interaction with turbines.</p> <p>Existing data indicate that no TECs or PECs will be affected by the proposal as none are currently known from the development envelope.</p> <p>The proponent considers that the proposal is likely to meet the EPA objective for the Terrestrial Fauna factor.</p>
<p><b>Assumptions</b> – <i>Describe any assumptions critical to your assessment e.g. particular mitigation measures or regulatory conditions</i></p>	<p>This preliminary assessment of impacts on terrestrial fauna assumes:</p> <ul style="list-style-type: none"> <li>• Representativeness of the initial desktop findings that the majority of migratory shorebirds dispersing from the Eighty Mile Beach Ramsar site follow more coastal routes when leaving to travel locally within Australia, and/or will have attained sufficient height to be flying above the topmost point of the turbine blade rotation by the time they would reach the development envelope – a minimum distance of 16 km from Mandora Salt Marsh, but more typically 25-30 km from Eighty Mile Beach (to be further investigated and validated during ongoing work on avifauna and additional studies in 2018).</li> </ul>

	<ul style="list-style-type: none"> <li>• The habitats systematically sampled during the first survey phase are representative of the range of habitats present in the wider development envelope (to be verified via helicopter during the seasonal sampling to be completed in 2018).</li> <li>• That no currently unidentified species or communities of conservation significance occur within the development envelope (to be further informed through seasonal sampling following the wet season and wider ground-truthing of inaccessible parts of the development envelope via helicopter in 2018).</li> <li>• That environmental management measures intended to mitigate or minimise general construction and operational impacts on terrestrial fauna are effective.</li> </ul>
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## 5.3 Benthic Communities and Habitat

### 5.3.1 EPA Objective

The EPA objective for the Benthic Communities and Habitat factor is to protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.

### 5.3.2 Potential Environmental Impacts

The proponent's preliminary assessment of the potential environmental impacts on benthic communities and habitat arising from the proposal are summarised in Table 5.3.

**Table 5.3: Potential environmental impacts of the proposal on benthic communities and habitat (after Part B of EPA 2016g).**

EPA factor	Benthic Communities and Habitat
<b>EPA policy and guidance</b> – <i>What have you considered and how have you applied them in relation to this factor?</i>	<p>Benthic Communities and Habitat has been identified as a preliminary key factor following EPA (2016i). Desktop assessment and survey requirements have been determined in the context of the guidance provided in <i>Technical Guide – Benthic Communities and Habitat</i> (EPA 2016j).</p> <p>Surveys are currently ongoing and will be completed in accordance with the requirements of EPA (2016j).</p>
<b>Consultation</b> – <i>Outline the outcomes of consultation in relation to the potential environmental impacts</i>	<p>A consultation meeting and subsequent discussions were held with the EPA, where the scope of the referral, likely key environmental factors and survey work required were discussed.</p> <p>Consultation with Marine Branch within the Department of Water and Environmental Regulation was also undertaken, as well as liaison with DBCA officers in respect of Eighty Mile Beach Marine Park and appropriate investigations.</p>
<b>Receiving environment</b> – <i>Describe the current condition of the receiving environment in relation to this factor</i>	<p>The benthic communities and habitat that the cable route will traverse sit within the Eighty Mile Beach Marine Park, and comprise bioturbated sediments with very sparse filter feeders and coral rubble, and a sediment bed that is highly mobile due to strong tidal currents, precluding the establishment of macroalgae, seagrass or coral (Section 4.4.2).</p>
<b>Proposal activities</b> – <i>Describe the proposal activities that have the potential to impact the environment</i>	<p>The only aspect of the proposal that may impact on benthic communities and habitat is the installation of the proposal export cable from the beach to the limit of State Waters (Section 3.2.4).</p>

<p><b>Mitigation</b> – Describe the measures proposed to manage and mitigate the potential environmental impacts</p>	<p>Mitigation measures that will be implemented to minimise impacts on benthic communities and habitat have followed the Western Australian mitigation hierarchy (Avoid, Minimise, Rehabilitate, Offset (Government of Western Australia 2014)) and will comprise:</p> <ul style="list-style-type: none"> <li>• Route selection for the cable to minimise the distance the cable route traverses through the Marine Park.</li> <li>• Use of a low impact installation method appropriate to the substrate (hydro-plough or similar).</li> <li>• Selection of optimal seasonal timing for the installation work through the Marine Park, to ensure any disturbance impacts on its associated values (including migratory shorebirds and marine turtles) are minimised.</li> </ul>
<p><b>Impacts</b> – Assess the impacts of the proposal and review the residual impacts against the EPA objective</p>	<p>The potential impacts arising from the proposal include:</p> <ul style="list-style-type: none"> <li>• Disturbance of sediments during cable installation or maintenance works may potentially lead to an increase in local water column turbidity and localised sediment deposition, arising from suspended and resuspended sediments being transported by water movements. The prevailing high-energy tidal regime of the region causes naturally turbid coastal waters and precludes the growth of benthic primary producers (BMT Oceanica, in prep.).</li> <li>• Ploughing activities to install the cables will cause re-working and settling out of sediments along the cable route, which may cause temporary, localised changes in particle size distribution (e.g. an increase in the silt and clay fractions) and carbon content (e.g. a lower proportion of organic carbon than natural sediments). Changing the physical and chemical properties of sediment may temporarily impact the abundance of macroinvertebrates. However, since the HVDC cables will be completely buried, any temporary and localised changes in particle size distribution and carbon content are not anticipated to permanently impact the sediment quality of the marine environment, particularly given the influence of tidal flows (BMT Oceanica, in prep.).</li> </ul> <p>Sub-sea cables are routinely installed through international waters without significant marine impacts and are generally not formally assessed. The proponent considers that the proposal is likely to meet the EPA objective for the Benthic Communities and Habitat factor.</p>
<p><b>Assumptions</b> – Describe any assumptions critical to your assessment e.g. particular mitigation measures or regulatory conditions</p>	<p>This preliminary assessment of impacts on benthic communities and habitats assumes:</p> <ul style="list-style-type: none"> <li>• The findings of the benthic communities and habitats field survey validate the current assessment of the nature of the marine habitat within the development envelope.</li> </ul>

## 5.4 Social Surroundings

### 5.4.1 EPA Objective

The EPA objective for the Social Surroundings factor is to protect social surroundings from significant harm.

### 5.4.2 Potential Environmental Impacts

The proponent's preliminary assessment of the potential environmental impacts on social surroundings arising from the proposal are summarised in Table 5.4.

**Table 5.4: Potential environmental impacts of the proposal on social surroundings (after Part B of EPA 2016g).**

EPA factor	Social Surroundings
<p><b>EPA policy and guidance</b> – <i>What have you considered and how have you applied them in relation to this factor?</i></p>	<p>Social Surroundings has been identified as a preliminary key factor following EPA (2016k). The aspects considered potentially relevant in relation to this factor include:</p> <ul style="list-style-type: none"> <li>• Aboriginal heritage</li> <li>• Landscape and visual amenity</li> </ul>
<p><b>Consultation</b> – <i>Outline the outcomes of consultation in relation to the potential environmental impacts</i></p>	<p>A consultation meeting and subsequent discussions were held with the EPA, where the scope of the referral, likely key environmental factors and survey work required were discussed.</p> <p>The Nyangumarta have been regularly consulted in respect of potential areas of heritage value within the development envelope, and representatives from the group have participated in environmental studies and clearance surveys as required.</p> <p>All neighbours within 30 km of the development envelope have been consulted.</p>
<p><b>Receiving environment</b> – <i>Describe the current condition of the receiving environment in relation to this factor</i></p>	<p>The remoteness of the development envelope means that it is not a tourist destination, nor does it have any other regular land use activities taking place on-site. For visual amenity, there are very few potential sensitive receivers in the vicinity of the development envelope (see Section 4.5.4).</p> <p>The traditional owners have indicated which areas of the site have been used in the past and are known to have cultural importance. Clearance work to date has not identified any heritage sites of significance within the conceptual design footprint.</p>
<p><b>Proposal activities</b> – <i>Describe the proposal activities that have the potential to impact the environment</i></p>	<p>The wind turbines will be approximately 300 m in height at the topmost swing of the turbine blades, and they are therefore likely to be visible from the Great Northern Highway.</p> <p>Clearing during construction could risk destroying heritage artefacts. This includes disturbance to create the construction footprint to accommodate the proposal infrastructure, including access roads, turbine pads, solar panel arrays, substations and transmission lines (Section 3.2).</p>
<p><b>Mitigation</b> – <i>Describe the measures proposed to manage and mitigate the potential environmental impacts</i></p>	<p>Mitigation measures that will be implemented to minimise impacts on benthic communities and habitat have followed the Western Australian mitigation hierarchy (Avoid, Minimise, Rehabilitate, Offset (Government of Western Australia 2014)).</p> <p>The most effective means of mitigating visual impacts is, during the site selection phase, to choose a site that is well removed from potential sensitive receivers, which has already been implemented for this Proposal.</p> <p>Based on industry best practice, other mitigation measures that will be taken to further minimise visual amenity impacts include:</p> <ul style="list-style-type: none"> <li>• Ensuring the turbines are consistent in form and colour.</li> <li>• Planning the turbines in orderly rows.</li> </ul> <p>The proponent will continue working with the traditional owners to undertake heritage clearances in areas that are being considered for ground disturbance. This will include pre-construction clearance surveys and the signing of an Indigenous Land Use Agreement. Given the nature of the infrastructure it should be possible to mitigate potential impacts by shifting proposed infrastructure locations to avoid any areas of significance that may be discovered later in the design process.</p>



<b>Impacts</b> – <i>Assess the impacts of the proposal and review the residual impacts against the EPA objective</i>	Given the avoidance and mitigation measures for visual amenity and Aboriginal Heritage values, the proponent considers that the proposal is likely to meet the EPA objective for the Social Surroundings factor.
<b>Assumptions</b> – <i>Describe any assumptions critical to your assessment e.g. particular mitigation measures or regulatory conditions</i>	This preliminary assessment of impacts on Social Surroundings assumes that the Nyangumarta have already highlighted all the known potential heritage concerns in the development envelope.

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## 6.0 Conclusions

### 6.1 Other Environmental Factors

The only other factor, although not considered a preliminary key factor, which may still be relevant to the proposal is Marine Fauna. Potential impacts on this factor will still be assessed in the completion of the BMT Oceanica marine impacts assessment (BMT Oceanica in prep.; Section 4.4), but the proponent's current assessment is that it is not likely to be a key factor for the proposal.

All other factors identified by EPA (2016f) (i.e. Coastal Processes, Marine Environmental Quality, Subterranean Fauna, Terrestrial Environmental Quality, Hydrological Processes, Inland Waters Environmental Quality, Air Quality, Landforms and Human Health) are not considered to be relevant to the proposal.

### 6.2 Environmental Benefits of the Proposal

Inherent to the proposal is a global environmental benefit of clean energy production and major carbon emissions reductions. At overview, these comprise:

- The Proposal will export approximately 15 TWh of clean energy per year, which will represent approximately 4% of Java's power consumption once the Proposal is fully commissioned.
- Based on average power consumption for residences on Java and in Singapore, the Proposal would produce enough energy to supply seven million homes.
- Approximately 14 million tonnes of CO<sub>2</sub> emissions per year will be saved based on Java and Singapore's current fuel mix for power generation. This will be the equivalent of almost one billion tonnes of eliminated CO<sub>2</sub> emissions over the life of the Proposal.

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## 7.0 References

BMT Oceanica (in. prep.). Australia-Singapore HVDC Cable: Marine State Waters Environmental Impact Assessment. Western Australia.

Department of Parks and Wildlife (2014). Eighty Mile Beach Marine Park Management Plan 80P 2014–2024.

DEWHA (2010). Survey Guidelines for Australia’s Threatened Birds. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC (2010). Survey Guidelines for Australia’s Threatened Bats. Commonwealth of Australia.

DSEWPaC (2011a). Survey Guidelines for Australia’s Threatened Mammals. Commonwealth of Australia. Retrieved from <http://www.environment.gov.au/epbc/publications/threatened-mammals.html>.

DSEWPaC (2011b). Survey Guidelines for Australia’s Threatened Reptiles. Department of Sustainability, Environment, Water, Population and Communities; Commonwealth of Australia. Retrieved from <http://www.environment.gov.au/epbc/publications/threatened-mammals.html>.

DSEWPaC (2012). Marine Bioregional Plan for the North Marine Regions. Department of Sustainability, Environment, Water, Population and Communities, Canberra. Retrieved from <http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra>.

EPA (2016a). *Environmental Factor Guideline: Flora and Vegetation*. Environmental Protection Authority, Western Australia.

EPA (2016b). *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*. Environmental Protection Authority, Western Australia.

EPA (2016c). *Environmental Factor Guideline: Terrestrial Fauna*. Environmental Protection Authority, Western Australia.

EPA (2016d). *Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna*. Environmental Protection Authority, Western Australia.

EPA (2016e). *Technical Guidance: Sampling of Short Range Endemic Invertebrate Fauna*. Environmental Protection Authority, Western Australia.

EPA (2016f). *Statement of Environmental Principles, Factors and Objectives*. Environmental Protection Authority, Western Australia.

EPA (2016g). Instructions for the referral of a Proposal to the Environmental Protection Authority under Section 38 of the *Environmental Protection Act 1986*. Environmental Protection Authority, Western Australia.

EPA (2016h). *Technical Guidance: Terrestrial Fauna Surveys*. Environmental Protection Authority, Western Australia.

EPA (2016i). *Environmental Factor Guideline: Benthic Communities and Habitats*. Environmental Protection Authority, Western Australia.

EPA (2016j). *Technical Guidance - Protection of Benthic Communities and Habitats*. Environmental Protection Authority, Western Australia.

EPA (2016k). *Environmental Factor Guideline: Social Surroundings*. Environmental Protection Authority, Western Australia.

Government of Western Australia (2014). *WA Environmental Offsets Guidelines*. Environmental Protection Authority, Western Australia.

Hale, J., and R. Butcher (2009). Ecological Character Description of the Eighty-mile Beach Ramsar Site. ECD, Department of Environment and Conservation, Perth, WA.

RIS (2009). Eighty Mile Beach Ramsar information sheet. Department of Conservation and Land Management [WWW Document]. Retrieved September 1, 2017, from [https://www.dpaw.wa.gov.au/images/documents/conservation-management/wetlands/ramsar/information\\_sheets/RIS\\_Eighty-mile\\_Beach\\_2009.pdf](https://www.dpaw.wa.gov.au/images/documents/conservation-management/wetlands/ramsar/information_sheets/RIS_Eighty-mile_Beach_2009.pdf).