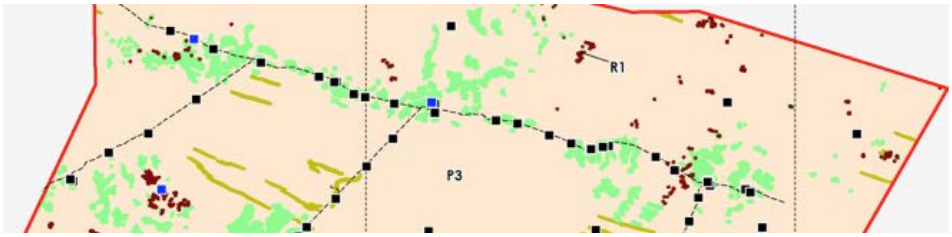
Biota Environmental Sciences

The Asian Renewable Energy Hub

Nyangumartamili wangal pa janyja

Asian Renewable Energy Hub



Environmental Review Document

Assessment Number 2140

May 2019

Biota Environmental Sciences

The Asian Renewable Energy Hub
Nyangumartamili wangal pa janyja

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Invitation to Make a Submission

The Environmental Protection Authority (EPA) invites people to make a submission on the environmental review for this proposal.

NW Interconnected Power proposes to construct and operate the Asian Renewable Energy Hub: a large-scale wind and solar renewable energy project, situated on the northeast boundary of the Shire of East Pilbara. The onshore components of the proposal 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 inert subsea power cables, with the current proposal only extending to the limit of State Waters (Commonwealth Waters and international permitting will be the subject of a separate assessment).

The Environmental Review Document has been prepared in accordance with the EPA's Procedures Manual (Part IV Divisions 1 and 2). The ERD is the report by the proponent on their environmental review, which describes this proposal and its likely effects on the environment.

The ERD is available for a public review period of six weeks from 13th May 2019, closing on 24th June 2019.

Information on the proposal from the public may assist the EPA to prepare an assessment report in which it will make recommendations on the proposal to the Minister for Environment.

Why write a submission?

The EPA seeks information that will inform the EPA's consideration of the likely effect of the proposal, if implemented, on the environment. This may include relevant new information that is not in the Environmental Review Document, such as alternative courses of action or approaches.

In preparing its assessment report for the Minister for Environment, the EPA will consider the information in submissions, the proponent's responses and other relevant information.

Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the *Freedom of Information Act 1992*.

Why not join a group?

It may be worthwhile joining a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on information in the Environmental Review Document.

When making comments on specific elements in the ER document:

- Clearly state your point of view and give reasons for your conclusions.
- Reference the source of your information, where applicable.
- Suggest alternatives to improve the outcomes on the environment.

What to include in your submission

Include the following in your submission to make it easier for the EPA to consider your submission:

- Your contact details – name and address.
- Date of your submission.
- Whether you want your contact details to be confidential.
- Summary of your submission, if your submission is long.
- List points so that issues raised are clear, preferably by environmental factor.
- Refer each point to the page, section and if possible, paragraph of the ERD.
- Attach any reference material, if applicable. Make sure your information is accurate.

The closing date for public submissions is: 24th June 2019.

The EPA prefers submissions to be made electronically via the EPA's Consultation Hub at https://consultation.epa.wa.gov.au.

Alternatively submissions can be:

- posted to: Chairman, Environmental Protection Authority, Locked Bag 10, Joondalup DC WA 6919; or
- delivered to: the Environmental Protection Authority, Prime House, 8 Davidson Terrace, Joondalup, WA 6027.

If you have any questions on how to make a submission, please contact EPA Services at the Department of Water and Environmental Regulation on 6364 7000.

Asian Renewable Energy Hub Environmental Review Document

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Scoping Checklist

Task No.	Required Work	Section and Page No.
Benthic Communities and Habitats		
1	Present the findings of an options analysis undertaken to determine the location of the export cable as the most appropriate, including an assessment of the significance of impacts on Kujungurru-Warrarn Nature Reserve and the Eighty Mile Beach Marine Park.	Section 2.3.4.5, p74-76 Section 4.6.5.3, p146
2	Map the export cable corridor in the context of the marine park zoning and address potential impacts/implications of the proposal on the management objectives and targets for the marine park values relevant to this factor.	Section 2.3.4.5, p78-79; Section 4.3, p100-108; Section 4.5.6.5, p 125
3	Present the findings of a desktop review and marine survey of Benthic Communities and Habitats types and spatial extents and any temporal variations to identify and describe the different types of benthic communities and habitats.	Section 4.3.3, p101; Appendix 2
4	Produce comprehensive mapping (at an appropriate scale) of the benthic communities/habitats within an appropriate Local Assessment Unit, overlain with the export cable corridor predicted disturbance footprint (including indirect impacts if relevant), to quantify the loss of Benthic Communities and Habitats to occur as a result of the proposal.	Section 4.3.3.2, p102-105; Section 4.3.5, p106 Appendix 2
5	A prediction of the extent of any potential indirect effects, including on adjacent benthic communities and habitats, with predicted recovery times.	Section 4.3.5, p106; Appendix 2
6	Describe the proposed management and mitigation measures to be implemented, including an assessment of their effectiveness and monitoring after construction, to demonstrate that all reasonable and practicable avoidance and mitigation measures will be taken to ensure residual impacts and risks are acceptable.	Section 4.3.6, p108
7	Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) of the WA Environmental Offsets Guidelines (2014), and the Commonwealth Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012) and related guide.	Section 4.3.6, p108; Section 6.0, p233
8	Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the WA Environmental Offsets Policy and Guidelines and Commonwealth Policy where the impact is for MNES. Spatial data defining the area of significant residual impacts should also be provided.	Section 6.2, p239; Section 7.5.1, p243
9	An assessment of any proposed offsets against the six offsets principles in the WA Environmental Offsets Policy.	Section 6.2, p239
10	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.3.7, p108
Marine Environmental Quality		
11	Present the findings of a desktop review of baseline data to document background marine environmental quality (including spatial and temporal variation) within the receiving marine environment.	Section 4.4.3, p109; Appendix 3
12	Map the export cable corridor in the context of the Eighty Mile Beach Marine Park zoning and address potential impacts/implications of the proposal on the management objectives and targets for the marine park values relevant to this factor.	Section 2.3.4.5, p78-79; Section 4.4.5, p108-108; Section 4.5.6.5, p 125
13	Predict the likely intensity, duration and extent of any effects on water and sediment quality caused by cable burial and any resultant potential impact on benthic communities and habitats.	Sections 4.4.4-4.4.5.5, p109-111; Appendix 3
14	Assess the potential issue of introduced marine pests, particularly if cable laying vessels are from overseas ports.	Section 4.4.5.3, p110; Appendix 3

Task No.	Required Work	Section and Page No.
15	Describe the proposed management and mitigation measures to be implemented, including an assessment of their effectiveness and considerations for closure, to demonstrate that all reasonable and practicable avoidance and mitigation measures will be taken to ensure residual impacts and risks to Marine Environmental Quality are acceptable.	Section 4.4.6, p111
16	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.4.7, p112
Marine Fauna		
17	Present the findings of a desktop review of baseline data to document marine fauna within the receiving marine environment, including identification of State conservation listed species, spatial and temporal usage patterns, critical habitats and identification of suitable environmental windows when disturbance to marine fauna would be minimised.	Section 4.5.3, p 113; Appendix 3
18	Discuss the likely presence of MNES marine fauna species within/near the project area as identified in the desktop review, including at a minimum: a. information on the abundance, distribution, ecology and habitat preferences of the listed species; b. information on the conservation value of each habitat type (e.g. breeding, migration, feeding, resting, inter-nest, etc.) from a local and regional perspective; c. if a population is present, its size and the importance of the population from a local and regional perspective; d. an assessment of the risk of impact to any listed species as a result of project activities; e. for any impact identified, appropriate mitigation/management measures to reduce the level of impact; and f. baseline information and mapping of local and regional occurrences.	Section 4.5.3-4.5.7, p 113-126; Section 7.2-7.5, p241-243; Appendix 3
19	Map the export cable corridor in the context of the marine park zoning and address potential impacts/implications of the proposal on the management objectives and targets for the marine park values relevant to this factor.	Section 2.3.4.5, p78-79; Section 4.5, p113-126 Section 4.5.6.5, p 125
20	An assessment of the sensitivity of marine fauna, including sawfish species, to the level of electromagnetic radiation expected from the buried HVDC cables and potential impacts on behavior.	Section 4.5.5.4, p121 Appendix 3
21	Assess the potential issue of introduced marine pests, particularly if cable laying vessels are from overseas ports.	Section 4.4.5.3, p110; Appendix 3
22	Determine the direct, indirect and cumulative impacts of the proposal to marine fauna and the significance of these impacts.	Section 4.5.4 - 4.5.5.5, p120-122; Appendix 3
23	Describe the proposed monitoring, management and mitigation measures to be implemented, including an assessment of their effectiveness and considerations for closure, to demonstrate that all reasonable and practicable avoidance and mitigation measures will be taken to ensure residual impacts and risks to marine fauna are acceptable, and that the proposal is not inconsistent with relevant recovery plans and threat abatement plans.	Section 4.5.6, p124; Appendix 3
24	Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) in the WA Environmental Offsets Guidelines (2014), and the Commonwealth Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012) and related guide.	Section 4.5.6, p124; Section 6.0, p233
25	Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the WA Environmental Offsets Policy and Guidelines and Commonwealth Policy where the impact is for MNES. Spatial data defining the area of significant residual impacts should also be provided.	Section 6.2, p239; Section 7.5.1, p243

Task No.	Required Work	Section and Page No.
26	An assessment of any proposed offsets against the six offsets principles in the WA Environmental Offsets Policy.	Section 6.2, p239
27	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.5.7, p126
Flora and Vegetation		
28	Undertake appropriate vegetation surveys within proposed areas of terrestrial disturbance/clearing and areas of potential indirect impacts. Surveys are to identify and characterise flora and vegetation in accordance with EPA policy and meet the requirements of Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a).	Section 4.6.3, p127; Appendix 5
29	Conduct an appropriate analysis of vegetation communities to establish local and regional conservation significance of each vegetation community.	Section 4.6.3.4-4.6.3.5, p131-135; Appendix 5
30	Conduct targeted surveys for any significant species and communities present, or assessed as potentially present, in the survey area, including, but not limited to, threatened and priority ecological communities, potential groundwater dependent ecosystems, threatened and priority flora, potentially range restricted flora and new flora species.	Section 4.6.3, p127-137; Appendix 5
31	Determine the direct, indirect and cumulative impacts of the proposal to flora and vegetation (including the Priority 3 Eighty Mile Beach Land System Ecological Community), and the significance of these impacts, including and the potential impacts of large-scale landscape fragmentation on flora and vegetation and related ecosystem processes, particularly fire.	Section 4.6.4-4.6.5.9, p141-150;
32	Demonstrate measures taken to reduce impacts, particularly of fragmentation, in the proposal design.	Section 4.6.5.7, p149
33	Describe the proposed monitoring, management and mitigation measures to be implemented, including an assessment of their effectiveness and considerations for closure, to demonstrate that all reasonable and practicable avoidance and mitigation measures will be taken to ensure residual impacts and risks are acceptable. This will include the requirement to develop environmental management plans for both the construction and operational phases of the proposal addressing management of weeds, feral fauna and rehabilitation. A dedicated fire management plan will be developed to address fire management during construction and operations with both infrastructure protection and vegetation management objectives.	Section 4.6.6, p150; Appendix 1; Appendix 6
34	Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) of the WA Environmental Offsets Guidelines (2014), and the Commonwealth Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012) and related guide.	Section 4.6.5, p143; Section 6.0, p233
35	Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the WA Environmental Offsets Policy and Guidelines and Commonwealth Policy where the impact is for MNES. Spatial data defining the area of residual impacts should also be provided.	Section 6.2, p239; Section 7.5.1, p243
36	An assessment of any proposed offsets against the six offsets principles in the WA Environmental Offsets Policy.	Section 6.2, p239
37	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.6.7, p151
Terrestrial Fauna		
38	Undertake a desktop study to provide context to the terrestrial fauna field surveys and impact assessment.	Section 4.7.3, p153; Appendix 6; Appendix 7
39	Undertake detailed (Level 2) terrestrial fauna surveys within proposed areas of terrestrial disturbance/clearing and areas of potential indirect impacts. Surveys are to identify and characterise faunal assemblages and habitats in accordance with EPA policy and EPA guidance listed under 'Relevant policy and guidance' below (EPA 2016b, 2016c, 2016d), including identification and clear mapping of fauna habitats.	Section 4.7.3, p153; Appendix 7; Appendix 8

Task No.	Required Work	Section and Page No.
40	Targeted sampling for the Night Parrot in accordance with the *Interim guideline for preliminary surveys of night parrot (Pezoporus occidentalis) in Western Australia* (DBCA 2017a).	Section 4.7.3, p153; Appendix 7
41	Targeted surveys for migratory shorebirds and waterbirds and their habitats in accordance with Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA 2016b) and Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Commonwealth of Australia 2017).	Section 4.7.3, p153; Appendix 8
42	Targeted sampling for conservation significant fauna species or communities present in the survey area, or identified as being potentially present in the survey area, will be completed, including, but not limited to, threatened and priority ecological communities, threatened and priority fauna, potential short-range endemic fauna, significant fauna habitats and new fauna species.	Section 4.7.3, p153; Appendix 7; Appendix 8
43	Identify the likelihood of fauna species listed under the EPBC Act occurring within/near the Development Envelope, including: a. information on the abundance, distribution, ecology, and habitat preferences of the listed species; b. information on the conservation value of each habitat type (e.g. breeding, migration, feeding, resting, inter-nesting etc.) from a local and regional perspective, including the percentage representation of each habitat type on site in relation to its local and regional extent; c. if a population of a listed species is present on the site, its size and the importance of that population from a local and regional perspective; d. an assessment of the risk of impact to any listed threatened species as a result of project activities; e. assess impacts to the Eighty Mile Beach Ramsar site, including both the beach and Mandora Salt Marsh components, assessing impacts to the ecological character of the site should be against the *Ecological Character Description of the Eighty-mile Beach Ramsar Site* (Hale and Butcher 2009). f. for any significant impacts identified, propose appropriate mitigation/management measures to reduce the level of impact and provide a discussion of the efficacy of these proposed mitigation/management measures; g. baseline information and maps identifying the above at both the site and regional levels.	Section 4.7.3-4.7.7, p153-201; Section 7.2-7.5, p241-243; Appendix 6; Appendix 7; Appendix 8
44	Determine the direct, indirect and cumulative impacts of the proposal to terrestrial fauna and fauna habitats, and the significance of these impacts, including a detailed impact assessment for migratory birds and the Eighty Mile Beach Ramsar site, and the potential impacts of large-scale landscape fragmentation on fauna habitats and the ecosystem processes that maintain them, particularly fire.	Section 4.7.4-4.7.5.9, p178-197
45	Subject to the final requirement for groundwater abstraction, undertake groundwater modelling to determine the likelihood and extent of any potential groundwater impacts to areas of fauna habitat, including that found in the Mandora Salt Marsh.	Section 5.2.2, p232
46	Assessment of the likely impacts of introduced predators using the new access tracks and being advantaged by any habitat fragmentation caused by the proposal.	Section 4.7.5.6, p196
47	Describe the proposed monitoring, management and mitigation measures to be implemented, including an assessment of their effectiveness and considerations for closure and rehabilitation, to demonstrate that all reasonable and practicable avoidance and mitigation measures will be taken to ensure residual impacts and risks are acceptable, and that the proposal is not inconsistent with relevant recovery plans and threat abatement plans.	Section 4.7.6, p198; Appendix 1; Appendix 5
48	Determine and quantify any significant residual impacts by applying the Residual Impact Significance Model (page 11) and WA Offset Template (Appendix 1) of the WA Environmental Offsets Guidelines (2014), and the Commonwealth Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012) and related guide.	Section 4.7.5, p178; Section 6.0, p233

Task No.	Required Work	Section and Page No.
49	Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the WA Environmental Offsets Policy and Guidelines and Commonwealth Policy where the impact is for MNES. Spatial data defining the area of significant residual impacts should also be provided.	Section 6.2, p239; Section 7.5.1, p243
50	An assessment of any proposed offsets against the six offsets principles in the WA Environmental Offsets Policy.	Section 6.2, p239
51	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.7.7, p200
Social Surroundings		
52	Characterise the heritage and cultural values of proposed disturbance areas and any other areas that may be indirectly impacted to identify sites of significance and their relevance within a wider regional context.	Section 4.8.5.2, p225
53	Conduct appropriate Aboriginal Heritage surveys and consultation to identify Aboriginal sites, values and/or cultural associations.	Section 4.8.5.2, p225
54	Characterise the land use and amenity values, particularly noting the sensitive receptors for the proposal area that could be affected by noise, dust, odour, light-spill emissions if relevant, and visual amenity issues.	Section 4.8.3.2, p 203; Section 4.8.4.2, p221
55	Characterise the existing environment by providing baseline data on noise, dust, odour and light spill emissions if relevant, at sensitive receptor sites that could be affected.	Section 4.8.3.2, p 203; Section 4.8.4.2, p221
56	Provide a description of the heritage values within the Development Envelope and proposed disturbance.	Section 4.8.5.2, p225
57	Complete computer-based noise modeling, using industry standard approaches, to predict the extent of noise generation from the operational wind turbines and how these may impact on sensitive receivers.	Section 4.8.4.4, p222; Appendix 10
58	Complete a visual impact assessment, using industry standard approaches, to predict infrastructure visibility and level of view shed changes arising from the proposal from sensitive receiving locations. The aspects of the proposal which may potentially affect the visual landscape character and scenic quality values both temporarily and permanently will be described, using agreed (by the EPA) reference and vantage points of surrounding areas and use area's viewer positions and perceptions. This should be designed and undertaken for before, during and after construction, during operations and after closure and decommissioning, to assess the impacts of the proposal on visual amenity in accordance with the *Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design* (WAPC 2007).	Section 4.8.3.4, p 209; Appendix 8
59	Assess the impacts of the proposal on heritage sites and/or cultural associations as a result of implementation of the proposal.	Section 4.8.5.3-4.8.5.4, p226-226
60	Assess the impacts of noise generation and landscape amenity modification arising from the proposal on sensitive receivers. Potential sources and impacts of noise, dust, light-spill and alteration to the landscape from the proposal should be identified and discussed. Light impacts (during construction, installation and operation, and maintenance) on Walyarta Conservation Park, Kujungurru-Warrarn Nature Reserve and the Eighty Mile Beach Marine Park should also be identified and discussed. Potential noise impact on the proposed operation and control centre is also to be included in the assessment.	Section 4.8.3.4, p209; Section 4.8.3.3, p208; Appendix 9 and 10
61	Demonstrate the application of the mitigation hierarchy to avoid and minimise impacts to social surroundings, including any considerations for closure.	Section 4.8.3.5, p220
62	A prediction of the residual impacts of the proposal on heritage sites and/or cultural associations is required for direct, indirect and cumulative impacts after consideration of the mitigation hierarchy.	Section 4.8.5.6, p230

Task No.	Required Work	Section and Page No.
63	A prediction of the residual impacts from the proposal on amenity values (including noise, dust, odour, light-spill, visual amenity) after considering and applying avoidance and minimisation measures. Impact predictions are to include, but not be limited to: a. The likely extent, severity and duration of impacts from noise, dust, odour, lightspill, alterations to the landscape and amenity; and b. Simulations/modelling of the predicted residual impacts from the proposal, including changes to the landscape from the agreed reference and vantage points. Include cumulative impacts on amenity from the proposal and any other currently approved developments.	Section 4.8.3.4, p209; Section 4.8.3.3, p208; Section 4.8.3.6, p221; Section 4.8.4.6, p225 Appendix 9 and 10
64	Demonstrate and document in the ERD how the EPA's objective for this factor can be met.	Section 4.8.6, p230

Executive Summary

Introduction

The subject of this Environmental Review Document (ERD) is the proposal by NW Interconnected Power Pty Ltd ('the proponent') to develop the Asian Renewable Energy Hub ('the proposal'). The proposal is to construct and operate a large-scale wind and solar 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).

The Western Australian Environmental Protection Authority (EPA) has determined that the proposal is to be assessed under Part IV of the *Environmental Protection Act 1986* (EP Act). The Environmental Scoping Document (ESD) for the assessment identified six preliminary key environmental factors:

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

The proposal has also been referred to the Commonwealth Government and determined to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) and is being assessed as an accredited assessment. The relevant matters of national environmental significance (MNES) for this proposal are:

- Ramsar wetlands (sections 16 and 17B of the EPBC Act);
- Listed threatened species and communities (sections 18 and 18A);
- Listed migratory species (sections 20 and 20A); and
- Commonwealth marine areas (sections 23 and 24A).

Background and Context

Onshore wind and solar energy are now the most cost-effective sources of new electricity generation in countries with good wind and solar resources. At the same time, technology developments now allow the efficient transmission of electricity over very long distances via High Voltage Direct Current (HVDC) cables, or for it to be converted into hydrogen related products, which can be transported using pipelines, ships or heavy vehicles.

The combination of these technological advancements has unlocked the potential for the development of renewable energy (RE) hubs to generate clean energy at a very large scale and to send it to where it is needed, globally.

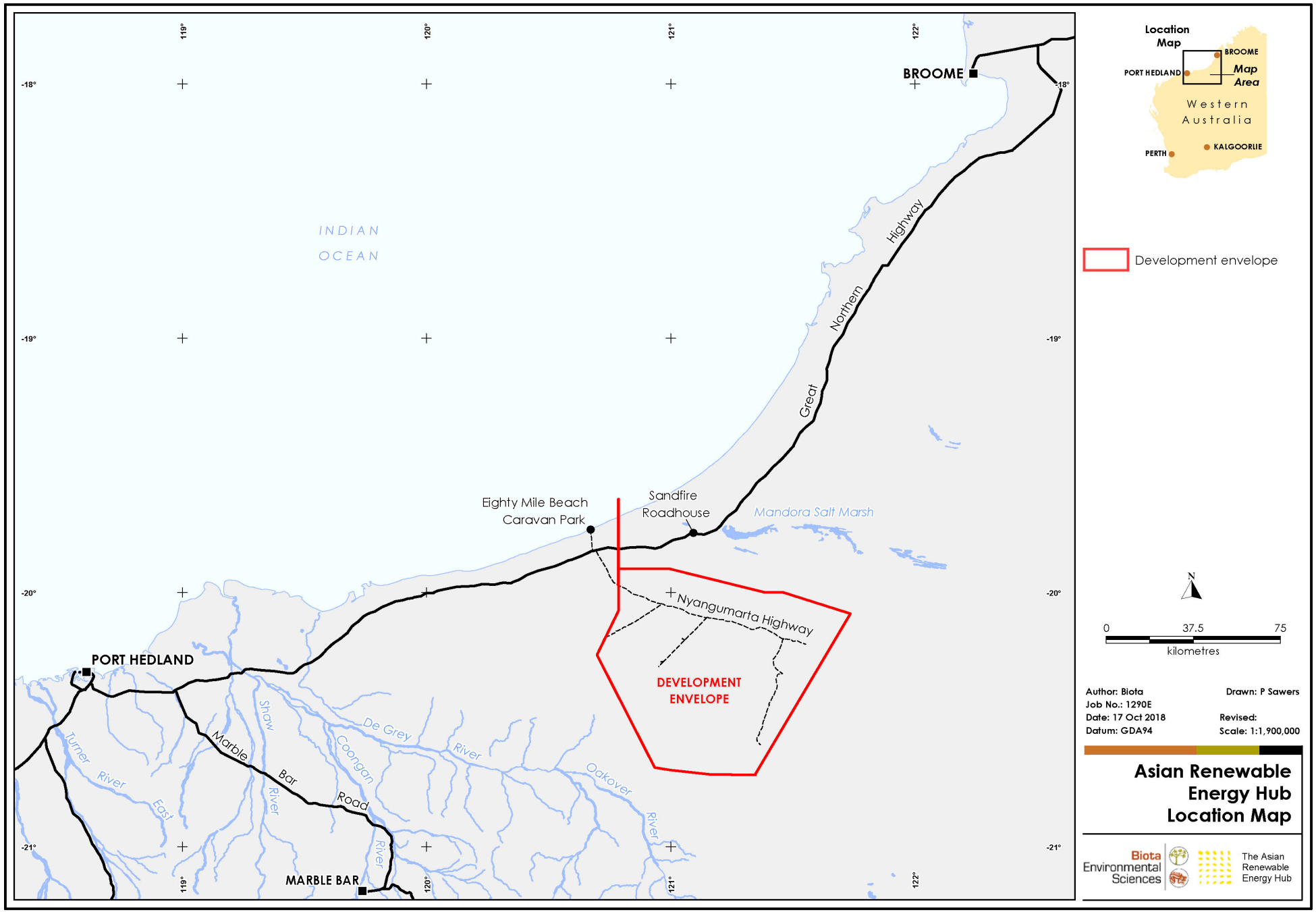

Figure 1: Regional location and development envelope.

Overview of the Proposal

The proposal will require the permanent clearing of 11,962 ha and will be implemented within an overall development envelope of 662,400 ha, representing a proposal footprint of approximately 1.81% of the development envelope by area. The key characteristics of the proposal are set out in Table 1 and Table 2. Figure 2 shows the development envelope for the proposal and its conceptual design.

Table 1: Summary of the proposal.

Proposal name:	Asian Renewable Energy Hub
Proponent:	NW Interconnected Power Pty Ltd
Assessment number:	2140
Location:	220 km east of Port Hedland and 270 km southwest of Broome, in the northwest of Western Australia (Figure 1)
Local Government Area:	Shire of East Pilbara
Public review period:	Environmental Review Document – 6 weeks
EPBC Act Reference No.:	EPBC 2017/8112

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 the ground to the top rotation 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, 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 potential environmental impacts.
- **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 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 up to 400 people.

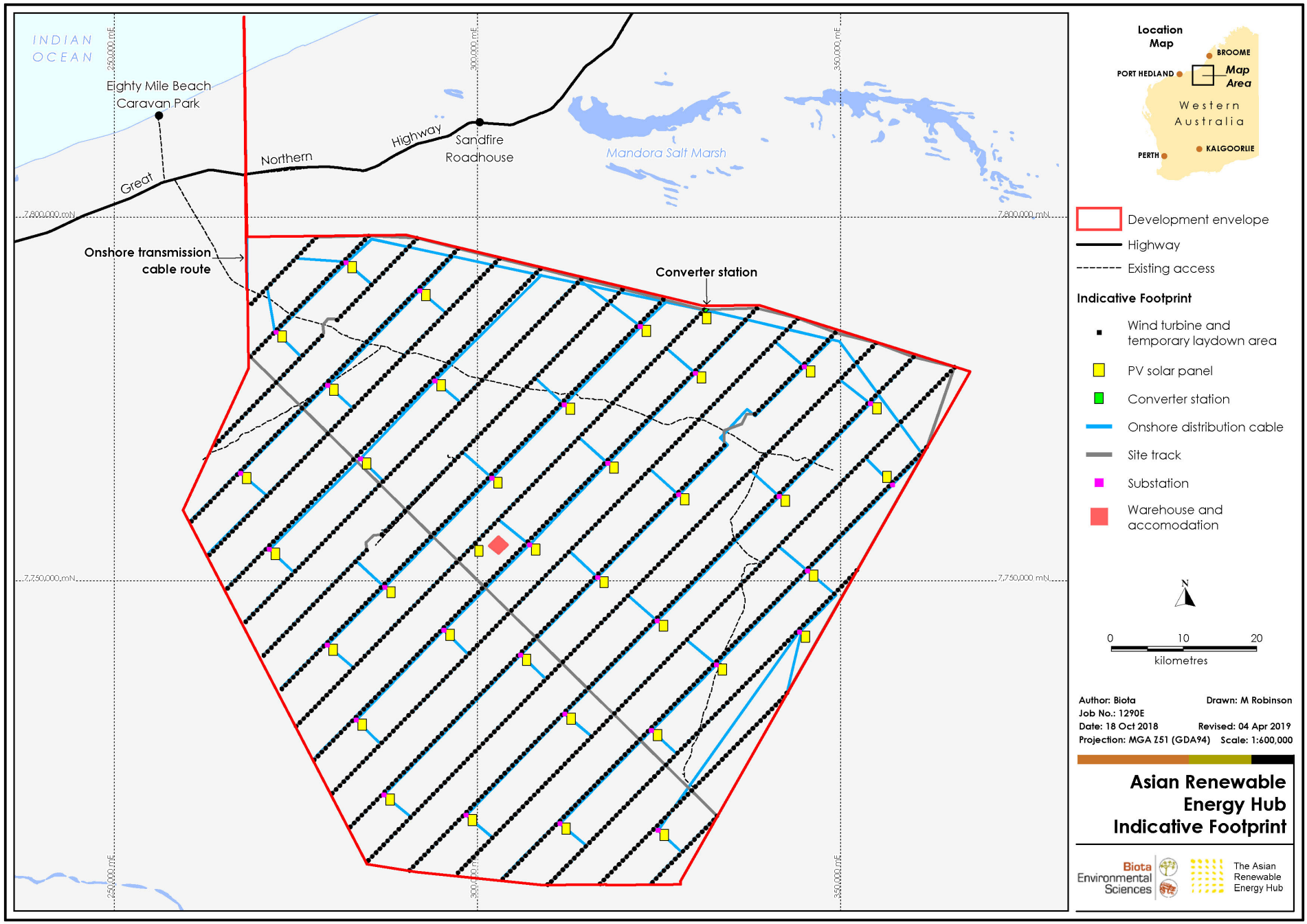

Figure 2: Indicative footprint for the proposal.

Components of the wind turbines, solar arrays and ancillary equipment 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.

Table 2: Location and proposed extent of physical and operational elements.

Element	Location	Proposed Extent
Physical Elements		
Wind turbine hardstand	Figure 2	Clearing of no more than 523 ha
PV solar arrays and associated electrical infrastructure	Figure 2	Clearing of no more than 6,651 ha
Converter station	Figure 2	Clearing of no more than 23 ha
Overhead transmission lines, including associated tracks and pylons	Figure 2	Clearing of no more than 158 ha
Overhead distribution cable	Figure 2	Clearing of no more than 1,611 ha
Site access tracks	Figure 2	Clearing of no more than 2,303 ha
Substations	Figure 2	Clearing of no more than 357 ha
Control compound, warehouse, accommodation	Figure 2	Clearing of no more than 337 ha
Temporary construction laydown areas	Figure 2	Temporary clearing of no more than 592 ha
Temporary clearing buried transmission cable section	Figure 2	Temporary clearing of no more than 21 ha
Offshore Subsea Transmission Cable	Figure 2	Short term disturbance to the sea floor of no more than 15.3 ha
Total Development Envelope		**662,400 ha**
Total Permanent Vegetation Clearing		**11,962 ha**
Total Temporary Vegetation Clearing		**613 ha**
Total Sea Floor Disturbance		**15.3 ha**

Summary of Potential Impacts, Proposed Mitigation and Outcomes

Table 3 provides a detailed summary of the potential impacts of the proposal, their mitigation and outcomes in regard to residual impact and the need for offsets, in the format required by EPA (2017).

The mitigation hierarchy (Government of Western Australia 2011) has been fundamental to the development of the proposal, from the initial stages of site and cable route selection, through to refinement of the development envelope and the conceptual design of the infrastructure layout. This has principally adopted the highest avoidance tier of the hierarchy, to effectively mitigate many potential impacts of the proposal that may have otherwise been significant.

This has resulted in a proposal that presents a minimised impact footprint and no residual impacts that are significant at species, ecological community, local or regional scales (see Table 3). The aspects of the preliminary key factors for the assessment that have had the greatest consideration in the collection of baseline data, and focus in environmental impact assessment, are briefly summarised below, with further detail provided in Table 3 and the body of this ERD.

Benthic Communities and Habitats

The prevailing high-energy tidal regime of the region causes naturally turbid coastal waters and precludes the growth of benthic primary producers, meaning there are no significant benthic communities and habitats present within the development envelope. Trenching, ploughing or jetting activities to install the four transmission cables will result in temporary disturbance to approximately 15.3 ha of seabed. This small scale and localised disturbance of bioturbated sediments is not considered to be ecologically significant. While this will also be a temporary disturbance within the Eighty Mile Beach Marine Park, it represents <0.01% of the Marine Park by area and does not impact on any unique attributes or reduce any of the ecological character for which the Eighty Mile Beach Marine Park was established.

Given that the residual impacts of the proposal are not significant, and that additional management measures will be implemented to further minimise the minor impacts that remain, the EPA's objective for the Benthic Communities and Habitats factor can be met.

Marine Environmental Quality

The risk of contaminant release arising from the seabed during cable installation is considered negligible, given the cable corridor traverses a Marine Park bordered on the landside by low density pastoral leases, with no history of urban or industrial development. Hydrocarbon and general waste may also be generated during cable installation, which can pollute the marine environment if not contained, but this will be completely mitigated by what are now standard environmental management measures.

Commissioning, decommissioning and maintenance works may result in the introduction of non-indigenous marine species (IMS) to the area. Mitigation measures will be employed for both biofouling and ballast water to minimise the risk of IMS associated with the proposal, in accordance with current State and Commonwealth regulatory requirements. Other potential impacts on marine environmental quality, including chlorine formation during monopole operation, and sediment contamination from cable deterioration, will be avoided or effectively minimised to non-significant levels in the implementation of the proposal.

The risk of significant impacts to marine environmental quality from contaminants is negligible. Other potential impact mechanisms will all be managed through well established mitigation measures as part of the Construction Environmental Management Plan (CEMP), such that the residual risk of any significant impacts is low. The EPA's objective for the Marine Environmental Quality factor can be met.

Marine Fauna

Marine fauna may potentially be impacted by collisions with vessels or entanglement with equipment and anchor lines during installation. All international shipping to deliver turbine components for the project will be via existing commercial ports on the Pilbara coast, and components will then be trucked from the ports to the site. No international freight vessel movements will occur within the Eighty Mile Beach Marine Park as part of the proposal. As existing Pilbara commercial ports have numerous daily heavy shipping movements, including through international shipping lanes further offshore, the delivery of components for the project will represent only an incremental increase on existing vessel movements, with no impacts on marine fauna in the Eighty Mile Beach Marine Park.

Cable installation, maintenance and decommissioning will be a small-scale, temporary disturbance relative to the wider ranges of the marine fauna that may potentially occur, that is unlikely to significantly affect regional populations. There will be no risk of marine fauna entanglement with the cables once they are operational, as they will be buried 5-10 m below the seabed. The potential impacts of electromagnetic field generation and heat generation from the operational cables will also be effectively mitigated by this burial of the cable below the seabed, in addition to cable shielding specifications and post-commissioning monitoring to confirm effectiveness as part of the CEMP.

The primary mitigation of behavioural impacts on marine turtles will be through avoidance, both by staging cable works to avoid peak turtle nesting and hatchling emergence periods during the year, and by managing cable works such that they are preferentially conducted during daylight hours.

The residual risk of the proposal presenting any significant impacts to marine fauna is low and the EPA's objective for the Marine Fauna factor can be met.

Flora and Vegetation

An overall total of 11,962 ha of vegetation will be permanently cleared for the proposal, representing 1.81% of the development envelope by area. The great majority of this will affect the P3 vegetation type (open shrublands over *Triodia* hummock grasslands on sandplain) at 11,137 ha of clearing, but this vegetation type is also the most widespread in the development envelope at 605,656.4 ha, and the implementation of the proposal will leave over half a million hectares of the same vegetation unit undisturbed within the development envelope (over 98% of its current extent).

Trenching for the cable installation will result in the clearing of a very small area of the Eighty Mile Beach Land System Priority Ecological Community (PEC) at 0.2 ha, which will be rehabilitated on completion of the cable works. This represents less than 0.01% of the total extent of the Eighty Mile Land System and the impacts to the PEC are therefore not considered significant.

The State and Commonwealth listed Threatened flora species *Seringia exastia* was recorded from the six locations within the eastern portion of the development envelope, but none of these fall within the clearing footprint of the current conceptual design. The situation is similar for the Priority 1 species *Tephrosia rosea* var. Port Hedland (A.S. George 1114), with the only current development envelope record more than a kilometre outside of the clearing footprint for the proposal. Pre-clearance targeted surveys for these species will be undertaken during the detailed design process, with provision for further infrastructure amendments to avoid direct impacts on Threatened flora and Priority 1 flora.

There were few weed records from the main development envelope, with weed populations limited to the cable corridor portion of the development envelope, and the vegetation was generally in Excellent and Very Good condition. Earthworks, disturbance to vegetation, movement of plant and equipment, and related activities have the potential to introduce new weeds and to spread existing populations of introduced flora; the latter primarily along the coastal portion of the cable corridor, where vegetation condition was reduced. Well established management measures will be implemented for all aspects of the construction and operation of the project to mitigate this risk of weed introduction and spread.

The proposal will result in a change to the current fire regime, but rather than considering this a negative impact of the proposal, it is more appropriately viewed as a positive opportunity to implement fire management for biodiversity objectives, in a currently unmanaged landscape where large-scale wildfires reduce vegetation diversity and overall resilience to other perturbations. With construction of the proposal's access track network there is the opportunity to develop and implement a Fire Management Plan to determine when fires will occur, and the size and intensity of the burn. This dramatically reduces risk to personnel and infrastructure, as well as achieving good environmental outcomes. The proposal will include the design and implementation of a biodiversity monitoring programme to provide continuous feedback to fire management for long-term maintenance of biodiversity and infrastructure protection. Given the above, the EPA's objective for the Flora and Vegetation factor can be met.

Terrestrial Fauna

In terms of ground fauna, the primary impact of the proposal will be the permanent clearing of 11,962 ha of fauna habitat. The great majority of this will affect 'Shrub and spinifex on sandplain' habitat at 11,150.6 ha of clearing, but this habitat type is also the most widespread in the development envelope at 605,656.4 ha, and the implementation of the proposal will leave well over half a million hectares of the same habitat undisturbed within the development envelope (over 98% of its current extent).

A new population of Black-footed Rock-wallaby (State: Schedule 2; EPBC Act: Endangered) was discovered as a result of the surveys conducted for the proposal, associated with rock pile and breakaway habitat isolates in the northeast of the development envelope. This habitat type accounts for a very small proportion of the site by area, but is critical to the survival of the species. The conceptual design for the project was modified to avoid clearing impacts on both core rock pile habitat and surrounding foraging and local movement habitat. This included a conceptual realignment of the existing Nyangumarta Highway, where it currently runs between several active rock piles that are separated by relatively short distances, to remove the risk posed by existing and future vehicle movements through core habitat. No significant impacts are therefore predicted for the Black-footed Rock-wallaby, and it is likely that with realignment of existing roads, targeted feral fauna control and fire management, habitat quality for the species will in fact be improved.

The Bilby (State: Schedule 3; EPBC Act: Vulnerable) was recorded from multiple locations within the development envelope, mostly within the very extensive Nita land system, where it adjoins slightly higher elevation Callawa land system habitat. Unlike the Black-footed Rock-wallaby, which is strongly linked to particular fixed landscape features, the Bilby moves through areas of suitable habitat over time, mostly in response to fire history, vegetation recovery and rainfall. A large proportion of the development envelope represents potential habitat for the Bilby: the Shrub and spinifex on sandplain habitat, within the Nita land system, has suitable substrate for the species to construct burrows and supports the flora species known to be important in the species' diet. While the proportionate loss of potential habitat for the species as a result of clearing is therefore not significant at the scale of the development envelope, with over half a million hectares to be retained, individual Bilby may still be impacted directly if they are actively utilising areas within the final design footprint at the commencement of construction earthworks.

The implementation of the proposal will result in the large-scale partitioning of the landscape into extensive blocks of habitat separated by access roads and other cleared areas. Not only will this provide a framework for ongoing operations phase management of habitats to create a significantly improved mosaic of varying fire age habitat, but the use of prescribed burns provides a means of management to move the Bilby population within the landscape, passively relocating them away from planned construction areas through means of their own behavioural ecology. As with the Black-footed Rock-wallaby, it is likely that the overall quality of habitat for the species will improve with the implementation of the proposal's mosaic fire management strategies.

Potential clearing impacts on the Black-footed Rock-wallaby population present in the development envelope have been, and will continue to be, completely mitigated through avoidance by modification of the proposal conceptual design. Potential construction directs impacts on the Bilby will be mitigated via the application of fire management, supported by pre-clearances targeted surveys to validate the effectiveness of the approach and provisioning of additional contingency management actions if required. The implementation of the Fire Management Plan for the development envelope will benefit the populations of both species, providing for improved landscape heterogeneity, which will also serve to buffer the resilience of the overall vertebrate fauna assemblage in the >98%

of the development envelope habitats that will remain intact. No significant impacts on fauna of conservation significance, or the assemblage generally, would therefore be predicted to arise from habitat removal, clearing activities or changed fire regimes.

Potential impacts on avifauna have been a fundamental focus of the proposal's development since site selection, given the Eighty Mile Beach Ramsar site is present in the wider locality. The primary mitigation in this regard has been avoidance, with the siting of the development envelope providing a separation distance of 26 km between the coastal portion of the Ramsar site and the nearest turbine (and 13 km from the Mandora Salt Marsh), significantly reducing the risk of shorebird interaction with turbines. Cable installation works through the coastal zone will also be scheduled to avoid disturbance during seasonal activity peaks at Eighty Mile Beach for migratory shorebirds.

Specialist migratory shorebird studies were completed to inform this ERD, and the available data indicate that the risk of significant impact on migratory shorebirds from the wind turbines element of the proposal is acceptably low. The findings of the study conducted for this assessment reconfirmed the ecological importance of both Eighty Mile Beach and Walyarta Conservation Park to avifauna, with an overall total of 95,609 migratory shorebird and waterbird individuals recorded across the two sites, including 34 bird species of conservation significance.

By comparison, just a single migratory shorebird species, the Oriental Pratincole, was recorded in the development envelope, with 35 individuals recorded (of the 2.88 million individuals of this species estimated in the East Asian Flyway population). This outcome is a function of the appropriate macro-scale siting of the proposal, whereby the development envelope has been set back from the coast during the site option evaluation process, mitigating the potential impact on migratory shorebirds through avoidance. The overall findings of this review are that virtually all of the migratory shorebird species, individuals, and avifauna values associated with Eighty Mile Beach Ramsar site are unlikely to be impacted by the proposal.

Although very few records were obtained from the development envelope, it is still possible that migratory shorebirds overfly the area when traveling to southern Australia. It is also possible that some waterbirds may cross the development envelope during the intermittent years that the Mandora Marsh fills, if other ephemeral water bodies south of the development envelope also fill during the same periods. If these bird movements do occur, the available data from both onsite observations and the literature suggest it is likely that they will be travelling at heights considerably above that of the wind turbine rotors' topmost swing.

This low risk of collision impacts is even further reduced by the best practice design of the wind farm itself: the turbines are separated by approximately 800 m and the rows of turbines have spacing provisioned for in excess of 4 km – considerably exceeding recommendations from past reviews of wind farms in regard to providing clear space for bird movement.

This already low risk profile for significant avifauna impacts will be further mitigated by the 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 on approach. Lastly, a comprehensive avifauna impacts monitoring programme will provide feedback to the operations to allow for continuous refinement and improvement of contingency protocols as required.

Given the above, the EPA's objective for the Terrestrial Fauna factor can be met.

Social Surroundings

The Social Surroundings factor incorporates consideration of visual amenity, noise and heritage matters. The initial site selection and design for the proposal has already incorporated a range of mitigation measures to avoid and reduce the potential adverse impacts on landscape and visual amenity, including:

- Site selection and siting considerations:
  - avoiding significant landscapes and National Parks;
  - setting the project well back from dwellings; and
  - setting the project well back from well known tourist destinations.
- Other site design criteria used to minimise any potential impacts include:
  - using similar types of turbines to keep uniformity of design;
  - using similar types of solar PV panel arrangement to keep uniformity in design;
  - adopting a minimum 15 km buffer distance to neighbouring residences;
  - adopting a 10 km buffer from the Great Northern Highway;
  - using modern turbine designs with three blades that spin slowly; and
  - using matt finish paint and appropriate colouring for the wind turbines.

The assessment undertaken for this ERD shows that there will be negligible negative visual effect on the regional or local landscape quality, mainly as a function of the large separation distance of the wind turbines from the few nearby sensitive receivers.

The situation with potential noise impacts is similar. Modelling shows that the expected noise generated by the wind turbines would be below 35dB at a range of approximately 2 km from a row of turbines. Given that the 15 km separation distance from the turbines to the nearest sensitive receiver is well in excess of this, noise is not considered a significant potential impact on social surroundings.

The potential impact to cultural heritage from the proposal relates to the risk of disturbance or destruction of known or unknown Aboriginal sites or objects during construction and operation activities. The current conceptual design for the proposal has been refined to avoid all previously known or newly discovered sites. As such, these sites will be avoided by all construction and operation activities, resulting in negligible risk of impacts to cultural heritage. Additional mitigation will be implemented by the proponent in the event that any currently unknown sites are identified during future surveys, with further modifications to the infrastructure layout to avoid impacts during the detailed design stage.

Given the above outcomes, the EPA's objective for the Social Surroundings factor can be met.

Matters of National Environmental Significance (MNES)

Potential impacts on three of the relevant MNES for this proposal have been effectively considered under preliminary key factors for the State assessment, with the relevant values of the Ramsar wetlands, Listed threatened species and communities, and Listed migratory species MNES effectively addressed under the key factors of Marine Environmental Quality, Marine Fauna, Flora and Vegetation and Terrestrial Fauna.

The outcomes in regard to potential impacts on these key factors, including the aspects of these factors that represent MNES and their mitigation, have been detailed above. Direct impacts on the Eighty Mile Beach Ramsar site will be very minor and transitory, being limited to trenching of the transmission cables, with no impacts on the Mandora Marsh part of the Ramsar site. Potential impacts on migratory shorebirds utilising the Ramsar site have been summarised in detail above, and are largely mitigated through avoidance, with the development envelope situated 13 km from Mandora Marsh and 26 km from Eighty Mile

Beach itself at its closest point. Potential impacts on marine fauna listed under the EPBC Act during cable installation are predicted to be non-significant and operational impacts potentially arising from electromagnetic field and heat generation will be mitigated through cable burial. Lastly, direct impacts on flora and fauna species listed as MNES (*Seringia exastia*, Black-footed Rock-wallaby and Bilby), will be completely avoided or effectively mitigated in the implementation of the proposal, as set out in detail earlier.

In regard to the fourth and final MNES, Commonwealth marine areas, the proposal as referred and determined to be a controlled action, is limited to Western Australian State Waters. The current proposal does not extend into any Commonwealth marine areas. Given that the conclusions of this ERD are that there will be no significant impacts on benthic communities or marine environmental quality even locally within State waters, there is no reasoned basis on which to predict any significant impact from the proposal on Commonwealth marine areas further offshore.

As this ERD concludes that there are no significant residual impacts on any of the controlling provisions for the assessment, no environmental offsets are required under the EPBC Act. This outcome is largely a function of the proponent's observation of the mitigation hierarchy from the early stages of project development and during conceptual design, as detailed above.

Conclusion

The proposal will also deliver significant economic benefits to the State, underpinned by a project that is inherently sustainable in its nature. Approximately A$21B of the project capital expenditure will be deployed in Western Australia, approximately A$6.8B of which is expected to be spent directly on Australian company equipment and services during construction. During operation, approximately A$300M will be spent every year in the State, resulting in A$15B of spending during the project lifetime.

Beyond the economic business case for the proposal as a means to generate cheap and clean energy, it has the benefit of being completely renewable and CO_2 emissions free. This means that for every megawatt hour (MWh) of wind or solar energy produced, up to 0.84 tonnes of CO_2 would be displaced that would have otherwise been emitted into the atmosphere from fossil fuel power stations. Given the expected production of ~55 TWh of clean energy each year from the project, that would equate to annual emissions savings of ~46 million tonnes of CO_2. Over the 50-year life of the project this would be the equivalent of 2.3 billion tonnes of CO_2.

The proposal is therefore an excellent example of a renewable energy development that has the potential to provide significant environmental, social and economic benefits at state, national and global scales. The proposal will make a major and sustained contribution to Western Australia's economy, within a land setting that is currently unutilised for virtually any other economic land use, and without impacting any Aboriginal heritage values.

These intergenerational benefits can be delivered with no significant impacts on either the Eighty Mile Beach Marine Park or Ramsar site, and the loss of less than 2% of the vegetation and fauna habitats within the development envelope; including avoidance or effective mitigation of impacts on species and communities of conservation significance.

Table 3: Summary of potential impacts, proposed mitigation and outcomes.

Benthic Communities and Habitat	
EPA Objective	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017); • Statement of Environmental Principles, Factors and Objectives (EPA 2015); • Environmental Factor Guideline: Benthic Communities and Habitats (EPA 2016e); • Technical Guidance - Protection of Benthic Communities and Habitats (EPA 2016f); and • Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (EPA 2016g). **Other Policy and Guidance** • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000); • A Directory of Important Wetlands in Australia (Department of the Environment 2000); • Eighty Mile Beach Marine Park Management Plan 80 2014 – 2024 (Department of Parks and Wildlife 2014); • Western Australian Marine Science Institute Dredging Science Node Reports https://www.wamsi.orq.au/dredqinq-science-node/dsn-reports; • WA Environmental Offsets Policy (Government of Western Australia 2011); • WA Environmental Offsets Guidelines (Government of Western Australia 2014); • EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities, 2012); and • Commonwealth Offsets Assessment Guide (DSEWPaC 2013).
Potential Impacts	• Direct disturbance to 15.3 ha of the seabed during transmission cables lay or pull-up. • Temporary increase in water column turbidity during cable lay or pull-up. • Release of sediment contaminants. • Hydrocarbon spills and waste generation from vessels. • Introduced marine species from vessel biofouling or ballast water.
Mitigation	**Avoid** • Transmission cable corridor option selection resulted in a shorter crossing of the Eighty Mile Beach Marine Park, and at a location where there are no benthic habitats and communities of significance. • Cable installation method will result in it being buried to a depth of 5-10 m below the seabed and there will therefore be no ongoing operational impacts on benthic habitats.
	Minimise • Limiting seabed disturbance to 15.3 ha of bioturbated sediments and sands (0.3% by area of a benthic habitats and communities local assessment unit, and <0.01% by area of Eighty Mile Beach Marine Park). • Procedures and navigational controls to ensure that cable installation only occurs within the surveyed cable corridor as part of the proposal CEMP.
	Rehabilitate • The cables will be buried beneath the seabed immediately after installation, reinstating the seabed sediments.
Outcomes	**Residual Impact** As the prevailing high-energy tidal regime of the region causes naturally turbid coastal waters, the small scale and localised disturbance of bioturbated sediments is not considered to be ecologically significant.
	Offset As there are no significant residual impacts on the Benthic Habitats and Communities factor, offsets are not required.

Marine Environmental Quality	
EPA Objective	To maintain the quality of water, sediment and biota so that environmental values are protected.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017); • Statement of Environmental Principles, Factors and Objectives (EPA 2015); • Environmental Factor Guideline: Marine Environmental Quality (EPA 2016h); and • Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (EPA 2016g). **Other Policy and Guidance** • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000); • Eighty Mile Beach Marine Park Management Plan 80 2014 – 2024 (Department of Parks and Wildlife 2014); and • Aquatic Biosecurity Policy 19 January 2017 (Department of Fisheries 2017).
Potential Impacts	Potential impacts during cable installation, maintenance, operation and decommissioning may include: • release of sediment contaminants; • hydrocarbon spills and waste generation from vessels; and • introduced marine species from vessel biofouling or ballast water. Potential impacts during the operational phase of the proposal relating to the operating HVDC cables themselves may involve: • chlorine formation during monopole operation; and • sediment contamination related to cable deterioration.
Mitigation	**Avoid** • Contamination arising from seabed disturbance has been avoided as the route traverses an area with no history of urban or industrial development. • As only the cathode will be located within the development envelope, no potentially harmful chemicals will be produced. Anodes will not be located within 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. • Burial of the cables to a depth of 5-10 m below the seabed will result in negligible cable weathering due to wave action or currents.
	Minimise • Hydrocarbon use and waste will be appropriately managed via housekeeping and spill prevention processes in the proposal CEMP. • Each vessel's operational history, fouling control and ballast water details will be audited to confirm they are accurate and reliable before contracting vessels. This process will involve completing the DPIRD risk assessment once the proposed cable lay or maintenance vessels have been identified. All work vessels will comply with the current Department of Fisheries Aquatic Biosecurity Policy (Department of Fisheries 2017) and vessel management procedures in line with Australian Government marine pest management guidelines (Department of Agriculture and Water Resources 2009). • The low risk of cable deterioration will be further managed through the implementation of a maintenance schedule during operations.
Outcomes	**Residual Impact** The risk of significant impacts from the release of contaminants from sediments and chlorine generation are negligible. The remaining three potential impacts: • hydrocarbon spills and waste generation from vessels; • contamination related to cable deterioration; and • introduced marine species, will all be managed through well-established and understood mitigation measures as part of the CEMP, such that the residual risk of any significant impacts is low.
	Offset As there are no significant residual impacts on the Marine Environmental Quality factor, offsets are not required.

Marine Fauna	
EPA Objective	To protect marine fauna so that biological diversity and ecological integrity are maintained.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017); • Statement of Environmental Principles, Factors and Objectives (EPA 2015); and • Environmental Factor Guideline: Marine Fauna (EPA 2016i). **Other Policy and Guidance** • A Directory of Important Wetlands in Australia (Department of the Environment 2000); • Eighty Mile Beach Marine Park Management Plan 80 2014 – 2024 (Department of Parks and Wildlife 2014); • Marine bioregional plan for the North-west Marine Region (DSEWPaC 2012); • Aquatic Biosecurity Policy 19 January 2017 (Department of Fisheries 2017); • Relevant Commonwealth recovery plans, conservation advice and/or threat abatement plans; • WA Environmental Offsets Policy (Government of Western Australia 2011); • WA Environmental Offsets Guidelines (Government of Western Australia 2014); and • EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012).
Potential Impacts	Potential impacts may occur during the construction phase of the project as a result of: • introduced marine species from vessel biofouling or ballast water; • hydrocarbon spills and waste generation from cable installation and maintenance vessels; • disturbance from vessel movements (collisions/noise), both in relation to international shipping for the project and cable installation vessels; • direct disturbance of beach nesting areas for marine turtles; and • behaviour modification from artificial lighting on vessels. The potential impacts of the first two potential impacts, introduced marine species and hydrocarbon spills, have been addressed earlier under the Marine Environmental Quality factor above. During the operational phase of the proposal, potential impacts arising from the operating HVDC cables themselves may include: • electromagnetic field generation during cable operation; and • heat dissipation during cable operation.
Mitigation	**Avoid** • All international shipping to deliver turbine components for the project from overseas will be via existing commercial ports on the Pilbara coast, with the most likely destinations being Port Hedland and Dampier. Components will then be trucked from the ports to the development envelope. International freight vessel movements within the Eighty Mile Beach Marine Park have been avoided, and Port Hedland and Dampier are existing commercial ports with numerous daily heavy shipping movements, including through international shipping lanes further offshore. The delivery of components for the project will represent an incremental increase on existing vessel movements only, with no risk of new impacts on marine fauna in the Eighty Mile Beach Marine Park. • As the strength of both magnetic and electric fields rapidly declines as a function of distance from the cable, exposure of marine species to EMF can be eliminated by cable shielding and burial to adequate depth, with the 5-10 m burial depth of the proposed cables avoiding this potential impact. • The installation, maintenance and decommissioning of cables will only occur during the period March to July, avoiding the peak turtle nesting and hatchling emergence periods. • The primary mitigation of behavioural impacts from artificial lighting will be avoidance, both by staging cable works to avoid peak turtle nesting period, and by managing cable works such that they are preferentially conducted during daylight hours. • The principal mitigation for potential impact of heat generation on marine fauna also follows the mitigation hierarchy, with avoidance through burial of the cable to a depth of 5-10 m below the seabed.

Mitigation (continued)	**Minimise** • Marine fauna observation and avoidance management measures will be implemented as part of the proposal CEMP to ensure vessel strikes or entanglement of marine fauna are avoided. • In the event that work is required after sunset, the potential impact of artificial lighting can be mitigated through the implementation of appropriate management as part of the proposal CEMP to ensure there is no unnecessary external lighting and that light spill is minimised.
Outcomes	**Residual Impact** With the implementation of the mitigation hierarchy in respect of direct disturbance to marine turtles, and EMF and heat dissipation from the cable through avoidance of these potential impacts by burying the cable, the residual risk of these mechanisms presenting any significant impacts to marine fauna is low. The remaining two potential impacts: • marine fauna disturbance from vessels during cable works; and • behavioural modifications in marine turtles due to artificial lighting during cable works, are also at low risk of significant impact on marine fauna, but will still be managed through well-established and understood mitigation measures, such that the residual risk of any significant impacts is again low.
	Offset As there are no significant residual impacts on the Marine Fauna factor, offsets are not required at State or Commonwealth levels.
Flora and Vegetation	
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017). • Statement of Environmental Principles, Factors and Objectives (EPA 2015). • Environmental Factor Guideline: Flora and Vegetation (EPA 2016j). • Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a). • Environmental Protection Bulletin 20 - Protection of naturally vegetated areas through planning and development (EPA 2013). • Guidance Statement 6 – Rehabilitation of Terrestrial Ecosystems (EPA 2006). • EPA Instructions on how to prepare EP Act Part IV Environmental Management Plans (EPA 2018a). **Other Policy and Guidance** • Environmental, health, and safety guidelines for wind energy (World Bank Group 2015). • WA Environmental Offsets Policy (Government of Western Australia 2011). • WA Environmental Offsets Guidelines (Government of Western Australia 2014). • EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012).
Potential Impacts	The potential impacts on flora and vegetation arising from the proposal include: • Permanent clearing of 11,962 ha of vegetation within the 660,686 ha within the development envelope to accommodate the proposal infrastructure. • Temporary clearing of 612.4 ha during construction for short-term use as laydown areas and the burial of transmission cables approaching the coast, including 0.2 ha of the Eighty Mile Land System PEC. • Potential direct clearing impacts on populations of *Seringia exastia* (State: Threatened; EPBC Act: Threatened (Critically Endangered)); • Potential direct clearing impacts on populations of one Priority 1 species and seven other Priority listed species; • Deployment of plant and equipment into the development envelope from other locations where introduced flora or soil pathogens may be present, and a consequent risk of weed introduction and spread during earthworks and construction activities; • Other impacts typically associated with construction and operations, such as risk of project-induced bushfires and off-road driving impacts on vegetation; and • The long-term (approximately 50 years) 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.

Mitigation	**Avoid** • The avoidance of potential direct clearing impacts on all currently known populations of *Seringia exastia* (State: Threatened; EPBC Act: Threatened (Critically Endangered)), with provision for further detailed design and modification to ensure avoidance in the final design. • Equivalent avoidance of direct clearing impacts on the Priority 1 species *Tephrosia rosea* var. Port Hedland (A.S. George 1114).
	Minimise • Limiting permanent clearing to the minimum necessary for the implementation of the proposal, such that the clearing will represent 1.81% of the development envelope by area, and all of the vegetation types within the main development envelope have in excess of 98% of their current mapped extent retained with the implementation of the proposal. • Selection of a transmission corridor route with minimal temporary clearing impacts on the overall extent of the Eighty Mile Land System PEC, such that 0.2 ha will be temporarily cleared, representing less than 0.01% of the PEC's total extent by area. • Minimising direct impacts on more widespread Priority 3 species through refinement of the conceptual design to avoid them where practicable as a best practice approach. • Development and implementation of a CEMP, addressing: o Comprehensive weed hygiene management: all plant and equipment brought on to the site will be required to be free of vegetation and soil to ensure the risks of weed introduction are minimised. This will include the creation of formalised clean down points prior to plant and vehicles entering site. A weed monitoring and control programme will be developed to address all construction areas to promptly identify and control any new infestations which may still arise during construction. o Vegetation clearing control measures: definition of clearing limits on all design drawings and specifications, surveying in these limits in the field and erecting bunting or other clear boundary markers on-site. Vegetation clearing will constitute a hold point requiring written authorisation from the Site Superintendent prior to proceeding. o Topsoil management protocols: site-specific topsoil management protocols will be prepared to facilitate maximum use of topsoil in rehabilitation works. Rehabilitation of non-permanent disturbed areas will initially focus on recovery and recruitment from soil seedbanks and stockpiled vegetative material, with additional seeding using locally occurring native species in the event that monitoring shows slow rehabilitation success. o Additional rehabilitation protocols: including specific consideration of Priority flora where appropriate, erosion control and dune stabilisation where required. o Rehabilitation and weed monitoring and contingency measures. o Bushfire Risk Management: the risks of construction related fires will be minimised by measures such as controlled procedures for any welding and grinding activities, inspection of the exhausts of any clearing equipment and the use of spark suppressors on any generating equipment on site. A fire emergency response plan will be prepared to the satisfaction of the Shire of East Pilbara and FESA. o Other general construction site matters such as waste management, management and workforce environmental inductions.
	Rehabilitate • Progressive rehabilitation of temporary clearing of 612.4 ha during construction for short-term use as laydown areas and the burial of transmission cables approaching the coast, including the disturbance to the Eighty Mile Land System PEC. • The proposal will result in the large-scale partitioning of the landscape into 'blocks' of vegetation separated by significant distances as a result of access roads and other cleared areas acting as fire breaks. Each area will be very extensive expanses of vegetation in its own right; on average approximately 5 km wide by 30 km in length (~15,000 ha). This will result in a change to the current fire regime, but rather than considering this a negative impact of the proposal, it is more appropriately viewed as a positive opportunity to implement fire management for biodiversity objectives, in a currently unmanaged landscape where large-scale wildfires reduce vegetation diversity and overall resilience to other perturbations.
Outcomes	**Residual Impact** The principal impact of the proposal on flora and vegetation will be the permanent clearing required of 11,962 ha that is required to construct the project infrastructure. Almost all of the vegetation types to be cleared are not of elevated conservation significance and the impact of the cable trenching on the Eighty Mile Land System PEC (vegetation type S1) is not significant at 0.2 ha of temporary clearing compared to its 42,259 ha overall extent. The two vegetation types that will be subject to the greatest clearing for the proposal, S2 and P3 (Section 4.6.5.1), are also the most extensive within the development envelope and more than 98% of their mapped extent will remain intact, such that their conservation status would not change as a result of the proposal.

Outcomes (continued)	Potential clearing impacts on known populations of the Threatened *Seringia exastia* and the Priority 1 *Tephrosia rosea* var. Port Hedland (A.S. George 1114) will be avoided in the current conceptual design, with further certainty on outcomes delivered by pre-construction targeted surveys and additional design refinement to avoid impacts if needed. Other Priority flora will also be avoided in the design where practicable and the data on the new populations from the assessment of the proposal will contribute to improved knowledge on their distribution. No significant impacts on flora of conservation significance would be predicted. The remaining potential impacts: • risk of weed introduction and spread; and • risk of project-induced bushfires, are also at low risk of significant impact on flora and vegetation values, and will be managed through well-established and demonstrated mitigation measures as part of the CEMP, such that the residual risk of any significant impacts is again low. Lastly, a comprehensive Fire Management Plan will be developed and implemented, including the use of mosaic burning similar to how traditional owners managed the land for tens of thousands of years. This will have the joint objectives of biodiversity enhancement and infrastructure and personnel protection, and offers an opportunity to significantly improve flora and vegetation diversity and resilience at a landscape scale compared to current unmanaged conditions.
	Offset As there are no significant residual impacts on the Flora and Vegetation factor, offsets are not required at State or Commonwealth levels.
Terrestrial Fauna	
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017); • Statement of Environmental Principles, Factors and Objectives (EPA 2015); • Environmental Factor Guideline: Terrestrial Fauna (EPA 2016k); • Technical Guidance - Terrestrial Fauna Surveys (EPA 2016d); • Technical Guidance: Sampling methods for terrestrial vertebrate fauna (EPA 2016b); • Technical Guidance - Sampling of short range endemic invertebrate fauna (EPA 2016c); and • EPA Instructions on how to prepare EP Act Part IV Environmental Management Plans (EPA 2018a). **Other Policy and Guidance** • Interim guideline for preliminary surveys of night parrot *(Pezoporus occidentalis)* in Western Australia (DBCA 2017a); • Environmental, health, and safety guidelines for wind energy (World Bank Group 2015); • Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011); • Significant impact guidelines for 36 migratory shorebird species (EPBC Act Policy Statement 3.21) (DEWHA 2009a); • Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Commonwealth of Australia 2017); • Wildlife Conservation Plan for Migratory Shorebirds (Department of the Environment and Heritage 2006); • WA Environmental Offsets Policy (Government of Western Australia 2011); • WA Environmental Offsets Guidelines (Government of Western Australia 2014); • EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012); and • Relevant Commonwealth recovery plans, conservation advice and/or threat abatement plans.
Potential Impacts	The potential impacts on terrestrial fauna arising from these aspects of the proposal include: • Clearing of 11,962 ha of fauna habitats present within the development envelope to accommodate the proposal infrastructure; • 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); • Construction and operation of up to 1,743 wind turbines, in rows over 4 km apart across the development envelope, spaced at approximately 800 m intervals within the rows, including connected distribution and transmission pylons and cables;

Potential Impacts (continued)	• Potential for impacts to migratory shorebirds, other avifauna or bats through interaction with wind turbines and distribution and transmission pylons and cables; • Risk of weed introduction and spread during earthworks and construction activities, modifying fauna habitats; • Other impacts typically associated with construction and operations impacts, such as risk of project-induced bushfires and off-road driving; • Potential for increased feral fauna movement through the landscape; and • The long-term (approximately 50 years) 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.
Mitigation	**Avoid** • 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. • Development and implementation of prescribed burning of blocks of habitat adjoining works areas ahead of planned construction periods to make them attractive and suited to Bilby, with subsequent burning of the construction areas in advance of earthworks commencing to displace Bilby into the adjoining, suitable fire age habitat blocks. Targeted pre-clearance surveys monitoring for Bilby to assess the effectiveness of the fire management approach to passively relocating Bilby out of planned works areas, with the provision for the development of additional active management measures specific to the species if needed, ahead of the commencement of clearing works. • Limiting permanent habitat clearing to the minimum necessary for the implementation of the proposal, such that the clearing will represent 1.81% of the development envelope by area, and all of the habitat types within the main development envelope have in excess of 98% of their current mapped extent retained with the implementation of the proposal. • 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 13 km from the Mandora Salt Marsh), significantly reducing the risk of shorebird interaction with turbines. • Scheduling of cable installation through the coastal zone to avoid disturbance during seasonal activity peaks at Eighty Mile Beach for migratory shorebirds.

	Minimise
	• Limiting permanent habitat clearing to the minimum necessary for the implementation of the proposal, such that the clearing will represent 1.81% of the development envelope by area, and all of the habitat types within the main development envelope have in excess of 98% of their current mapped extent retained with the implementation of the proposal.
	• Specific recognition of the confirmed Priority fauna species in the CEMP measures where relevant, and avoidance of known records in the project design where practicable.
	• Development and implementation of a CEMP addressing:
	  o Comprehensive weed hygiene management.
	  o Habitat clearing control measures.
	  o Rehabilitation protocols.
	  o Erosion control and dune stabilisation if required.
	  o Rehabilitation and weed monitoring and contingency measures.
	  o General construction site matters such as waste management, fire risk management and workforce environmental inductions.
	  o Targeted feral fauna monitoring and control in areas of higher risk.
	• Design and implementation of a landscape-scale Fire Management Plan for the development envelope for the operational life of the proposal.
	• 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-footed Rock-wallaby populations.
	• Various aspects of the conceptual design of the wind farm and individual turbines can contribute to reducing the risk of avian mortality. In the context of the current proposal, the mitigation incorporated comprises:
	  o Design of turbine tower: Many authors report that more birds have historically been killed around older lattice style turbines than solid structure turbines. This has been attributed to birds, particularly raptors, using the turbines as attractive perching and or nesting locations, increasing the likelihood of rotor collision. Irrespective of the final model selected, the turbines to be used for the proposal will incorporate solid towers.

Mitigation (continued)	○ Size of turbines: Large turbines are more visible and have lower blade rotational speeds than smaller turbines. Collision rates also appear to be related to ease of visibility. Large turbines with low rotational speeds, like those to be used in the proposal, are more visible to avifauna than smaller turbines. ○ Spacing between turbines: Past assessments have found that the greater the spacing between turbines, the fewer the diversionary responses by birds and the greater frequency with which birds flew between turbines without incident. The conceptual design for the proposal has turbines very widely spaced, approximately 800 m apart along a row and over 4 km between rows, consistent with this best practice. ○ Provision of visibility enhancement devices on all overhead distribution and transmission cables. • Design and implementation of an avifauna impacts contingency management plan, including: ○ Incorporation of bird radar monitoring to detect significant sized flocks of birds approaching the wind farm in advance, with automated alert responses triggered such that the full-time operational staff in the project control compound can respond. ○ High definition video cameras with live feeds, which will be reviewed by personnel in the operations control compound. ○ Protocols to shut down the operation of individual turbines or groups of turbines for periods when flocks are passing, based on both bird radar and high definition video monitoring. ○ Maintaining records of the number of major flocks of shorebird or waterbirds that have been detected and resulted in temporary shut downs, including the locations at which turbines were braked and the path the flock followed. ○ Inclusion of an adaptive management element, feeding back information from the project avifauna monitoring program to refine protocols. • Design and implementation of an avifauna impacts monitoring programme, documenting baseline use of the development envelope by migratory shorebirds and other avifauna, any local movement patterns that may be identified, with equivalent monitoring and collection of avifauna data post-commissioning of the turbines, including best practice estimation of actual mortality rates using current techniques.
	Rehabilitate • Progressive rehabilitation of temporary clearing of 612.4 ha used during construction for short-term use as laydown areas and the burial of transmission cables approaching the coast, including the disturbance to the Eighty Mile Land System PEC. • The proposal will result in the large-scale partitioning of the landscape into 'blocks' of vegetation separated by significant distances as a result of access roads and other cleared areas acting as fire breaks. Each area will be very extensive expanses of vegetation in its own right; on average approximately 5 km wide by 30 km in length (~15,000 ha). This will result in a change to the current fire regime, but rather than considering this a negative impact of the proposal, it is more appropriately viewed as a positive opportunity to implement fire management for biodiversity objectives, in a currently unmanaged landscape where large-scale wildfires reduce vegetation diversity and overall resilience to other perturbations.
Outcomes	**Residual Impact** ***Ground Fauna Outcome*** None of the fauna habitats to be cleared are of elevated conservation significance. The habitat types that will be subject to the greatest clearing for the proposal are also the most extensive within the development envelope and more than 98% of their mapped extent will remain intact, such that their conservation status would not change as a result of the proposal. Similar habitats are also very widespread in the region outside of the development envelope, and are very likely to support a similar faunal assemblage. Potential clearing impacts on the Black-footed Rock-wallaby population present in the development envelope have been, and will continue to be, completely mitigated through avoidance by modification of the proposal design. Potential direct impacts on the Bilby during construction will be mitigated via fire management, supported by pre-clearance targeted surveys to validate the effectiveness of the approach and provisioning of contingency management if required. Fire management will benefit the populations of both species, providing for improved landscape heterogeneity, which will also serve to buffer the resilience of the overall vertebrate fauna assemblage in the >98% of the development envelope habitats that will remain intact. No significant impacts on fauna of conservation significance, or the assemblage generally, would therefore be predicted to arise from habitat removal, clearing activities or changed fire regimes. ***Avifauna Outcome*** The available data indicate that the risk of significant impact on migratory shorebirds from the wind turbines element of the proposal is acceptably low. The findings of this assessment reconfirmed the ecological importance of both Eighty Mile Beach and Walyarta Conservation Park to avifauna, with an overall total of 95,609 migratory shorebird and waterbird individuals recorded across the two sites, including 34 species of conservation significance. By comparison, just a single migratory shorebird species, the Oriental Pratincole, was recorded from the development envelope from 35 individuals (of the 2.88 million individuals of the species estimated in the East Asian Flyway population). This is a function of the appropriate macro-scale siting of the proposal, whereby the development envelope has been set back from the coast during the site option evaluation process, mitigating the potential impact on migratory shorebirds through avoidance.

	Although very few records were obtained from the development envelope, it is still possible that migratory shorebirds overfly the area when traveling to southern Australia. It is also possible that some waterbirds may cross the development envelope during the intermittent years that the Mandora Marsh fills, if other ephemeral water bodies south of the development envelope also fill during the same periods. If these bird movements do occur, the available data from both onsite observations and the literature suggest it is likely that they will be travelling at heights considerably above that of the wind turbine rotors' topmost swing. This low risk of collision impacts is even further reduced by the best practice design of the wind farm itself: the turbines are separated by approximately 800 m and the rows of turbines have spacing provisioned for in excess of 4 km – considerably exceeding recommendations from past independent reviews of existing wind farms in regard to providing clear space for bird movement. This already low risk profile for significant avifauna impacts will be further mitigated by the 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 on approach. Lastly, a comprehensive avifauna impacts monitoring programme will provide feedback to the operations to allow for continuous refinement and improvement of contingency protocols as required.
	Offset As there are no significant residual impacts on the Terrestrial Fauna factor, offsets are not required at State or Commonwealth levels.
Social Surroundings	
EPA Objective	To protect social surroundings from significant harm.
Policy and guidance	**EPA Policy and Guidance** • Instructions on how to prepare an Environmental Review Document (EPA 2017); • Statement of Environmental Principles, Factors and Objectives (EPA 2015); • EPA Environmental Factor Guideline: Social surroundings (EPA 2016l); and • EPA Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans (EPA 2018a). **Other Policy and Guidance** • *Aboriginal Heritage Act 1972*; • Visual Landscape Planning in Western Australia: a manual for evaluation, assessment, siting and design (WAPC 2007); • Planning Bulletin 67 Guidelines for Wind Farm Development (WAPC 2004); • Environmental, health, and safety guidelines for wind energy (World Bank Group 2015); • National Wind Farm Commissioner website, https://www.nwfc.qov.au/, Australian Government; • Aboriginal Heritage Due Diligence Guidelines (Department of Indigenous Affairs and Department of Premier and Cabinet 2013); and • EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012).
Potential Impacts	***Visual*** • Given the temporary nature of construction and decommissioning activities and the development envelope's distance from the identified sensitive receivers, these activities will not have a measurable impact on visual amenity. • The same is true of potential shadow flicker and glinting impacts from the wind turbines since their effects are very localised and none of the local dwellings are close enough for those effects to be a significant consideration. • The primary potential visual and landscape impact from the proposal therefore relates to the operational phase of the project, and the presence and operation of the wind turbines in particular in changing the existing viewsheds from key locations. ***Noise*** • Potential Impacts from noise can arise during operational activities and during construction, major maintenance and decommissioning. • 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. ***Heritage*** • The potential impact to cultural heritage from the proposal relates to the risk of disturbance or destruction of known or unknown Aboriginal sites or objects during construction and operation activities.

Mitigation	**Avoid**
	• In the initial site selection and design the proponent has already incorporated a range of mitigation measures to avoid and reduce the potential adverse impacts on landscape and visual amenity, including:
	  o Site selection and siting considerations:
	  o avoiding significant landscapes and National Parks;
	  o setting the project well back from dwellings; and
	  o setting the project well back from well know tourist destinations.
	• The primary mitigation adopted by the proponent was to eliminate the risk of noise impacts from the outset by selecting a site that was far from existing sensitive receivers, adopting a minimum 15 km buffer distance to neighbouring residences.
	• Noise modelling shows that the expected noise generated by the wind turbines would be below 35dB at a range of approximately 2 km from a row of turbines. Given the separation distance from the turbines to the nearest sensitive receiver is well in excess of this at approximately 15 km minimum, noise is not considered a significant potential impact on social surroundings.
	• The current conceptual design for the proposal has been refined to avoid the previously known or newly discovered sites. As such, these sites will be avoided by all construction and operation activities, resulting in negligible risk of impacts to cultural heritage.
	• If it is determined as a result of further survey that final design overlaps an area of newly discovered archaeological and/or cultural heritage significance, the infrastructure layout will be altered accordingly, if required, to avoid such areas.

	Minimise
	• Construction noise from the proposal will be localised and temporary, and will comply with the *Environmental Protection (Noise) Regulations 1997*.
	• Other site design criteria used to minimise any visual potential impacts include:
	  o using similar types of turbine to keep uniformity of design;
	  o using similar types of solar PV panel arrangement to keep uniformity in design;
	  o using modern turbine designs with three blades that spin slowly; and
	  o using matt finish paint and appropriate colouring for the wind turbines.

Outcomes	**Residual Impact** ***Visual*** The assessment undertaken shows that there will be negligible negative visual effect on the regional or local landscape quality. ***Noise*** The predicted outcome is that there will not be any impact from construction or operational noise on any of the identified sensitive receivers. ***Heritage*** Given the nature of the potential impacts and the mitigation strategies proposed, there is a high degree of confidence that there will not be any significant impacts on cultural heritage from the proposal.
	Offset As there are no significant residual impacts on the Social Surroundings factor, offsets are not required.

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