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Ministerial Services

EPBC 2021/8891

To: Minister for the Environment (for decision)

Clearly Unacceptable Decision – Asian Renewable Energy Hub Revised Proposal, 220 km east of Port Hedland, WA (EPBC 2021/8891)

Timing: As soon as possible – statutory timeframe for decision was 14 June 2021. The delay is due to the requirement for further consultation with the Environment Legal Branch.

Recommendations:

- 1. That you consider the information in this brief and the referral at Attachments D1 – D6.

Considered / Not considered

- 2. That you agree that, on the basis of the information in the referral, it is clear that the action would have unacceptable impacts on the ecological character of a declared Ramsar wetland and on listed migratory species protected under Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Agreed / Not agreed

- 3. If you agree to 2, that you agree that Part 7, Division 1A of the EPBC Act ('decision that action is clearly unacceptable') should apply to the referral.

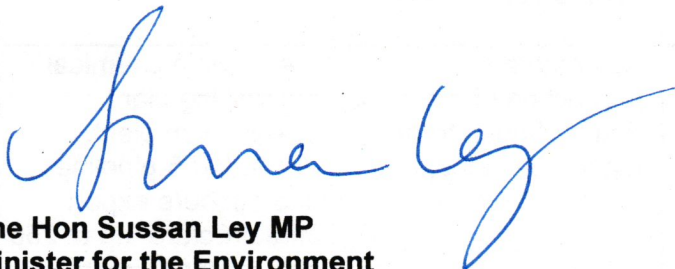
Agreed / Not agreed

- 4. If you agree to 2 and 3, sign the Statement of Reasons at Attachment C if you are satisfied that it reflects your reasoning for the decision.

Signed / Not signed

- 5. If you agree to 2 and 3, sign the notice at Attachment A (which will be published if you make the recommended decision) and the letters at Attachments B1 – B6 informing the person proposing the action and other relevant parties of your decision.

Signed / Not signed



**The Hon Sussan Ley MP
Minister for the Environment**

Date: 15/6/21

Comments:

BACKGROUND:

1. On 13 May 2021, NW Interconnected Power Pty Ltd (the proponent), submitted a valid referral in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
2. The proposed action is to construct a large-scale wind and solar renewable energy project in the shire of East Pilbara, situated approximately 220 kilometres (km) east of Port Hedland, Western Australia (WA) (the proposed action). The project site is 666,030 hectares (ha) in size with a permanent clearing footprint of 20,748 ha.
3. A total of 20,748 ha will be cleared as part of the proposed action, with the key infrastructure components to include:
 - wind turbines and solar arrays
 - downstream processing plants for desalination and production of ammonia and hydrogen
 - marine infrastructure corridor (e.g. pipeline and offshore out loading facility platform with rock armouring)
 - new permanent town
 - transmission and distribution cables, substations, gravel roads, site offices, workshops, and warehouses
4. The proposed action is an expansion to an existing Asian Renewable Energy Hub proposal (EPBC 2017/8112) approved by a delegate of the Minister on 16 December 2020 ([Attachment F1](#)). The proposed action (a revised version of the approved design) is considered by the Department to be a significant increase in scale and potential magnitude of impact compared to the approved project (Table 1). The new components of the proposed action include an infrastructure corridor of pipelines that will transport ammonia (rather than cables that transmit electricity), seawater, and brine through the Eighty-mile Beach Ramsar site; a marine offshore facility to export ammonia; an 8000 person town; expansion of solar arrays, storage evaporation ponds, and heavy industries to support the ammonia and hydrogen production including desalination plant, ammonia production facilities, electrolysis plant, and ammonia/hydrogen storage.

Table 1. Key differences between this proposed action and the original approved proposal. Important to note that the revised proposal figures have been extrapolated from referral information and in some circumstances may be an underestimate of the likely impacts.

	Original Approved proposal (EPBC 2017/8112)	Revised proposal (EPBC 2021/8891)	Change
Export	Direct via undersea electricity cable	Downstream production of ammonia and hydrogen to be loaded on ships.	+ Ammonia chemical processing plant, desalination plant, expanded 5-pipeline and offshore export infrastructure, up to 250 ship calls per year.
Workforce	Fly-in fly-out (FIFO) model	Establishment of a new town for up to 8000 workers within a 2,095 ha development envelope.	+ Permanent new town
Development envelope	662,400 ha	666,038 ha	+ 3,638 ha

	Original Approved proposal (EPBC 2017/8112)	Revised proposal (EPBC 2021/8891)	Change
Permanent clearing	11,962 ha	20,810 ha	+ 8,848 ha (3,380 ha from the town and heavy industrial area)
Temporary clearing	592 ha	492 ha	- 100 ha
Partial clearing (management)	Undefined	12,762 ha	
Seabed disturbance	15.3 ha	345 ha	+ 329.7 ha
Eighty-mile Beach disturbance	0.2 ha	Undefined	
Wind turbines	1,743 turbines 800m apart	1,743 turbines 700m apart	- 100m in-line turbine spacing
Solar	Up to 2,000 MW solar PV in 37 x 55 MW modules	Up to 10,800 MW solar PV in 18 x 600 MW arrays	Fewer, larger arrays

MATTERS FOR DECISION-MAKING

5. While approval for the original proposal has been granted, the Department recommends that, based on the revised components of this proposal (outlined above), you find that the proposed action would have an unacceptable impact on the ecological character of the Eighty-mile Beach Ramsar site (protected under sections 16 & 17B of the EPBC Act) and migratory species (protected under sections 20 & 20A of the EPBC Act).

Ramsar wetlands (s16 & 17B)

Site Description

6. Eighty-mile Beach was designated a Ramsar wetland on 7 June 1990. The Eighty-mile Beach Ramsar site contains two wetland areas that include a 220 km stretch of beach and 4 km wide intertidal mudflats at low tide (the intertidal site), and the Mandora Salt Marsh that is linked to the intertidal site through groundwater but is 40 km inland ([Attachment F4](#), Figure E1). The Eighty-mile Beach Ramsar site meets six criteria for listing as a wetland of international importance.
7. According to the *Information Sheet for the Eighty-mile Beach Ramsar site* ([Attachment F3](#)), the *Ecological Character Description of the Eighty-mile Beach Ramsar Site Report* ([Attachment F4](#)), and the Department's Ramsar Line Area Advice ([Attachment E1](#)), the Eighty-mile Beach intertidal site contains the largest area of continuous intertidal mudflats in Australia's Ramsar estate, which is considered to be in excellent condition (Criterion 1).
8. Eighty-mile Beach Ramsar Site is considered to be the second most important site in Australia, after Roebuck Bay, for migratory shorebird (marine intertidal) and waterbird (wetland and estuary) staging areas along the East Asian Australasian Flyway (EAAF; Criterion 4). This site is considered to be the most internationally important site for nine species of migratory shorebird in the EAAF ([Attachment F10](#)) and supports more than 1% of the flyway population for 21 migratory birds under the Ramsar habitat criteria for wetlands of international importance (Criterion 6). Surveys demonstrate that at least 500,000 migratory shorebirds regularly use the intertidal site during the summer staging period, with over 2.88 million Oriental Pratincoles (or greywaders) (Migratory listed) recorded in February 2004 (Criterion 5).
9. The Eighty-mile Beach Ramsar Site and subtidal habitats are considered to be critical habitat for the Flatback Turtle (*Natator depressus*) for nesting and inter-nesting habitats (Criterion 2).

wetlands within the arid Western Plateau bioregion and the wetlands are recognised as important refugia for biodiversity in arid Australia (Criterion 1). The marsh contains rare and outstanding freshwater peat mound springs, provides habitat for the critical life stages of 13 species of waterbird, and supports the largest inland population of Grey Mangroves lining Salt Creek (Criteria 1, 3 and 4).

11. The key ecological characteristic of the Eighty-mile Beach Ramsar site is the uninterrupted tidal movements and process that replenish nutrients and sediments within the site, which ultimately underpin the foodwebs that support migratory shorebirds and other marine fauna. As outlined in Ecological Character Description of the Eighty-mile Beach Ramsar Site, the limits of acceptable change for key aspects of the ecology of the Eighty-mile Beach Ramsar site without risking the ecological character include *unrestricted tides along the entire length of the beach site, not impacted or modified by any artificial structure* (Attachment F4, Table E3).

Impacts to the Ramsar site

12. The proposed township, heavy industries facility (downstream plant), renewable energy production area and terrestrial infrastructure development is located approximately 13 km south of the Mandora Marshes component and 26 km inland of the coastal component of the Eighty-mile Beach Ramsar site. A proposed marine infrastructure corridor will link the downstream plant (e.g. desalination plant and ammonia production and storage facility) with an offshore export platform via a pipeline that intersects the Eighty-mile Beach Ramsar intertidal site.
13. The terrestrial infrastructure corridor will be ~32 km long, with an additional ~20 km offshore, which involves the installation of 5 pipelines (3 water and 2 ammonia export) that start at the inland downstream plant area and transverses the coastline, across the coastal dunes and the beach, intertidal, and subtidal habitats within the Eighty-mile Beach Ramsar site. The pipelines will be installed in the intertidal and subtidal habitats by creating a trench at least 3 m deep and possibly up to 500 m wide (from shapefile provided by the proponent) and extend out 20 km offshore into Commonwealth waters to an offshore platform that will be equipped with ammonia export buoys (Attachment D3, Figure 2.2). A permanent stringing yard (containing booster pumps) will be placed within the Ramsar site (Attachment D3, Figure 2.2). This marine infrastructure corridor will require temporary terrestrial and intertidal clearing of 492 ha and a permanent offshore disturbance of 346 ha.
14. The impact of this marine infrastructure corridor will exceed the limits of acceptable change for the Eighty-mile Beach Ramsar site as the proposed action would not result in *unrestricted tides along the entire length of the beach site, not impacted or modified by any artificial structure*, which is a key component of the wetlands ecological character (Attachment F4, Table E3). As described in Table 1, the size and extent of the proposed action crossing these habitats is much larger than the original approved project.
15. Installation of the marine infrastructure corridor will restrict tidal movements and processes, which would be *inconsistent with maintaining the ecological character of the wetland and providing for the conservation and sustainable use of the wetland*. Artificial structures, such as piles to support offshore platforms and rock armouring surrounding the platform, are known to change the flow patterns of oceanographic tidal movements, affect sedimentation transport behaviours along a beach and mudflats (e.g. sand, mud and nutrient replenishment along the beach and mudflats would negatively change), and will lead to direct loss of benthic habitat and ongoing scouring impacts (Attachment F11). Even though the modelling has not been undertaken for the proposal, the artificial structures in proposed marine infrastructure corridor will cause a disruption to the tidal movement and processes along the beach for both sand, mud and nutrients, which will negatively impact the ecological character of the Ramsar site.

16. The proposed pipeline will be used to support the desalination plant for both water extraction and diffusing waste brine. Brine from the desalination process is a combination of toxically concentrated salts, heavy metals, and dangerous pre-treatment chemicals that are warmer and denser than seawater. Even though modelling has not been undertaken for the proposal, the amount of seawater proposed to be processed for desalination will result in a large discharge volume of brine. This size of outfall will create a "dead zone" within the Eighty-mile Beach area and given the shallow nature of the bay (10 m) and large tidal movements, the dead zone created by the brine outfall will likely impact a large area directly offshore or even within the Ramsar site during yearly large tidal movements. The risks of this dead zone reaching the intertidal area that supports critical foraging habitat for migratory shorebirds would be catastrophic.
17. Even though the referral information states the pipeline corridor will be buried 3 m below the benthic habitats, studies (Attachment F11 – F13) have demonstrated that scour, wave-current combinations and liquidation of the sediments surrounding the pipelines may lead to floating of the pipelines and scouring surrounding the entire length of the corridor, which may lead to numerous failures of submarine pipelines (Attachment F13). While the cables in the original approved proposal were similarly at risk of being scoured, floating and failures, the contents within the pipelines in this revised proposal will be transporting highly toxic ammonia and brine. The subsea electricity cables were flexible and clearly would not pose a risk of catastrophic spill within the Ramsar site in the event of structural failure.
18. There is also a continuous spill risk from the estimated 250 ship filling events per year. Though likely smaller in volume, these regular spills will result in local toxicity and a dead zone surrounding the export platform.
19. The referral states that the risk of ammonia spills from the plant and pipeline will be mitigated by best practice engineering design, but no spill mitigation and management plans for the proposed action have been provided. However, it has been demonstrated in other situations that even with the best available engineering technology, there would be a risk of spills. For example, the results of a Parliamentary Inquiry found that Yara Pilbara Fertilisers, utilised the best available engineering technology, such as 24-hour leak monitoring, but even so this resulted in 5 spill events in 2016, totaling 8.42 tonnes of ammonia released into the environment in a single year (Attachment F26, Table 3.2). In the present circumstances, due to the remote location, the response time to address a spill would take too long to contain the catastrophic impact of this type of spill. In this type of event, it would result in the loss of most, if not all, of the ecological characteristics of the Eighty-mile Beach Ramsar site.
20. The Department's Wetland section advice (Attachment E1, page 6-9) has summarised the impacts of the proposed action on the ecological character of Eighty-mile Beach Ramsar site according to the *EPBC Significant impact guidelines 1.1* (Attachment F5). The Department has relied on this advice in reaching the view that these impacts to the Eighty-mile Beach Ramsar site would be clearly unacceptable. These have been outlined using four significant impact criteria to include the following:
- *Areas of the wetlands will be destroyed and substantially modified* through the establishment of the marine infrastructure corridor that will result in the modifications of areas of the Ramsar site and these impacts cannot be mitigated or offset. The construction activities will result in the impact and destruction of the mudflats, offshore benthic habitat and communities, macroinvertebrate communities, and other coastal habitats. The pipeline dimensions in this revised proposal are significantly larger than those of the original proposal and now includes the offshore platform and permanent stringing yard that is being proposed to be constructed within the Eighty-mile Beach Ramsar site (Attachment D3, Figure 2.2).

- 1) disruption to tidal flows, caused by the proposed marine infrastructure corridor and offshore marine facility, will impact the deposition and movement of sediments and nutrients that will ultimately impact food webs critical to migratory shorebirds;
 - 2) the marine infrastructure corridor crossing, and associated works area will impact the primary coastal dune system and the 100 kms of discontinuous floodplain immediately inland from the frontal sand dunes; and
 - 3) even small changes to land height from the manufacturing facilities (the ammonia plant and the desalination plant), the town or additional water storages and quarries will capture runoff that currently goes to the marshes or the floodplains behind the dune system.
- *A substantial and measurable change in the physico-chemical status of the wetland through three new main project components:*
 - 1) ammonia production due to the risks with the emissions into the air and spills in water as a result of venting leaks, tank rupture, transfer via pipelines and into vessels and vessel damage. Due to the highly toxic nature of ammonia (the manufacture of which is licensed as a hazardous facility), a large spill would lead to catastrophic mortality of marine flora and fauna (e.g. fish, plankton, shellfish, etc.), fringing vegetation, benthic habitats, and shorebirds. Relevantly, the proposed development is located in a high wind and high storm area with large tides and a highly sensitive and biodiverse marine environment.
 - 2) the development of an 80 Gigalitre (GL) desalination plant, electrolysis plant and evaporation ponds will result in the need to diffuse brine into the marine environment ~10 km offshore using a brine discharge outfall. The Ramsar site normally experiences low salinity, therefore the hypersaline and warm water is likely to impact marine fauna and benthic habitats. Modelling for the brine outfall has not been provided in the referral information, but there is an assumption that due to the high winds and large tidal movements the brine outfall area of impact will likely be large.
 - 3) the manufacturing hub, transport infrastructure, town, food production and industrial activities are highly likely to result in a significant impact on the physico-chemical status of the wetland through the discharge of contaminants, nutrients, and sediments into the Ramsar site.
 - *The habitat or lifecycle of native species dependent on the wetland being seriously affected due to the impacts listed on the intertidal flats and subtidal habitats, which in turn will impact one of the most important staging and feeding areas for migratory shorebirds in the world. These habitats are also critical for Flatback Turtles. Impacts to these species are 4-fold:*
 - 1) light pollution associated with the town and 24-hour operation of the ammonia plant and desalination facility is highly likely to have a significant disruptive impact on the behaviour and life stages and ultimately on survivorship of migratory shorebirds and marine turtles which are critical components of the Eighty-mile Beach Ramsar site;

- 2) air and water pollution from the ammonia production, including the kinds of gaseous emissions referred to at Attachment E1 (page 9), as well as discharges into the ocean via a brine discharge pipeline from the desalination plant. The Wetlands Section advice (Attachment E1, page 9) notes that any changes to the water or air quality is highly likely to have a significant impact on the fauna species dependant on the Ramsar site;
- 3) permanent offshore infrastructure increasing vessel traffic as both a risk for direct mortality and as habitat degradation from both pollutant release and potential for invasive species introduction;
- 4) as a result of the construction of a town, to be populated by 8000 people, there will be an unavoidable risk of significantly greater human disturbance and a significant risk of increased unregulated beach access including by vehicles, boats and domestic animal access, increased beach pollution and increased boat mooring and anchoring.

21. Advice from the Department's Office of Water Science (OWS) has also identified that the proposed action will impact groundwater and surface water flows depending on the final town and industrial area placement (Attachment E3). The proposed action will likely result in cumulative increases in contamination of both surface and groundwater as a result of a permanent town, despite the commitment to wastewater reuse as a mitigation measure (Attachment E3). The industrial area and township are currently proposed to be constructed within the catchment for both the coastal and marsh component of Eighty-mile Beach Ramsar site (Attachment F24). OWS provided rough calculation of the level of extraction that will be required for the proposed action, which equates to 152 (cubic metres) m³/minute of intake and approximately 87 m³/min of discharge. This amount of discharge within the shallow and sensitive environments of the Eighty-mile Beach Ramsar site will result in an impact to marine organisms. Lastly, the OWS also identified the risk that any rupture of ammonia or brine pipelines would have a significant local impact on the sensitive marine environment.

22. The Eighty-mile Beach Ecological Character Description identifies the area as having the highest occurrence of tropical cyclones in the whole of Australia (Attachment F4, Figure 11). The Wetlands Advice additionally identified significant risk with construction and operation of pipelines and offshore out loading facilities in an area subject to high and cyclonic wind conditions (Attachment E1).

Conclusion

23. Section 334 of the EPBC Act provides that, in relation to a wetland that is a declared Ramsar wetland, the Commonwealth and each Commonwealth agency must take all reasonable steps to ensure it exercises its powers and performs its functions in relation to the wetland in a way that is not inconsistent with:
- a) the Ramsar Convention; and
 - b) the Australian Ramsar management principles; and
 - c) if the wetland is included in the List of Wetlands of International Importance kept under the Ramsar Convention and a plan for managing the property has been prepared as described in section 333, that plan.
24. Article 3(1) of the Ramsar Convention provides that parties shall formulate and implement their planning so as to promote the conservation of the relevant wetlands, and as far as possible the wise use of wetlands in their territory.

would have a significant and unacceptable impact on the ecological character of the Eighty-mile Beach Ramsar site because the installation of marine infrastructure would disrupt tidal movements and processes, which would result in the habitats and lifecycle of native species, that are dependent upon the wetland, being seriously affected. The proposed action will also be creating a large dead zone in close proximity to the Ramsar site and will create risks of the Ramsar site being impacted by the brine outfall diffuser, which will seriously impact marine and benthic organisms. Further, the proposed action creates the risk of a toxic spill of ammonia within the Ramsar site, which would have catastrophic ecological consequences. These risks include risks associated with the possible rupture of pipelines containing brine, and risks associated with an increase in salinity in waters in the Ramsar site. The proposed action will also give rise to light, air and water pollution in the Ramsar site, including owing to ammonia production, and the establishment of the proposed town.

26. A number of the more significant impacts associated with the proposed action cannot be mitigated or offset. In particular, the Wetlands Section has advised that the following risks associated with the proposed action cannot be mitigated (Attachment E4, page 2):

- Air and water emissions from the ammonia plant, desalination plant and facilitated infrastructure/construction (evaporation ponds, backup generation, cooling towers, cement making, rock quarrying, etc).
- The facilitated uses and activity associated with a town of 8,000 people.
- The light pollution associated with the town/industrial facilities/marine offshore facility.
- The changes to the water regime of the catchment and the tidal regime of the beach.
- The increased shipping and docking associated with the marine offshore facility and increased traffic (boat and vehicular) as a result of the construction and operation of the marine offshore facility, the industrial complex, the renewable energy hub and the town.

27. The Wetlands Section of the Department has also identified, with high confidence, the following significant risks (Attachment E4, page 2):

- Damage from extreme events leading to a catastrophic impact on the biodiversity of the area and of Eighty-mile Beach Ramsar site, particularly as a result of chemical contamination, industrial debris and damage to water and wastewater infrastructure and pipelines, and shipping spills.
- Challenging disaster recovery efforts due to remoteness and lack of infrastructure and personnel.

Planned and unplanned emissions from ammonia and hydrogen production impacting the biodiversity of the area and the Eighty-mile Beach Ramsar site.

28. The Eighty-mile Beach Ramsar site has a unique combination of permanent and temporary wetlands, unique zoobenthic community and is in excellent condition. It performs a spatially and biologically specialised role that no alternate sites could accommodate in the event of significant impacts to the Eighty-mile Beach Ramsar site.

30. Further, the Department considers that a decision that the proposal is clearly unacceptable is consistent with the Australian Ramsar management principles, which are at Schedule 6 to the *Environment Protection and Biodiversity Conservation Regulations 2000*. In particular, this decision would be consistent with principle 3.04, which provides that an action should not be approved if it would be inconsistent with maintaining the ecological character of the wetland, or providing for the conservation and sustainable use of the wetland.

Migratory Species (s20 & 20A)

Migratory Shorebirds

31. The Eighty-mile Beach site supports a very large number and diversity of shorebirds, with over 100 species using the site, including 7 listed threatened species and an internationally significant population of 21 species of waterbird, including 4 Australian resident species (Attachment F4).
32. Both the *EPBC Act Policy Statement 3.21: Significant Impact Guidelines for 36 Migratory Shorebird Species* (Attachment F15) and the *EPBC Wildlife Conservation Plan for Migratory Shorebirds* (Attachment F9), identify the importance of Eighty-mile Beach Ramsar site as being nationally and internationally significant habitat for migratory shorebirds for staging along the EAAF and providing overwintering habitat for juveniles unable to make the migration. Eighty-mile Beach is the second most important critical habitat in Australia for migratory shorebirds protected under the EPBC Act.
33. The site supports an internationally important population of three species of migratory shorebird listed in Appendix I of the Bonn Convention, which are also listed as threatened species (s 18 & 18A) under the EPBC Act:
- Great Knot (*Calidris tenuirostris*) – critically endangered, migratory
 - Eastern Curlew (*Numenius madagascariensis*) – critically endangered, migratory
 - Red Knot (*Calidris canutus*) – endangered, migratory

Information on the status, habitat requirements, and threats to these species can be found in the relevant Conservation Advices (Attachments F6 – F8).

34. As outlined above in the Ramsar section, the large continuous mudflats (225 km long and 4 km wide) are in excellent condition. The capacity for the Eighty-mile Beach site to support the vast number and array of birds is underpinned by the primary productivity of the site that supports an abundance of macroinvertebrates (Attachment F14), which provide food during low tide for shorebirds and waterbirds. This critical ecological function of the Ramsar site underpins four of the six Ramsar listing criteria (Criterion 2, 4, 5, 6) (Attachment F4).

35. According to the *Analysis of possible change in ecological character of the Roebuck Bay and Eighty Mile Beach Ramsar sites* (Attachment F22), *Migratory Shorebirds of the East Asian - Australasian Flyway; Population Estimates and Internationally Important Sites* (Attachment F10), *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Attachment F23), and *EPBC Wildlife Conservation Plan for Migratory Shorebirds* (Attachment F9), one of the key causes of migratory shorebird decline is the loss of staging habitat. Given migration is energetically expensive, most migratory shorebirds require high quality staging habitats along the migration path where they can feed and replace energy.
36. As outlined above in the Ramsar Section (paragraphs 13, 15), the proposed action will install a marine infrastructure corridor through a critical staging area for migratory shorebirds. Significant disruption to the tidal flows as a result of this infrastructure will impact the deposition and movement of sediments and nutrients, which in turn will impact the foodwebs of the intertidal habitats (e.g. mudflats) that the migratory shorebirds depend upon in this staging area to replace energy stores (Attachment E1, page 6).
37. The Department's Migratory Line Area advice (Attachment E2) and published literature (Attachment F14) have outlined that these critical foodwebs are based on unique zoobenthos communities, including marine macroinvertebrates, which are sensitive to changes in environmental conditions. The proposed action will change environmental conditions in three main ways that will be detrimental to the productivity of these foodwebs, namely including through the acute impacts of ammonia spillage (paragraph 17), the impacts of desalination plant brines (paragraph 16) and the chronic increase in pollutants from the town and new shipping route (paragraphs 18, 20, 21).
38. Other impacts to migratory shorebirds have been identified by the Department's Wetlands Section advice (Attachment E1) include:
- Artificial light and the loss of darkness associated with the town and the 24-hour operation of the ammonia plant and desalination facility is highly likely to have a significant disruptive impact on the behaviour, life stages, and ultimately on survivorship of migratory shorebirds (Attachment E1, page 9);
 - human disturbance resulting from the construction and inhabitancy of the proposed town (Attachment E1, page 8)

Conclusion

39. The importance of the EAAF has resulted in the development of international partnerships, which encompass 22 countries, including Australia, who has taken a lead role in protecting migratory birds and the wetlands which underpin the flyway. These partnerships are supported through Australia being a party to the Bonn Convention (Attachment F19) and the Ramsar Convention (Attachment F20) by bilateral agreements with Japan (JAMBA, Attachment F16), China (CAMBA, Attachment F17) and the Republic of Korea (ROKAMBA, Attachment F18) and as a partner of the East Asian – Australasian Flyway Partnership (EAAFP) (Attachment F21).
40. The Bonn Convention (Attachment F19), Article 2(3)(b) obliges parties to endeavour to provide immediate protection for migratory species included in Appendix 1. Article 3(4) provides further detail in respect of this obligation, requiring Parties that are Range States of a migratory species listed in Appendix I to endeavour:
- a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;

LEX 23611 b) to prevent, remove, compensate for or minimise, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and

c) to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating already introduced, exotic species.

41. As discussed in paragraphs 12 to 22 above, the proposed action would have a significant and unacceptable impact on the Eighty-mile Beach Ramsar site and the migratory species it supports.

42. As identified in paragraph 28, the Ramsar site performs a critical, and irreplaceable role for the migratory shorebirds of the EAAF, there is no alternative site in the event of significant impacts to the Eighty-mile Beach Ramsar site.

43. In the Department's view, in light of the risks of the proposed action to migratory shorebirds using the Eighty-mile Beach Ramsar site, approving the proposed action would result in unacceptable impacts, and would also be inconsistent with Articles 2 and 3 of the Bonn Convention, on the basis that the Eighty-mile Beach Ramsar site is critical habitat for the Appendix I listed migratory shorebirds listed in paragraph 33.

44. Further, given the significance of the Eighty-mile Beach Ramsar site as a staging, breeding and/or refugia site for many migratory species covered by CAMBA, JAMBA and ROKAMBA (the 2nd most important in Australia on the East-Asian Australian Flyway), the Department is also of the view that allowing the proposed action to proceed would not be a good faith implementation of the obligations that Australia has undertaken under CAMBA, JAMBA and ROKAMBA.

Avoidance, Mitigation Measures and Offsets

45. The referral states that the project design will avoid impacts to the Ramsar site and migratory birds by:

- a. Selection of the main development envelope to separate the nearest turbine from the coastal portion of Eighty-mile Beach by 38 km, and from the Mandora Marsh by 13 km.
- b. Scheduling of pipeline installation works to avoid seasonal activity peaks for migratory shorebirds and marine turtles.
- c. Reduction of the habitat clearing footprint during the design stage to the minimum practicable.
- d. Development of a terrestrial environmental management plan and a marine environmental management plan (not yet developed).
- e. Development of an avifauna monitoring program and collection of mortality data post commissioning of the turbines (not yet developed).

46. The Eighty-mile Beach is one of Australia's most important Ramsar sites and is critical habitat for the migratory birds of the EAAF. For the reasons identified in paragraphs 26 and 42, the Department is of the view that there is no alternate site which could be used to offset impacts to the Eighty-mile Beach Ramsar site.

Other protected matters

47. There are other likely significant, and possibly unacceptable impacts to other matters protected under the EPBC Act as a result of this proposed action (Attachment F25). However, it is not necessary to consider these impacts for the purposes of making this decision, and therefore these impacts have not been discussed in this brief.

Recommendation that the likely impacts are clearly unacceptable

48. Under section 74B of the EPBC Act, if you consider that it is clear that the action would have unacceptable impacts on a matter protected by a provision of Part 3, namely Ramsar wetlands (s16 & 17B) and migratory species (s20 & 20A), you can decide that Part 7, Division 1A of the EPBC Act ('decision that the action is clearly unacceptable') should apply to the referral.
49. In deciding whether the proposed action is clearly unacceptable, you are required to make this decision on the basis of information contained in the referral (Attachments D1 – D6). You are also permitted to consider the information contained in this brief, as well as any general information (i.e. not specific to the action) that is part of the Department's existing knowledge or is publicly available information (in certain circumstances), and which is relevant to consideration of the likely impacts of the action. You may not consider other information such as the public comments received during the referral process or undertake an active inquiry in relation to the proposed action.
50. The Department is of the view that the proposed action would have unacceptable impacts on matters protected by provisions of Part 3 of the EPBC Act, namely the matters and provisions referred to at paragraph 5 above. These unacceptable impacts include impacts on the Eighty-mile Beach Ramsar site affecting its ecological character and on the migratory species that these areas support. Unavoidable impacts will arise from:
- significant disruption to the tidal flows as a result of the offshore infrastructure corridor, which will impact the deposition and movement of sediments and nutrients that in turn will impact the foodwebs of the mudflats and coastal area;
 - the continuous release of desalination brines into the ocean adjacent the Ramsar site, and possible movement into the Ramsar site; and
 - habitat degradation from increased anthropogenic disturbance as a result of a permanent township.
51. There is also a daily spill risk from the presence of pipes pumping ammonia to the offshore platform, resulting in local toxicity and deaths of invertebrates and subsequently birds, and a high likelihood of a catastrophic and irreversible ammonia spill due to the weather intensity at the site.
52. In addition to the risk of a catastrophic and irreversible chemical spill, the progressive habitat degradation as a result of increased anthropogenic presence represents an unacceptable impact to the Eighty-mile Beach Ramsar site and the species it supports. The Department is of the view that the proponent will be unable to mitigate these impacts through design or management strategies, (as is relevant to the risk of a chemical spill) due to the remoteness.
53. While the previous iteration of this project was approved, the Department is of the view that the new elements proposed in this referral are such as to make it clear that the action proposed in this referral would have unacceptable impacts on matters protected by provisions of Part 3.
54. The Department therefore recommends that you decide that Division 1A of Part 7 of the EPBC Act should apply to the proposed action.

55. If you decide that the action is clearly unacceptable, section 74C(3) of the EPBC Act states that the proponent may:

- withdraw the referral and take no further action in relation to the proposed action;
- withdraw the referral and refer, under section 68 of the EPBC Act, a new proposal to take a modified action; or
- request, in writing, that you reconsider your decision that the action is clearly unacceptable.

Consultation and handling:

56. The Department's Wetlands Section, Migratory Species Section, Office of Water Science, Commonwealth Marine Parks Section, Heritage Branch and Legal Division were consulted and provided advice in the preparation of this brief. Only those advices that were relevant in making the clearly unacceptable determination have been included in this briefing package.



Kylie Calhoun
Assistant Secretary
Environment Assessments West (WA, SA, NT)
Branch
15 June 2021

A: Decision Notice [FOR SIGNATURE]

B: Letters

B1: Letter to Proponent [FOR SIGNATURE]B2: Letter to DWER [FOR SIGNATURE]B3: Letter to Minister for Energy [FOR SIGNATURE]B4: Letter to Minister for Indigenous Australians [FOR SIGNATURE]B5: Letter to Minister for Industry [FOR SIGNATURE]B6: Letter to Minister for Resources [FOR SIGNATURE]C: Statement of Reasons [FOR SIGNATURE]

D: Referral Documentation

D1: ReferralD2: Supplementary Information (DAWE Request)D3: Supporting InformationD4: Flora and Vegetation SurveyD5: Shorebird and Waterbird SurveyD6: Terrestrial Fauna Survey

E: Line Advice

E1: Wetlands Section AdviceE1.1: Wetlands Section Reference List PDF PortfolioE2: Migratory Species AdviceE2.1: Migratory Species Reference List PDF PortfolioE3: Office of Water Science AdviceE3.1: Office of Water Science Reference List PDF PortfolioE4: Wetlands Section Advice Follow-up

F: Supporting Information

F1: EPBC 2017/8112 Final ApprovalF2: Overview MapF3: Eighty-mile Beach Information SheetF4: Eighty-mile Beach Ecological Character ReportF5: Significant Impact Guidelines 1.1F6: Great Knot Conservation AdviceF7: Eastern Curlew Conservation AdviceF8: Red knot Conservation AdviceF9: Migratory Shorebirds Conservation PlanF10: EAAF Population Estimates, 2008F11: Costal Structure ScourF12: Pipeline Wave PropagationF13: Seabed-Structure-InteractionsF14: Benthic Invertebrate Mapping at Anna Plains and Roebuck Bay

F16: Japan-Australia Migratory Bird Agreement (JAMBA)F17: China-Australia Migratory Bird Agreement (CAMBA)F18: Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)F19: Bonn ConventionF20: Ramsar ConventionF21: EAAF Partnership AgreementF22: Analysis of possible change to EC of Roebuck Bay and Eighty-mile BeachF23: Revision of EAAF Population Estimates, 2016F24: Ramsar Catchment and Proposed Infrastructure MapF25: ERT Report (20km buffer)F26: Yara Fertilizers Parliamentary Inquiry, 2018

COMMONWEALTH ENVIRONMENTAL WATER OFFICE
EPBC ACT REFERRAL ADVICE FROM WETLANDS SECTION
REFERRAL: EPBC 2021/8891
DATE DUE BACK TO ESD: 03/03/2021
ASIAN RENEWABLE ENERGY HUB REVISED PROPOSAL,
SHIRE OF EAST PILBARA, WA

Brief Description of Proposal

The proposed action is to construct a large scale industrial hub using wind and solar to manufacture 'green' ammonia for export by tankers from a marine offshore facility as well as a town to accommodate a permanent workforce of between 5000 to 8000. Ammonia is the transport mechanism for hydrogen and has been referred to as "the LNG for hydrogen". The hub will be constructed over a 10 year period and operate for 50 years.

The proposed action is situated on the north east boundary of the Shire of East Pilbara in Western Australia. It covers a development envelope of 666,038 ha (666 square kilometres) and extends approximately 20km offshore into the Commonwealth marine area. This represents an 0.8% increase compared the area proposed in the earlier referral (2017/8112) but the nature and scale of the two referrals are very different.

Referral 2017/8112 consisted of a large scale wind farm and solar arrays with underground electrical cabling running through the Eighty Mile Beach Ramsar Site as part of an export cable to Singapore and Asia. This new referral consists of an increase in the size of wind and solar farms plus the addition of a large scale green hydrogen and ammonia plant using water from a desalination plant, an infrastructure corridor and a permanent town designed to house 5000 to 8000 residents. The transportation system for the renewable energy is no longer reliant on offshore electrical cabling but ammonia piped to an offshore marine facility for offloading on to tankers. The original referral was to export 15GW but the revised proposal is for a further 11GW allowing for 23 GW export with an extra 3MW of electricity to facilitate further development (which may include fertiliser production). As such the development now presents as a greenfields industrial development well beyond a solar and wind energy hub. For a comparison of the changes between the two referrals, refer Attachment A.

According to the referral document, the direct development footprint will require broadscale land clearing of up to 20,748 ha (207 square kilometres), partial clearing and vegetation management of up to 12,726 ha (127 square kilometres) and temporary clearing of up to 491 ha. The marine component of the development would result in the direct disturbance of up to 345 ha of seabed. There is a discrepancy between these land clearing figures and the development footprints of the wind and solar farms, desalination plant and ammonia facility which is are likely to have a combined footprint of $100+254+45+20=419$ square kilometres with the size of the town additional.

The proposal includes the following elements:

- Up to 1,743 wind turbines, covering approximately 100 square kilometres. Each turbine will be up to 290m tall from the ground to top rotation of the highest blade. Turbines will be installed in longitudinal rows, spaced at least 4km apart. Turbine pads will be spaced approximately 700m apart within the rows.

- Solar panels deployed in 18 arrays of up to 600 MW. Each array will take up 1,414 ha (14 square kilometres) incorporating substations, making a development footprint of 254 square kilometres. There will be up to 70 inverters and up to 2 MW in batteries co-located throughout the array.
- Transmission and distribution cables including buried and overhead cables will be installed during construction of turbine footings. This will require clearing for temporary 10m tracks and laydown areas around and between each of the 1,743 pylons.
- A 1,541km network of site tracks. 15m wide corridors will be cleared for the creation of 10m wide compacted gravel pavements. Drainage treatments will be incorporated into final track design to manage surface water so that local recharge is maximised, and sheet flow is avoided.
- Up to 6 site compounds, each approximately 50 ha in size. These will be used by upstream operations personnel and support services for the life of the proposal. Buildings and warehouse facilities will be established on crushed rock platforms constructed from rock material excavated from the site or imported from nearby quarries. (There is an existing quarry at Port Hedland, approximately 250 kms south west of the proposed development).
- A manufacturing hub, comprising of
 - ammonia production and storage facilities
 - cooling towers and separation unit
 - evaporation ponds and electrolysis plants
 - hydrogen storage
 - backup generators
 - up to 3 open air seawater storage reservoirs
 - an approximately 80 GL/ year output desalination plant
 - an open air raw water storage reservoir
 - on-site administration and downstream control compound for operational personnel
- An infrastructure corridor extending from the downstream plant area to the coast. This will accommodate: a power cable; track; 5 pipelines (3 water and 2 ammonia export); and a pipe stringing yard and booster pump facility.
- Offshore infrastructure which will extend approximately 20 km from the coast and will comprise the 5 pipelines, an offshore platform, secondary export buoys and brine discharge ocean outfall.
- A town designed to house 5000 to 8000 and associated infrastructure.

Issues Checklist

How far is the proposal from a Ramsar site?

The majority of the proposed action location is approximately 26km inland of the coastal component of the Eighty Mile Beach Ramsar site, and 13km south of the Mandora Marshes component of the Ramsar site. However, the infrastructure corridor will pass through the beach component of the Ramsar site with pipelines extending into the ocean. The location of the pipe stringing yard is unclear, but may also be within the beach portion of the Ramsar site or in the floodplain area directly behind the coastal dune system.

LEX 23611 The Eighty Mile Beach Ramsar site is the largest pristine area of intertidal mudflats (approximately 1000 square kms) in Australia's Ramsar estate and critical to underpinning East Asian Australasian flyway populations and populations of green and flat back turtles. Page 18 of 42

It consists of approximately comprises of two separate areas:

- a 220km stretch of beach and associated intertidal mudflats ranging from 4 to 5 kms from Cape Missiessy to Cape Keraudren; and
- Mandora Salt Marsh, 40km to the east of the beach.

Eighty Mile Beach meets six of the nine Ramsar criteria:

- Criterion 1: Eighty Mile Beach represents the greatest extent of continuous intertidal mudflat in excellent condition within the Northwest (IMCRA) bioregion. Mandora Salt Marsh contains an important and rare group of wetlands within the arid North Western Plateau bioregion. In particular the peat mound springs can be considered both bioregionally rare and outstanding examples of this wetland type in Western Australia.
- Criterion 2: The site supports the flatback turtle (*Natator depressus*), which is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*. It also supports feeding and possibly nesting of the green turtle (*Chelonia mydas* listed as vulnerable). The site supports 6 species of migratory shorebirds that are also listed threatened species: the critically endangered eastern curlew (*Numenius madagascariensis*, the ~~critically~~ critically endangered red knot (*Calidris canutus*), the critically endangered great knot (*Calidris tenuirostris*), the critically endangered curlew sandpiper (*Calidris ferruginea*), the vulnerable listed greater sand plover (*Charadrius leschenaultii*) and critically endangered bar-tailed godwit (*Limosa lapponica*).
- Criterion 3: The Mandora Salt Marsh contains temporary and permanent wetlands in a predominantly arid bioregion (Western Plateau) and has been recognised as important refugia for biological diversity in arid Australia. The inland grey mangroves lining Salt Creek represent the most inland occurrence of this species.
- Criterion 4: Eighty Mile Beach is considered one of the most important wetland for migratory shorebirds in Australia (second only to Roebuck Bay). It is a critical stopover and staging site for a number of shorebirds on migration to and from southern Australia. Mandora Salt Marsh supports the critical life stage of breeding for at least 13 species of waterbird, including large numbers of Australian pelicans and black swans. The beach part of the site is also significant for the breeding of at least one species of marine turtle (flatback turtle).
- Criterion 5: Eighty Mile Beach is considered to regularly support over 500,000 birds. Total counts (summer) for just a 60 km stretch of the 220 km intertidal site are generally more than 200,000. There is a record of 2.88 million oriental pratincoles on the beach in February 2004. The site supports more than 300,000 migratory shorebirds during the austral summer (August- May).
- Criterion 6: Eighty Mile Beach supports more than 1% of the flyway population (or 1% of the Australian population for resident species) of 21 waterbirds, including 17 migratory species and 4 Australian residents: greater sand plover, oriental plover, red-capped plover (resident), grey plover, bar-tailed godwit, red knot, great knot, red-necked stint, sanderling, sharp-tailed sandpiper, curlew sandpiper, eastern curlew, little curlew, common greenshank, grey-tailed tattler, terek sandpiper, ruddy turnstone, pied oystercatcher (resident); oriental pratincole, black-winged stilt (resident) and great egret (resident).

Issue	Y	N
areas of the wetland being destroyed or substantially modified?	X	
a substantial and measurable change in the hydrological regime of the wetland?	X	
the habitat or lifecycle of native species dependent upon the wetland being seriously affected?	X	
a substantial and measurable change in the physico-chemical status of the wetland?	X	
an invasive species that is harmful to the ecological character of the wetland being established or encouraging the spread of existing invasive species?	X	

Issues to note

While detailed plans have not been submitted as part of the referral, the proposed development does not contain any significant unique or innovative structures or designs. As such, the nature of the key elements of the development are known and the environmental impacts associated with their construction and operation are also known. The environmental impacts of wind farms, solar farms, urban development, ammonia facilities, desalination plants, pipelines and offshore port facilities and increased shipping have been subject to detailed assessments at both the state and Federal levels over many years.

Wind farm expansion:

The number of wind turbines have increased from 1,200 to 1,743 (ie about a 40% increase) at the same height of 290 metres. At present, the largest windfarm operating in Australia Cooper Gap Wind Farm in Queensland contains 123 wind turbines at a height of 180 metres, generating 453 MW, and covering a site of 100 square kilometres.

The turbines to be used in Asian Renewable Hub weigh 60 tonnes each and their height or weight are at the limits of ground transport. It is unclear where the turbines will be manufactured and how they will be transported to the site. It is likely that a larger transport corridor will be needed to transport the turbines than currently exist. If the Port of Broome is the destination for the wind turbines and other components of the manufacturing hub and town, then the increased traffic from that port to the site could negatively impact the Roebuck Bay Ramsar site. These facilitated impacts have not been identified.

It is also unclear whether the proposed turbines are rated for tropical conditions given that most turbines are built for specifications in temperate zones and there is a trade-off between optimising engineering design and cost. Locating the largest wind turbines in an area of cyclonic winds and remoteness is a considerable risk factor for the biodiversity of that region, including MNES such as the Eighty Mile Beach Ramsar site and its dependent fauna.

Solar farm expansion:

The number of solar arrays has increased from 2400 MW to 10800 MW. The original development footprint was 60 square kilometres. The revised development footprint is 254 square kilometres which makes it larger than the one proposed by Sun Cable which is currently considered the largest proposed windfarm in Australia. The Sun Cable development is to be located in Tennant Creek, NT and has a development footprint of 120 square kilometres to generate 10000 MW which for transfer to Darwin and then by underground cable to Singapore. Locating the largest solar array in an area of cyclonic winds and remoteness is a considerable risk factor for the biodiversity of that region, including MNES such as the Eighty Mile Beach Ramsar site and its dependent fauna.

The referral refers to the ammonia plant as generating 'green hydrogen'. According to Monash University's 'Ammonia Economy Roadmap', May 2020, Generation 2 ammonia production, that is, ammonia production using renewable energy and water is likely to be commercially available in 2030 which is within the timeframe of the construction period of the Asian Renewable Energy Hub. More innovative technologies (Generation 3) based on electrochemically produced ammonia will not be commercially available until sometime after that. As such and given the requirement for a desalination plant, it can be inferred that the Hub will use Generation 2 ammonia production and use the Haber-Bosch process for combining hydrogen and nitrogen. This existing method of ammonia production has been used in Australia including in fertiliser production. The Yara Fertiliser Plant in the Pilbara is a case in point and that plant occupies 20 hectares on a 74 hectare site.

Air emissions include nitrous oxide, carbon dioxide, carbon monoxide, sulphur dioxide, ammonia and volatile organic compounds. Waste water discharges include phosphorus, nitrogen and methanol. It is unclear whether waste water discharges will be pumped out to the ocean using the brine discharge pipeline from the desalination plant but that is a common method used.

While the plant will be constructed to have shut off valves for the plant, pipelines and transfer hoses, there is nevertheless a risk of ammonia spillage. Any large scale spillage in the marine environment or in the mudflats would be catastrophic for the wetlands of the Ramsar site and its dependent fauna.

Desalination Plant

The 80GL desalination plant will provide water for the ammonia plant and water for the town. The capacity of the Sydney Desalination Plant is 90GL/year with a footprint of 45 hectares. The proposed desalination plant in the referral will take seawater from intake pipes located in the marine park abutting the Ramsar site and it will then be screened, filtered and have its salt and impurities removed by reverse osmosis. The seawater or brine concentrate will be pumped back in to the marine park. Typically the concentrate is twice the salinity of seawater and 1 degree warmer. The degree to which the salinity and temperature returns to ambient conditions depends on the location and design of the outlet nozzles. Given that the receiving environment is already low salinity, there is a risk that any damage to the brine discharge pipe is likely to have a significant impact on the benthic communities that underpin the foodweb of the Ramsar site. This impact would be further exacerbated if town wastewater and the waste products of the Ammonia plant were also transported via the brine discharge pipeline.

Town

The construction of a town is a significant intensification from the previous proposal. Details of the town construction and use, including size, layout and infrastructure requirements (such as sewage treatment, waste disposal, lighting, roads, housing, community and commercial facilities) have not been provided in the referral documentation. Light and noise from the town is highly likely to adversely impact the foraging, predator vigilance and reproduction success of wetland dependent species. The presence of people and accompanying vehicles and domestic animals will increase recreational usage of the Ramsar site and disturb the breeding, foraging and roosting behaviour of key species.

Infrastructure corridor

An infrastructure corridor will extend from the main development area to the coast and into the ocean. A pipe yard will be included, presumably as part of this infrastructure corridor, behind the beach dunes. No detail has been provided on the size of the infrastructure corridor, what it will include or how it will be established. No detail has been provided on the size of the pipe yard or what it will include.

The proposal includes an offshore platform to ship the final product internationally. No detail has been provided on the size of the platform or infrastructure required. No detail has been provided on the number or size of ships that will use the platform but it does specify two export buoys.

Potential impacts

According to the Ecological Character Description (ECD), Eighty Mile Beach has fewer threats than comparable sites in southern and eastern Australia by virtue of its remote location, limited diversity of adjacent land uses (pastoral and transport corridor) and limited public access. However, a small number of potential and actual threats that may impact on the ecological character of the Ramsar site have been identified in the ECD. These include: recreational use (shell collection, driving on the beach), agriculture (grazing and groundwater extraction for irrigation), introduced species, mining, commercial fishing and climate change (increase in cyclones and sea level rise).

The impacts of infrastructure such as a manufacturing hub, new township, wind turbines, PV solar arrays, pipelines and offshore platforms, and increased shipping were not considered in the ECD, probably due to the remote location of the site, making such developments unlikely.

Potential impacts of the proposed action on the Ramsar site are discussed in detail below.

Areas of the wetland being destroyed or substantially modified

The original referral included laying underground cables (by trenching and/or hydro-ploughing) through the coastal portion of the Ramsar site. In the original Wetlands advice, concern was raised over potential impacts to areas of wetland habitat including grey mangroves and mudflats. Disturbance, particularly in the areas of mudflats could impact macroinvertebrate communities which would impact shorebirds using the site. Additional information was required on the route and method of cable installation.

The new referral notes that instead of underground cables, an infrastructure corridor will be created. This corridor will extend from the downstream plant area to the coast and will accommodate: a power cable; a track; 5 pipelines (3 water and 2 ammonia export); a stringing yard and booster pump facility. No information is provided in terms of the size of the infrastructure corridor, nor how the pipelines will be installed along the coastline and into the ocean.

The offshore infrastructure will extend approximately 20 km from the coast and will comprise 5 pipelines, an offshore platform, secondary export buoys and brine discharge ocean outfall. No information has been provided on how the pipelines will be laid from the coastline to the offshore platform. No information has been provided on the size or infrastructure to be included in the offshore platform but it will involve an offloading facility.

These activities will result in the disturbance or destruction of areas of the mudflats, benthic habitats and communities and/or other coastal habitats. The magnitude of these impacts will be greatest during construction but the operation of the pipeline will also involve ongoing impact with regular movements to and from the marine offshore facility and for pipeline maintenance. and duration of these impacts cannot be ascertained from the information provided.

The establishment of the infrastructure corridor and laying of pipelines will result in modification of areas of the wetland and these impacts cannot be mitigated or offset.

A substantial and measurable change in the hydrological regime of the wetland

The Ramsar site is located in a region of macro tides with the tidal regime averaging 6 to 8 metres. Currently there are no structures to impede tidal flows across the site. Unrestricted tidal flows are a critical process for the Ramsar site and therefore part of its ecological character. (Eighty Mile Beach Ecological Character Description, 2009). There will be significant disruption to the tidal flows as a result of the infrastructure corridor containing five pipelines and the construction of the marine offshore facility which will impact the deposition and movement of sediments and nutrients which in turn will impact the foodwebs of the mudflats and coastal area and impact critical biota such as migratory birds.

LEX 23611 The pipeline corridor crossing and associated works area will also impact the primary coastal dune system and the 100 kms of discontinuous floodplain immediately inland from the frontal sand dunes. The function and integrity of these systems are critical to maintaining the existing hydrological regime of the Ramsar site. Further impact is likely due to the large amount of quarried rock that will be required to provide foundations for the development. Depressions and changes to the soil profile will occur in the surrounding region which will then impact the hydrological regime of the Ramsar site. Page 22 of 42

The Mandora Salt Marsh component of the site is a series of floodplain depressions consisting of two lakes, permanent and almost permanent freshwater swamps and saturated peat mound springs which are extremely rare. Rainfall and runoff during the wet season (January-March) are important to the hydrology of the site as is the irregular inundation by cyclonic events. The profile of the surrounding land is very flat and the close proximity of the development footprint and the infrastructure corridor to the Mandora Salt Marsh means that even small changes to land height from the manufacturing facilities (ammonia plant, desalination plant), town or additional water storages, quarries will capture runoff that currently goes to the marshes or the floodplains behind the dune system.

This depletion of surface water flows occurs in a climate that is currently the hottest in Australia and where evaporation exceeds annual rainfall by 6 to 14 times (CSIRO Pilbara Water Resource Assessment Summary Report 2015).

According to CSIRO, groundwater is the main water resource in this part of the Pilbara and coastal aquifers are an important local drinking source. Since groundwater systems are recharged during large rainfall events which are difficult to predict, changes to the availability of groundwater due to extraction or from changes to flow or recharge as a result of the presence of large scale solar and wind farms and industrial facilities, an 8000 person town, large water storages and trenching and dredging for pipelines is likely to have a significant impact on the Mandora Saltmarsh component of the site and the groundwater dependent ecosystems that it supports.

The tidal, surface water and groundwater impacts of the proposed development on the Ramsar site are unavoidable and unlikely to be able to be mitigated.

A substantial and measurable change in the physico-chemical status of the wetland

The creation and operation of a manufacturing hub, transport infrastructure and the town is highly likely to result in impacts on the physico-chemical status of the wetland through the discharge of contaminants, nutrients and sediments (for example during construction on site or through stormwater runoff, sewage, etc). If food production and/or industrial activities are included with the township or surrounding area, these could also result in the movement of contaminants, nutrients or sediments into the local waterways and then to the Ramsar site which is currently in pristine condition.

The ammonia production plant and pipelines pose a risk to the surrounding environment in terms of release of contaminants into the local waterways, coastal and/ or marine waters, for example during the production of ammonia, or as a result of an ammonia spill.

Ammonia production involves the release of emissions to air and water which are detrimental to ecosystems and while some of these can be mitigated, most production of this type in the north west of Western Australia discharge waste products out to sea via pipelines.

Ammonia is highly toxic to living things. When released into water, it quickly mixes to become ammonium hydroxide but a fraction can form a buoyant cloud which is also highly toxic. Ammonia spills can occur as a result of a venting leak, tank rupture, in transfer via pipelines and by vessel damage. While there is likely to be shut off valves for pipelines and transfer hoses, the proposed development and transport choice comes with a risk of an uncontrolled ammonia spill. The development is located in a high wind and high storm area with large tides and a highly sensitive and biodiverse marine environment. A large spill in this area would lead to mortalities of fish, plankton, shellfish and other benthic organisms.

LEX 23811 Fringing vegetation will be killed and shorebirds present at the site would be directly affected by either ingesting ammonium hydroxide or by losing their water repellancy as ammonium hydroxide strips the protective oils. Direct loss and loss in the condition and resilience of biota would occur. Page 23 of 42

The referral documentation notes the creation of an 80 GL desalination plant; brine or seawater concentrate discharge ocean outfall; evaporation ponds and electrolysis plants. Given the experience of other desalination plants, the brine is likely to be hypersaline and warmer than the surrounding marine environment. In this environment, marine waters have low salinity so any change in salinity is likely to impact marine and benthic organisms, particularly given the large wind and tidal movements experience by the Ramsar site. Similarly if there are toxic waste products in the wastewater, this has a high probability of spreading throughout the site with detrimental affect.

The establishment of the town, ammonia production plant and ammonia pipelines will result in a change to the physico-chemical status of the Ramsar wetland, given its pristine nature. The creation and operation of a desalination plant; electrolysis plants; evaporation ponds; and brine discharge outfall (which is likely to include wastes from ammonia production) is highly likely to result in a significant change to the physico-chemical status of the Ramsar wetland.

The habitat or lifecycle of native species dependent on the wetland being seriously affected

Eighty Mile Beach is one of the most important sites in the world for migratory shorebirds and one of the most significant non-breeding sites within the East Asian Australasian Flyway. The intertidal flats provide important staging and feeding areas, particularly on southward migration routes, between August and November. After arriving at the Eighty Mile Beach, young birds of some species remain there for one to three years before they attempt to migrate north. (Eighty Mile Beach Marine Park Management Plan 2014-2024).

The site supports more than 1% of the flyway population (or 1% of the Australian population for resident species) of 21 waterbird species, including 5 critically endangered species. Mandora Salt Marsh supports the critical life stage of breeding for at least 13 species of waterbird, including large numbers of Australian pelicans and black swans.

Eighty Mile Beach provides habitat critical to the survival of flatback turtles and greenback turtles from the southwest Kimberly Stock. Critical habitat includes a 60 km buffer seaward of the beach. Flatback turtles nest on the beach between October and March.

Impacts associated with the town

Close proximity of the beach and the mudflats to a 8000 person town means that there is an unavoidable risk of significantly greater human disturbance and a significant risk of increased unregulated beach access including by vehicles, boats and domestic animal access, increased beach pollution and increased boat moorings and anchoring. Given the extreme temperatures experienced during summer months, the remoteness and the length of the Ramsar site, temporal and spatial restrictions of visitor access from either the land or ocean side will be extremely difficult to enforce.

Impacts associated with the infrastructure corridor across the Ramsar site

The installation of the pipelines (whether above ground, underground or under sea), infrastructure corridor and offshore platform, has the potential to disturb marine species including migratory shorebirds and turtles feeding within or adjacent to the Ramsar site and/ or moving to and from the beach during their nesting period. Impacts associated with pipeline construction include destruction of wetland ecosystems, dredging and dredge plumes, noise, light and mechanical traffic back and forth. The operation of the offshore platform will necessarily involve regular boat traffic to and from the Ramsar site.

Impacts associated with Wind farms

LEX 23611 The proposed development includes the placement of 1,743 wind turbines (each up to 290m tall), potentially within the route of birds travelling within the local landscape as well as to and from southern Australia. Mortality of listed threatened and migratory species are considered likely from collision with turbines and powerlines. Resident waterbird species may also move from one wetland to another (sometimes across great distances), so are also at risk from collision with turbines and powerlines. Page 24 of 42

Large scale windfarms produce low frequency background noise which is known to have a detrimental impact on species abundance and richness through changes to foraging, predator vigilance and reproduction success. The refuge capacity of Mandora Swamp is most likely to be negatively impacted.

Noise pollution cannot be mitigated or offset.

Light Pollution

Artificial light and the loss of darkness associated with the town and the 24 hour operation of the ammonia plant and desalination facility is highly likely to have a significant disruptive impact on the behaviour and life stages and ultimately on survivorship of migratory shorebirds and marine turtles which are critical components of Eighty Mile Beach Ramsar site.

For migratory birds, lights can be disorienting and increase the likelihood of collision with built infrastructure, can cause them to use less preferable roosting sites and makes them more visible at night which increases the risk of predation.

Marine turtle hatchlings generally emerge from their beach nests at night and are drawn to the lower brighter horizon of the sea surface. Artificial light attracts them inland increasing their risk of death by predation, dehydration or exhaustion. Adult female turtles can also be deterred by artificial lighting from nesting. Highly lit industrialised coastal areas to the north of Eighty mile beach (Broome) and to the south (Port Hedland) are likely to increase the importance of the Ramsar site for turtle breeding in to the future.

Light pollution is unavoidable and cannot be mitigated or offset.

Air and water pollution

Facilities which manufacture ammonia are licensed as hazardous waste facilities. Their emissions include nitrous oxide, carbon dioxide, carbon monoxide, sulphur dioxide, ammonia and volatile organic compounds (precursors to photochemical smog), phosphorus, nitrogen and methanol. Some of these emissions will be discharged to the ocean via brine discharge pipeline from the desalination plant. Any changes to the water or air quality is highly likely to have a significant impact on the fauna species dependant on the Ramsar site.

The combined impacts associated with the proposed development means that a significant impact on species dependent on the wetland is unavoidable and cannot be mitigated or offset.

An invasive species that is harmful to the ecological character of the wetland being established or encouraging of existing invasive species

The creation of a town increases the risk of the introduction or establishment of invasive species in the surrounding landscape. Local landscaping may result in the spread of invasive plant species. Human settlements increase the risk of invasive animal species using the area opportunistically (such as foxes, cats, mice and rats).

On the basis of the limited information provided, it is assumed that the introduction or spread of invasive species into the wetland is highly likely as a result from the proposed action.

Conclusion

The proposed development consists of a green hydrogen and ammonia plant with storage facilities, large scale desalination plant, 1,743 wind turbines and 4800 MW solar farm, an infrastructure corridor of 5 pipelines and 1 cable through the Eighty Mile Beach Ramsar site, a marine offshore facility servicing two tankers to export ammonia, a permanent town of between 5000-8000 workers and a number of water storage facilities including a permanent 4 square kilometres cooling lake.

Eighty Mile Beach Ramsar site is the largest pristine area of intertidal mudflats in Australia's Ramsar estate and is one of the most important stopover point for migratory birds in the EAAF. It also supports large numbers of nesting flat back turtles and possibly green turtles (both listed as vulnerable). The site provides a buffer and refuge for migratory species when there is bad weather to the north and in the case of migratory birds, bad weather to the north east. It is located in a largely wilderness area that has some cattle grazing and is bounded by the WA Marine Park on the ocean side which abuts the Commonwealth Marine Park.

As described in the Issues Checklist and the above assessment against the significant impact criteria, the nature and scale of this greenfields industrial development comes with significant risks for the ecological character of the Ramsar site. Significant risks include:

Bird strike from wind turbines

Ammonia spills

Hydrogen spills

Contamination by waste products

Release of air contaminants and steam.

Release of hypersaline water (and wastewater products) at an increased temperature.

Light and noise pollution

Increased human recreational use and vehicular traffic.

The transportation system of pipelines and off loading to tankers at an offshore marine loading facility occurs in an area subject to high and cyclonic wind conditions. It brings with it considerable risk of catastrophic damage to the Ramsar site as a result of severe climatic events. This is in addition to the significant risks associated with operational failure of the offloading technology, pipeline or tankers.

Although detailed project specification and/or environmental assessment has not been undertaken, the scale and nature of the action and its attendant risks is such that a significant impact on the ecological character of the Eighty Mile Beach Ramsar Site is not only likely, but unavoidable. It is further concluded that the impacts on the ecological character of this development and its facilitated impacts will not be able to be mitigated or offset.

Advice prepared by: s. 22(1)(a)(ii)

Other areas consulted: no

ESD Referral Officer: s. 22(1)(a)(ii)

Cleared by: **s. 22(1)(a)(ii)** Director: Wetlands Section

Signature: ... **s. 22(1)(a)(ii)**

Date: 10 March 2021

Cleared by: Michael Wrathall, Assistant Secretary: Wetland Policy and Northern Water Use Branch

Signature: **s. 47F(1)**

Date: 11/03/2021

Sources:

- Eighty Mile Beach Ecological Character Description
- Eighty Mile Beach Ramsar Information Sheet
- Referral Documentation
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- <https://research.monash.edu/en/publications/a-roadmap-to-the-ammonia-economy>
- <https://www.sciencealert.com/world-s-largest-solar-farm-to-pipe-power-internationally-from-australia-under-the-sea>
- Newman et al Light and Noise Impacts on Urban development on biodiversity: Implications for protected areas in Australia, EMR, 2014
- <https://www.csiro.au/en/Research/LWF/Areas/Water/Assessing-water-resources/Pilbara>
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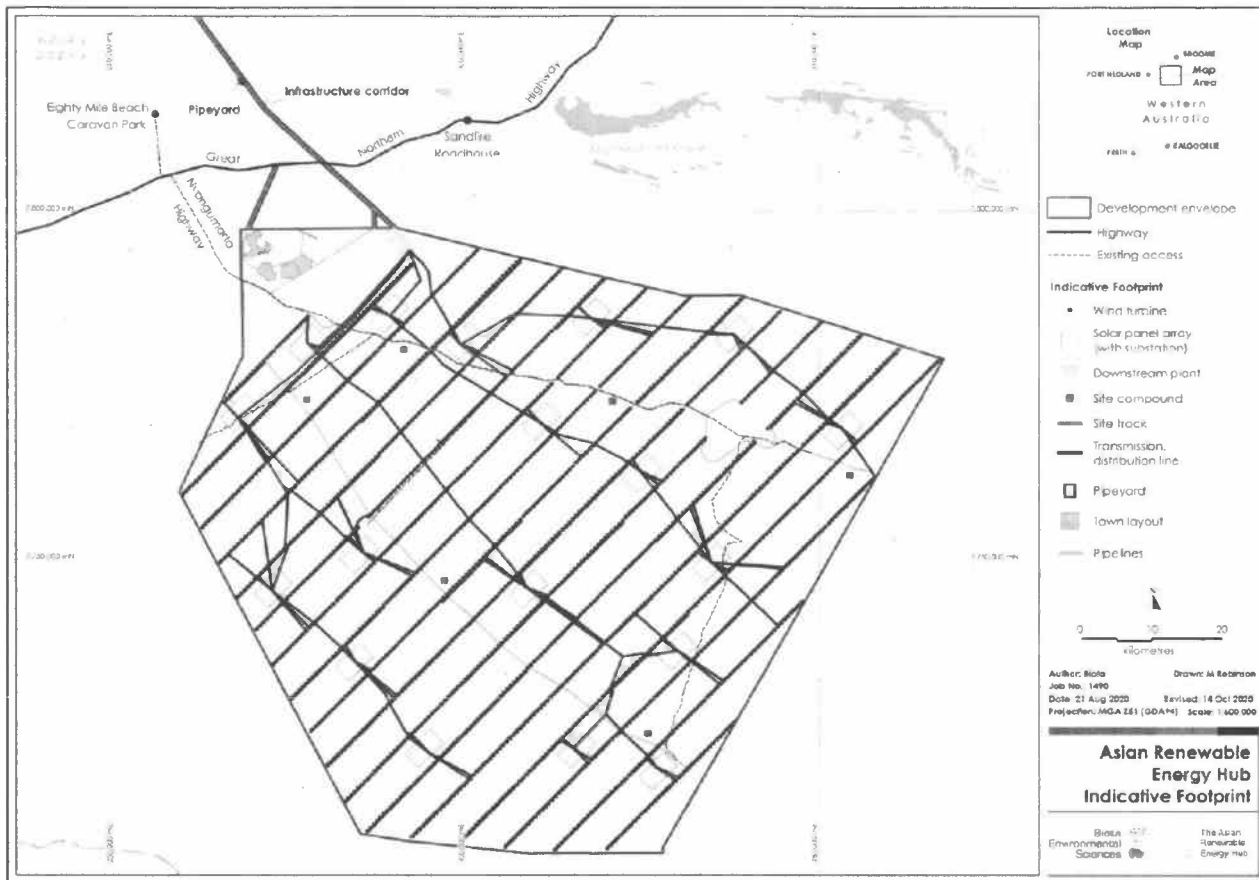
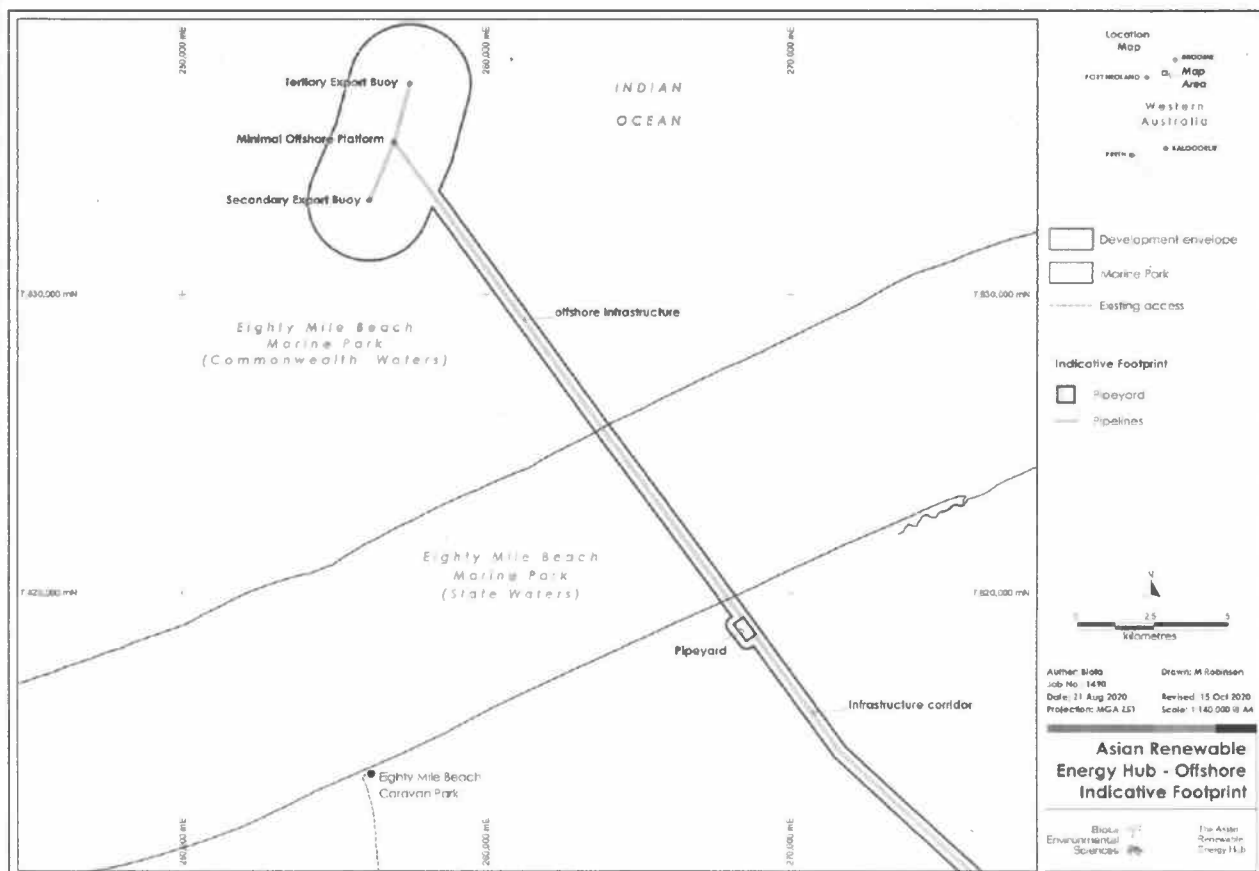


Diagram showing offshore component of the development:



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MIGRATORY SPECIES SECTION EPBC ACT REFERRAL ADVICE**

EPBC 2021/8891 – Asian Renewable Energy Hub (Revised Proposal)

Stage: Referral

1.0 Proposed action

The Asian Renewable Energy Hub is a proposal by NW Interconnected Power Pty Ltd to construct a large-scale wind and solar renewable energy project, at Eighty Mile Beach and the northeast boundary of the Pilbara. The proposed action area covers 666,038 ha in size and is within the Eighty Mile Beach Ramsar site. The offshore infrastructure traverses coastal waters of both the State and Commonwealth Eighty Mile Beach Marine Park.

The action was previously referred under the EPBC Act and determined a Controlled Action (2017/8112). The revised proposal differs from the previous proposal in that there has been an addition of downstream processing facilities to produce green hydrogen and ammonia as stored renewable energy, removal of export power cables and the addition of a desalination plant, expansion of the solar arrays, construction of a town and provision of at least 3GW of generation capacity to promote economic growth and regional diversification.

Advice was previously sought from the Migratory Species Section (MSS) in relation to referral 2017/8112.

2.0 Listed Threatened and Migratory Species

2.1 *Migratory Shorebirds*

The proposal is close to the Eighty Mile Beach Ramsar site between Broome and Port Hedland. Eighty Mile Beach is internationally important habitat for 16 migratory shorebirds, including the critically endangered Eastern Curlew, Great Knot, Curlew Sandpiper and Bar-tailed Godwit (*menzbieri*), endangered Red Knot and vulnerable Greater Sand Plover. Eighty Mile Beach is the most important wetland for shorebirds in Australia as it is a critical stop-over and staging site for very large number of shorebirds on migration to and from southern Australia. The site supports more than 300,000 migratory shorebirds during the austral summer (August – May).

Based on the information provided, adverse impacts to listed threatened and migratory birds are considered possible, as the location of the wind turbines are within the migratory routes of these birds to and from southern Australia. Mortality of listed threatened and migratory birds are considered possible from collision with turbines and powerlines. Migratory shorebirds travel in flocks (sometimes very large flocks) in open airspace, particularly at night while migrating. The proponents must provide further information on a range of species to determine migratory pathways and flight height to determine the level of impacts (blade height). Tracking surveys should be conducted throughout the year, including southward migration, the non-breeding period, northward migration and individuals who overwinter (usually juvenile birds).

The development footprint is unlikely to modify or destroy an area of important habitat for any migratory species however, additional surveys would be beneficial.

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Inadequate information has been provided on how the proponent will manage artificial light, so it is considered possible that artificial light will have adverse impacts for shorebirds.

2.2 Marine Turtles

2.2.1 *Flatback turtle (Vulnerable and Migratory)*

The Recovery Plan for Marine Turtles (2017-2027) identifies the proposed development area (80 Mile Beach and a 60km buffer seaward of the beach) as being habitat critical to the survival of flatback turtles from the southwest Kimberley Stock. Nesting in this area occurs October to March. The proposed development area also overlaps with Biologically Important Areas (BIAs) for nesting and inter nesting flatback turtles. Potential threats from the proposed activity to marine turtles include light pollution, habitat modification and displacement from nesting beaches. Action A1 of the Recovery Plan for Marine Turtles (2017-2027) states that, for all turtle stocks, all actions must 'manage anthropogenic activities to ensure that marine turtles are not displaced from identified habitat critical to the survival'.

The marine and coastal component of the proposed action includes installation of a power cable, five pipelines, an offshore platform, export buoys and brine discharge ocean outfall. If the construction and installation components of the action occur outside of the peak nesting period (October to March) and the beach maintains characteristics necessary for successful turtle nesting, adverse impacts are unlikely occur. If these activities were to occur within the nesting period (October to March) the proponent would need to ensure that no marine turtles are displaced from the beach or inter-nesting areas and are not injured during construction. There is currently inadequate information on timing or techniques to determine this, so it is considered possible that adverse impacts to flatback turtles could occur.

Inadequate information has been provided on how the proponent will manage artificial light during construction and operation, so it is considered likely that artificial light will have adverse impacts for flatback turtles.

There is also inadequate information on the physical and chemical properties of the waste brine and the mitigation measures to eliminate entrainment and impingement of marine turtles in the desalination plant. Therefore, it is considered possible that adverse impacts to flatback turtles could occur.

2.3 Cetaceans

2.2.1 *Humpback whales (Vulnerable and Migratory)*

Large numbers of humpback whales migrate along Australia's west coast each year between May to November. The proposed development area is within a migration BIA for humpback whales. Potential impacts include noise and vessel disturbance. The impacts from noise are likely to be localised during construction however, noise modelling has not been provided by the proponent.

It is considered possible that impacts to humpback whales from anthropogenic noise and increased vessel traffic may occur.

2.2.2 *Pygmy blue whale (Endangered and Migratory)*

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The marine development footprint does not overlap the primary migration area of the pygmy blue whale but is still within the species distribution. The chance of encountering pygmy blue whales close to shore are low, however, if present the threats would be similar to those discussed for humpback whales above.

3.0 Potential Impacts

Noise

Acoustic modelling has not been provided for noise generating activities associated with the wind farm development. Effects of elevated noise or continued exposure include displacement or avoidance of biologically important areas, interruption to communication, reduced breeding success and, potential physical damage, including temporary or permanent hearing impairment. Underwater noise has the potential to travel large distances, so species not seen in the immediate development area, such as pygmy blue whales, may still be impacted by underwater noise.

Actions that may result in acoustic injury or disturbance to whales should be undertaken in accordance with the requirements of [EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales](#). The precautionary mitigation and management measures outlined in the policy statement provide guidance on reducing the risk of impacts to whales from all underwater anthropogenic noise generating activities, not just seismic exploration.

Vessel strike

Vessel strike is a key threat identified in the *Conservation Management Plan for the Blue Whale*, the *Humpback Whale Conservation Advice* and the *Recovery Plan for Marine Turtles*. Additional vessel traffic poses an increased risk of interactions to all nationally listed marine fauna, resulting in an increased risk of injury or mortality. Increased vessel traffic can also result in disruption to important behaviours such as feeding, nesting and migration.

The assessment of the proposed action and development of measures to minimise impacts to marine fauna should be guided by the [National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna](#) (the Strategy). Collisions with vessels are one of the main known causes of mortality to whales and other marine megafauna species. The Strategy includes a description of data that should be collected to determine the risk of vessel strike and how to reduce the risk, including the adoption of maximum speed limits that should be employed in areas where marine fauna may potentially be encountered. The process for reporting marine megafauna incidents should be described.

Vessel disturbance from increased shipping traffic is likely to be minor and short-term; however, a vessel management plan should be prepared to minimise risk of injury to cetaceans and other marine species, and provided for review to ensure adequate assessment of potential impacts. The assessment should also be undertaken in accordance with the [Australian National Guidelines for Whale and Dolphin Watching](#) which detail a no approach zone of 50 m for dolphins, 100 m for

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whales and 300 m for whales with calves. The guidelines also detail caution zones of 150 m for dolphins and 300 m for whales.

Impingement and entrainment of marine turtles

Desalination plants require a substantial intake of sea water, which can result in impingement (i.e. collision with screens) and entrainment (i.e. drawn into the plant) of marine organisms, such as sea turtles (Lattemann & Hopner 2008). This is particularly an issue for sea turtle hatchlings due to their small size and limited swimming abilities. Research has concluded that flow rates of 0.1 m s^{-1} do not impinge larger animals (RPS 2009). Swim speed of Flatback turtle hatchlings has been recorded from 0.23 m s^{-1} – 0.50 m s^{-1} , with swim speed slower in the presence of artificial light (Wilson et al. 2018). Flatback turtle hatchlings should be able to swim away from an intake flow rate of 0.1 m s^{-1} or less (RPS 2009), however a precautionary approach should be taken and monitoring employed to ensure hatchlings are not entrapped. Screens of roughly 5 mm mesh width are normally used to avoid marine debris and marine megafauna from entering the water intake (Morton et al. 1996).

Light pollution

Sea turtles are sensitive to artificial light, with light having the potential to disrupt nesting behaviour for adult females and sea finding behaviour of hatchlings (DEE 2020). Artificial light may disorient flying birds, affect stopover selection and affect the foraging behaviour of shorebirds (DEE 2020). Appropriate lighting design/controls and light impact mitigation will be site/project and species specific. The assessment should be undertaken in accordance with the best practice light design principles as per the [Australian National Light Pollution Guidelines for Wildlife](#). An artificial light management plan should be prepared to mitigate the risk of artificial light on marine turtles and shorebirds.

Habitat degradation

Desalination discharge has the potential to impact on the physical, chemical and biological characteristics of the marine environment with follow on effects for benthic habitats and implications for species' biological requirements (i.e. temperature, salinity and pH limits). The proponent has not detailed how the volume of discharge (80 GL/year) will dissipate in the marine environment nor provided a summary of the physical and chemical properties of the wastewater discharge.

The construction phase is likely to cause disturbance to the beach, intertidal flats and subtidal benthic habitats. For migratory shorebirds, the loss of important habitat reduces the availability of foraging and roosting sites. This affects the ability of the birds to build up the energy stores required for successful migration and breeding. For marine turtles, loss or displacement from biologically important nesting beaches and habitat critical to the survival would have negative implications for breeding success.

4.0 Recommendations

- An assessment of underwater noise emissions should be provided. Underwater noise generating activities should be managed in accordance with *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*.

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- Activities should be guided by the *National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna* and undertaken in accordance with EPBC Act Regulations – Part 8 and *the National Whale and Dolphin Watching Guidelines 2017*.
- A project lighting strategy should be provided for review.
- Screens of 5 mm or less and an intake flow rate of 0.1m s⁻¹ or less should be implemented for the desalination plant and monitoring required to ensure hatchlings are not entrapped.
- A mitigation measure for shorebirds could include the installation of transmission lines underground and the placement of turbines away from the migratory routes of migratory birds.
- As per Action A1 of the Recovery Plan for Marine Turtles (2017-2027) all actions must 'manage anthropogenic activities to ensure that marine turtles are not displaced from identified habitat critical to the survival', therefore the proponent must indicate how they will not displace marine turtles from Eighty Mile Beach and the nesting and inter nesting habitat are not degraded.
- More information should be provided by the proponent regarding the desalination plant and offshore platform, including modelling to show if any oceanographic changes to the beach system (i.e. erosion and accretion) are likely to occur.

5.0 References

DEE (2020) Australian Government National Light Pollution Guidelines for Wildlife: Including marine turtles, seabirds and migratory shorebirds. Version 1.0.

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Prepared by: **s. 22(1)(a)(ii)** cetaceans, marine turtles), **s. 22(1)(a)(ii)** (migratory shorebirds)
Cleared by: **s. 22(1)(a)(ii)** , A/g Director, Migratory Species Section
Date: 3 March 2021

**OFFICE OF WATER SCIENCE ADVICE
ASIAN RENEWABLE ENERGY HUB REVISED PROPOSAL, 220KM EAST OF PORT
HEDLAND, WA**

Requesting section	Projects Assessments West Section 2	Requesting officer	s. 22(1)(a)(ii)
Date of request	01/04/2021		
EPBC reference	EPBC 2021/8891	OWS reference	OWS 2021-024
Project assessment stage	Referral		
OWS contact officer	s. 22(1)(a)(ii)		
Cleared by	s. 22(1)(a)(ii) Director / Senior Principal Research Scientist Technical Analysis Team	Date	16/04/2021

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This document, prepared at the request of the Environment Approvals Division, outlines the Office of Water Science's (OWS) technical advice on the Asian Renewable Energy Hub Revised Proposal, 220km east of Port Hedland, WA.

The Project will harness wind and solar resources and export the renewable energy by producing and shipping ammonia overseas.

The proposed action area covers 666,038 ha which extends into the Commonwealth marine area. This is a 0.8% increase on the 662,400 ha development envelope of the original proposal. The following are proposed:

- Wind Turbines – Up to 1,743 wind turbines, with each turbine being up to 290 m tall from the ground to the top rotation limit of the highest blade tip
- PV Solar panels – 18 arrays of up to 600 MW, with each array taking up 1,414 ha
- Transmission and distribution cables
- Site tracks – 1,541 km network of site tracks
- Site compounds - Up to six site compounds, each ~50 ha in size
- Downstream plant - Up to three open air seawater storage reservoirs, an ~80 GL/year output desalination plant, an open-air raw water storage reservoir, a small on-site administration and downstream control compound for operational personnel, evaporation ponds and electrolysis plants, hydrogen storage, backup generators, cooling towers and separation unit, and Ammonia production and storage and facilities

- Infrastructure corridor - extending from the downstream plant area to the coast and will accommodate: a power cable, a track, and the five pipelines required for the proposal (3 water and 2 ammonia export), as well as a pipe stringing yard and booster pump facility. The offshore infrastructure will extend ~20 km from the coast and will comprise the 5 pipelines, a minimal offshore platform, secondary export buoys and brine discharge ocean outfall.
- A permanent town of 8000 people.

As noted in the request for advice, the proponent has provided scant information in regard to the potential impacts of this revised proposal. As a consequence, **this advice should only be considered draft** and details some key areas that the proponent will need to address if they wish to prosecute this proposal.

Question 1: We would appreciate advice from OWS on whether the proposed action (e.g., construction and operation of these facilities) would have an impact on surface water and groundwater flows such that the downstream wetland and/or the Broome Sandstone Aquifer may be impacted? We are aware that the development envelope footprint spans the upstream catchment to the intertidal zone for Eighty-mile beach and is adjacent to the Mandora Salt Marsh. In particular, with the limited information provided by the proponent, is it likely that the project could cause increased groundwater mounding or considerably change the surface and groundwater inflow to the wetland?

Surface water impacts

1. There are some surface water drainage lines that start in or beyond the development envelope and 'flow' toward Mandora Salt Marsh after rainfall. The proposal, especially the town, has the potential to intercept any surface water flow during heavy rainfall periods. The level of impact would be dependent on where the town is placed and how the proposed solar and wind infrastructure is sited and constructed (see paragraph 6).
2. The solar and wind power infrastructure is unlikely to impact on the quality of these surface water flows. However, again dependent on where the town is placed, urban runoff and other contaminants associated with urban development could enter Mandora Salt Marsh (or the near-shore environment). The extent of the impact would be dependent on the level of dilution noting that the town is proposed to be permanent and so there would likely be a cumulative concentration of these contaminants on the southern side of the marsh.

Groundwater Impacts

3. It would appear that all water for the industrial, urban and agricultural activities will be sourced through seawater desalination. If this is the case, there will be no impact on the Broome Sandstone Aquifer or the Mandora Salt Marsh from extraction.
4. Similar to surface water, it is unlikely that there will be any impact to groundwater quality from the solar and wind power infrastructure.
5. From the limited information available on groundwater levels (Paul et al 2013) it does appear that groundwater from the proposal area moves towards the Mandora Salt Marsh (see Appendix 1), noting there would also be groundwater flow towards the coast from the proposal area. Depending on where the town is placed (see paragraph 6), urban runoff and other contaminants associated with urban development could enter the Broome Sandstone Aquifer and hence the Mandora Salt Marsh. The extent of the impact would be dependent on the volume of contaminants entering the Broome Sandstone Aquifer but again, noting

that the town is proposed to be permanent, there would likely be a cumulative concentration of these contaminants into the marsh.

- a. Storey *et al.* (2011) and Halse *et al.* (2005) both note that water tables in the area of the marsh are shallow resulting in significant groundwater discharge to the marsh after rainfall.
 - b. More recently, Rutherford *et al.* (2021) and Rutherford *et al.* (2017) indicate that advective flow along geological faults associated with the Wallal Aquifer and through-flow discharge from the Broome Sandstone Aquifer are the main sources of mound spring discharge in Mandora Salt Marsh.
6. OWS notes that the proponent has committed to provide a 1km buffer around potential black-footed rock wallaby habitat (WAEPA 2020, p. 16) with Figure 5 showing the location of this habitat and the exclusion zone. This would indicate that the town would likely be placed in the south-eastern part of the proposal area. This location could possibly reduce the impact on the Mandora Salt Marsh but increase the level of impact on the near-shore environment.
- a. This possible location is also sand dune country in the Little Sandy System with significant fauna identified (WAEPA, Figure 4).
 - b. Further, given the distance from existing road infrastructure, this possible location will require a significant increase in other road infrastructure than that detailed in the original proposal.
7. OWS assumes that agricultural products e.g. fruit and vegetables will be grown in greenhouses and so there is unlikely to be any groundwater impacts. However, water for the recreational facilities of the town and home garden watering, despite the stated commitment to wastewater reuse (Referral, Section 1.2) is likely to result in some groundwater mounding beneath the town. This may result in some localised changes to groundwater flow directions; however, assuming that water conservation measures are enforced, this impact is likely to be minor. As noted in paragraph 5 the movement of contaminants e.g. fertiliser that enters the Broome Sandstone Aquifer from this watering is more likely to result in impacts to the Mandora Salt Marsh and to the near-shore marine environment through groundwater discharge to the sea.
- a. OWS estimates that the likely water requirements for the town are between 1-2GL/yr depending on the amount of recreational facilities and agricultural production.

Q2. We would also value OWS assessment of any other potential impacts to MNES that should be considered in regards to the proposed action. For example, the proposed action will also include 5 pipelines that will be feed offshore into the Commonwealth Marine Area that will terminate at an offshore transshipment platform, the development of a desalination plant (e.g., intakes, bitterns disposal) and a township.

8. As noted in the paragraphs addressing Question 1 there is the potential for changes in groundwater discharge but primarily quality from the town to impact on MNES associated with Mandora Salt Marsh. It is highly unlikely that that the pipelines or the offshore platform would impact on the marsh.
9. The construction of the pipelines will disturb the near-shore marine environment during this period of time. However, as noted in Piersma *et al.* (2016) the lack of sea grass along eighty-

mile beach means there would be no impact on foraging habitat for Dugongs or turtles. However, Piersma et al (2016) did observe numerous invertebrate and other marine species along the stretch of eighty-mile beach for example sentinel crabs (*Macrophthalmus* sp.) and Ingrid-eating snails (*Nassarius dorsatus*) – see Appendix 2 for a full list of species encountered.

10. No information is provided as to the location of the desalination plant though it would most likely be placed near the coast between eighty-mile beach and the Great Northern Highway. Construction of the desalination plant is likely to impact on the near-shore marine environment and any MNES located where the plant is to be built e.g. Curlew Sandpiper (*Caldis ferruginea*).
11. Intake of seawater and brine disposal (bitterns disposal) is always problematic for desalination plants.
 - a. The impact on marine species from the intake can be managed by the volume and intensity of suction. However, extraction of 80GL/year of seawater does appear to be slightly problematic as this equates to 152kL/min or 152m³/min which, locally, is a considerable displacement of water. This is likely to be the minimum offtake as this volume does not include a standard 10% stand-down time for maintenance i.e. the plant would not be operational for approximately 36 days per year so the shortfall would have to be taken up across the other days in the year.
 - b. The outfall is stated to discharge approximately 20km offshore (Referral, section 1.2) and OWS presumes the brine will be released through a series of diffusers to minimise the development of local hypersaline conditions (which may impact on marine fauna in close proximity to the outfall). However, OWS notes from the bathymetry off eighty-mile beach the water depth appears to be less than 10m at the possible location of the outfall. Even with the use of dispersers discharge into shallow water is more likely to impact on marine organisms and be more subject to coastal currents, potentially resulting in localised accumulations of other contaminants associated with the brine disposal e.g. metals which naturally occur in seawater.
 - i. Given an offtake of 80GL of seawater this will result in approximately 46GL/yr of brine being discharged based on the likely recovery ratio of 0.44 (Jones et al, 2019) i.e. approximately 34GL of fresh water will be obtained. This equates to 87m³/min of brine discharge.
 - c. The apparent shallow water depth at the offshore platform location means that there will be a limit of the size of the ship that the ammonia can be exported on resulting in a significant increase in ships in the area which may impact on marine migratory species.
12. Any rupture of any of the ammonia or brine pipelines would have significant local impact on the marine environment.
13. It is also worth noting that while solar and wind power will be used to produce the ammonia (and hydrogen) (Referral, section 1.2) there will still be significant CO₂ emissions as the production of ammonia is likely to involve the use of the Haber-Bosch method which results in considerable CO₂ emissions – ammonia production worldwide results in 1% of total CO₂ emissions (ScienceMag).
 - a. Should this be the process there is no commentary as to the source of nitrogen and this requires clarification and how the nitrogen will be supplied to the project.

14. OWS also notes that eighty-mile beach is part of the Nyangumarta Warrarn Indigenous Protected Area and the development should consider the values set out in the plan of management (NWAC and YMAC 2015).

Q3. we would value your ongoing advice on this project and would be interested in consulting your team on what would be considered suitable groundwater and surface water modelling that will be required to adequately assess the potential impacts not only to the Ramsar site but also terrestrial, intertidal and subtidal ecosystems.

15. In order to do any surface water modelling a detailed topographic map would need to be developed using LiDAR or similar because, as noted in McFarlane (2015), surface drainage in the project area is uncoordinated and no defined stream network is apparent. Once this detailed topography has been obtained then rainfall-runoff models could be developed to better understand how the town may change surface flows towards Mandora Salt Marsh (and the coast).
16. A groundwater model was developed by Aquaterra for the then WA Department of Water (Holder 2010 and Aquaterra 2009) though it is not clear whether this model is still current as AQ2 is currently doing a review for the Department of Water and Environmental Regulation. Depending on its currency this model could be used to provide boundary conditions for a local-scale groundwater model that can be used to assess any changes to groundwater flow volume and direction toward Mandora Salt Marsh and the coast due to this project, particularly the town. Given the Aquaterra model used MODFLOW then it is easy to do particle tracking using this new model to assess whether a more detailed solute transport model needs to be developed.
17. A hydrodynamic model would need to be developed to assess the likely movement of the brine to help determine what response strategies may be required to mitigate any impact. This modelling should also include scenarios where the brine or ammonia pipelines rupture individually and collectively given the ecological importance of the overall area e.g. the increase in seagrass meadows towards Roebuck Bay.

[Water Assessment Information Portal \(WAIP\)](#): for more information on water-related environmental impacts, please see the WAIP (accessible on the intranet via Home ⇒ Themes ⇒ Water ⇒ Water Assessment Information Portal).

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Department of Parks and Wildlife (2014). *Eighty Mile Beach Marine Park Management Plan 80 2014-2024*. Department of Parks and Wildlife, Perth.

Appendix 1.

A review of the Broome Sandstone aquifer in the La Grange area

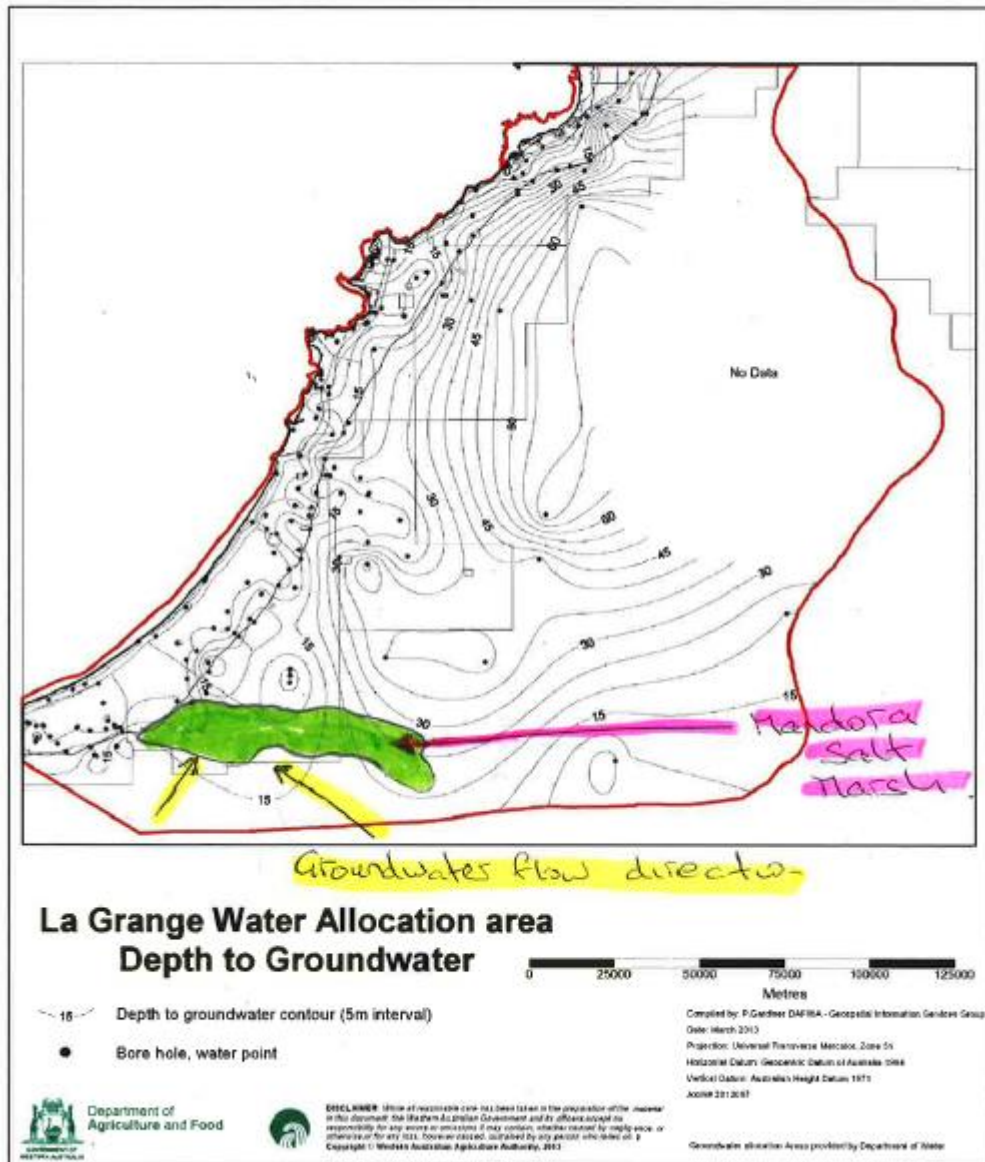


Figure 22 Groundwater depth and contours (m BGL)

Modified from Paul et al 2013.

Appendix 2.

Taxon	n _{ind}	1999 average density (n/m ²)	maximum density (n/m ²)	n _{ind}	2016 average density (n/m ²)	maximum density (n/m ²)	Change Ratio of avg. density in 2016 over 2006
BIVALVES							
<i>Anodontia omissa</i>	125	6.1	760	28	1.4	160	0.2
<i>Divaricella irpex</i>	185	9.1	760	1449	72.2	9000	7.9
<i>Siliqua pulchella</i>	2968	145.1	11600	383	19.1	720	0.1
<i>Tellina exotica</i>	78	3.8	120	79	3.9	120	1.0
<i>Tellina</i> 80 MB	0	0	0	25	1.3	80	new
<i>Tellina</i> rose	0	0	0	66	3.3	880	new
<i>Heterocardia gibbulosa</i>	31	1.5	90	100	5.0	240	4.2
SNAILS							
<i>Nassarius dorsatus</i>	288	9.2	680	178	8.9	120	0.9
<i>Mitrella essingtonensis</i>	6	0.3	80	43	2.1	80	7.0
POLYCHAETE WORMS							
red Polynoidae	979	47.9	960	1183	58.9	520	1.2
Onuphidae (<i>Diopatra</i>)	185	7.1	760	1449	72.2	9000	10.2
Glyceridae	298	14.6	240	369	18.3	280	1.3
Nephtyidae	791	38.7	360	580	28.9	480	0.7
Spionidae	174	8.5	400	593	29.5	1160	3.5
Capitellidae	443	21.7	1200	1928	96.0	1960	4.4
Maldanidae	0	0	0	46	2.3	120	new
Oweniidae	2246	109.8	4480	3070	152.9	12960	1.4
Cirratulidae	147	7.2	4120	89	4.4	240	0.6
Amphinomidae	4	0.2	80	42	2.1	320	10.5
CRUSTACEANS							
Corophiidae	2013	94.4	48000	1527	76.1	56000	0.8
<i>Callinassa</i> sp.	4	0.2	8	58	2.9	240	14.5
<i>Macrophthalmus</i> sp.	653	32.0	480	263	13.1	520	0.4
small hermit crabs Paguroidea	41	2.0	80	246	12.3	4120	6.2
ECHINODERMS							
<i>Amphiura tenuis</i>	3550	173.6	2240	6331	315.4	3520	1.8
<i>Arachnoides tenuis</i>	2	0.1	40	32	1.6	80	16.0
<i>Paracautina</i> sand-tailed seacucumber	35	1.7	560	43	2.1	120	1.2
<i>other seacucumbers</i>	438	21.4	1120	222	11.1	120	0.6
NEMERTEA	22	1.1	80	94	4.7	160	4.3
PHORONIDA	342	16.7	1200	52	2.6	200	0.2
ENTEROPNEUSTA <i>Balanoglossus</i>	3	0.2	40	47	2.3	160	11.5
ANEMONA <i>Edwardsia</i> sp.	52	2.5	320	26	1.3	80	0.5

From Piersma et al 2016 - Table 4.

First assessment of the quantitative changes in macrozoobenthic species along Eighty Mile Beach between 1999 and 2016. This is based on 819 sampling sites visited in 1999 and 804 sites visited in 2016, most of which show overlap. It includes the taxa of which at least 25 individuals have been found. Taxa showing more than a 40% change are shown in green (an increase) or red (a decrease).

Background Notes for Referral: EPBC 2021/8891 Asian Renewable Energy Hub Revised Proposal – Ramsar Implications May 2021

Headline Statement: The Ramsar Administrative Authority has advised that the above proposal would have a significant impact on the ecological character of the Eighty Mile Beach Ramsar site against all 5 significant impact criteria. Some of these impacts are unavoidable and cannot be mitigated.

The Proposal

The referral relates to an industrial complex of 6,660 square kilometres in remote East Pilbara WA. Key elements are:

- 10,800MW solar array covering 255 square kilometres with 1,743 wind turbines generating 453MW covering 100 square kilometres with associated batteries, control/maintenance hubs and service tracks.
 - Biggest energy hub in Australia both in terms of wind and solar generation.
- Ammonia production and storage facilities likely to be Haber-Bosch processing (highly polluting) as other 'green ammonia' technologies are yet to be commercially available.
- 80GL/year Desalination plant with associated pipelines, raw water storages, brine discharge ocean outfall.
- Offshore infrastructure including offshore platform, 5 pipelines, secondary export buoys and brine discharge ocean outfall.
- Infrastructure corridor to accommodate power cables, track, 5 pipelines (including 2 ammonia export pipelines), pipe stringing yard and booster pump facility.
- Town to cater for a population of 8,000 people.

This referral is a significant increase in scale and potential impact compared to the original referral, which consisted of a smaller solar array, fewer wind turbines, and an electricity cable going through the Ramsar site. Additional elements are the infrastructure corridor of ammonia and seawater and brine pipelines through the Ramsar site, a marine offshore export facility, expansion of wind and solar arrays, heavy industries and a town.

Eighty Mile Beach Ramsar site

Eighty Mile Beach Ramsar site is one of the most important migratory bird staging sites in the East Asian Australasian Flyway and the second most important site in Australia after Roebuck Bay, Western Australia.

- Contains the largest area of continuous mudflats in Australia's Ramsar estate at 225 km wide and up to 4 km wide in places.
- Listed under 6 of the 9 Ramsar criteria (1-6) with migratory birds, turtles, mudflats and uninterrupted tidal action being part of the ecological character of the Ramsar site (the matter protected).
- One of the very few Ramsar sites in pristine condition and with very little development or use in the catchment/surrounding areas.

The site consists of two non-contiguous areas: Eighty Mile beach and Mandora Swamp. The proposed land development is 26km from the beach and 13km from Mandora Swamp. The infrastructure corridor passes through the beach component with pipelines extending out to sea. The topography of the area is flat.

Assessment

The impacts associated with the development that cannot be mitigated include:

- Air and water emissions from the ammonia plant, desalination plant and facilitated infrastructure/construction (evaporation ponds, backup generation, cooling towers, cement making, rock quarrying, etc).
- The facilitated uses and activity associated with a town of 8,000 people.
- The light pollution associated with the town/industrial facilities/marine offshore facility.
- The changes to the water regime of the catchment and the tidal regime of the beach.
- The increased shipping and docking associated with the marine offshore facility and increased traffic (boat and vehicular) as a result of the construction and operation of the marine offshore facility, the industrial complex, the renewable energy hub and the town.

Risks

Proposed development located in an area:

- subject to extreme weather events (tropical cyclones) and monsoonal activity – the intensity of both are likely to increase under climate change.
- already subject to extreme summer heat.
- subject to regular wet season flooding which isolates existing small communities and cuts road access.
- very remote from existing social infrastructure.

Other significant risks include:

- damage from extreme events leading to a catastrophic impact on the biodiversity of the area and of Eighty Mile Beach Ramsar site, particularly as a result of chemical contamination, industrial debris and damage to water and waste water infrastructure and pipelines, and shipping spills. (High confidence)
- challenging disaster recovery efforts due to remoteness and lack of infrastructure and personnel. (High confidence)
- Planned and unplanned emissions from ammonia and hydrogen production impacting the biodiversity of the area and the Ramsar site. (High confidence)

Wetlands Section
CEWO
14 May 2021